

CAUVERY COLLEGE FOR WOMEN (AUTONOMOUS)

Nationally Accredited with 'A' Grade by NAAC

ISO 9001:2015 Certified

TIRUCHIRAPPALLI

PG AND RESEARCH DEPARTMENT OF MATHEMATICS



M. Sc. MATHEMATICS

AUTONOMOUS SYLLABUS

2022 – 2023 and onwards

CAUVERY COLLEGE FOR WOMEN (AUTONOMOUS)
PG AND RESEARCH DEPARTMENT OF MATHEMATICS

VISION

To strive for excellence in the mathematical sciences in addition to encourage people to undertake opportunities in transdisciplinary domains.

MISSION

- To enhance analytical and logical problem-solving capabilities.
- To provide excellent mathematical science knowledge for a suitable career and to groom students for national prominence.
- To teach students how to use data analytics.
- To prepare students for transdisciplinary research and applications.
- Value-based education and service-oriented training programmes are used to acquire life skills.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEOs	Statements
PEO1	LEARNING ENVIRONMENT To facilitate value-based holistic and comprehensive learning by integrating innovative learning practices to match the highest quality standards and train the students to be effective leaders in their chosen fields.
PEO2	ACADEMIC EXCELLENCE To provide a conducive environment to unleash their hidden talents and to nurture the spirit of critical thinking and encourage them to achieve their goal.
PEO3	EMPLOYABILITY To equip students with the required skills in order to adapt to the changing global scenario and gain access to versatile career opportunities in multidisciplinary domains.
PEO4	PROFESSIONAL ETHICS AND SOCIAL RESPONSIBILITY To develop a sense of social responsibility by formulating ethics and equity to transform students into committed professionals with a strong attitude towards the development of the nation.
PEO5	GREEN SUSTAINABILITY To understand the impact of professional solutions in societal and environmental contexts and demonstrate the knowledge for an overall sustainable development.

PROGRAMME OUTCOMES FOR M.Sc MATHEMATICS

PO NO.	On completion of M.Sc Mathematics, the students will be able to
PO 1	Problem Analysis Provide opportunities to develop innovative design skills, including the ability to formulate problems, to think creatively, to synthesize information, and to communicate effectively.
PO 2	Scientific Skills Create and apply advanced techniques and tools to solve the societal environmental issues.
PO 3	Environment and Sustainability Ascertain eco-friendly approach for sustainable development and inculcate scientific temper in the society.
PO 4	Ethics Imbibe ethical and social values aiming towards holistic development of learners.
PO 5	Life long learning Instill critical thinking, communicative knowledge which potentially leads to higher rate of employment and also for higher educational studies.

PROGRAMME SPECIFIC OUTCOMES FOR M.Sc MATHEMATICS

PSO NO.	The Students of M.Sc Mathematics will be able to	POs Addressed
PSO1	Make a significant contribution to society's development through mathematical study	PO1 PO2 PO3
PSO2	Provide an in-depth and extensive functional understanding of mathematical basics.	PO1
PSO3	Develop the experimental abilities in order to solve scientific and technical problems.	PO1 PO5
PSO4	Promote the learners and explore the potential in emerging fields.	PO4 PO5
PSO5	Enhance problem-solving, thinking, and creative skills through assignments and project work.	PO4 PO5



Cauvery College for Women (Autonomous), Trichy-18
PG & Research Department of Mathematics
M.Sc Mathematics

Learning Outcome Based Curriculum Framework (CBCS-LOCF)
For the Candidates admitted from the Academic year 2022-2023 onwards

Semester	Course	Course Title	Course Code	Inst. Hrs. / week	Credits	Exam			Total
						Hrs.	Marks		
							Int.	Ext.	
I	Core Course– I (CC)	Algebra-I	22PMA1CC1	6	5	3	25	75	100
	Core Course – II (CC)	Ordinary Differential Equations	22PMA1CC2	6	5	3	25	75	100
	Core Course –III (CC)	Integral Equations, Calculus of Variations and Transforms	22PMA1CC3	6	5	3	25	75	100
	Core Course - IV (CC)	Algebraic Number Theory	22PMA1CC4	6	5	3	25	75	100
	Discipline Specific Elective Course-I (DSE)	A. Advanced Numerical Analysis	22PMA1DSE1A	6	3	3	25	75	100
		B. Mathematical Modelling	22PMA1DSE1B						
		C. Boundary Value Problems	22PMA1DSE1C						
Total				30	23	-	-	-	500

15 Days INTERNSHIP during Semester Holidays

II	Core Course– V (CC)	Algebra-II	22PMA2CC5	6	5	3	25	75	100
	Core Course – VI (CC)	Real Analysis	22PMA2CC6	6	5	3	25	75	100
	Core Course -VII (CC)	Linear Algebra	22PMA2CC7	6	5	3	25	75	100
	Core Choice Course– I (CCC)	Partial Differential Equations	22PMA2CCC1A	6	4	3	25	75	100
		Mathematical Programming	22PMA2CCC1B						
		Difference Equations	22PMA2CCC1C						
	Discipline Specific Elective Course-II (DSE)	A. Computational Mathematics Using MATLAB (P)	22PMA2DSE2AP	6	3	3	40	60	100
		B. Mathematical Modelling Using MATLAB (P)	22PMA2DSE2BP						
		C. Ordinary Differential Equations and Partial Differential Equations Using MATLAB (P)	22PMA2DSE2CP						
	Internship	Internship	22PMA2INT	-	2	-	-	100	100
Extra Credit Course	SWAYAM	As per UGC's Recommendation							
Total				30	24	-	-	-	600

III	Core Course– VIII(CC)	Topology	22PMA3CC8	6	5	3	25	75	100
	Core Course – IX (CC)	Discrete Mathematics	22PMA3CC9	6	5	3	25	75	100
	Core Course - X (CC)	Graph Theory	22PMA3CC10	6	5	3	25	75	100
	Core Choice Course– II (CCC)	Cyber Security	22PGCS3CCC2A	5	4	3	25	75	100
		Measure and Integration	22PMA3CCC2B						
		Mechanics	22PMA3CCC2C						
	Discipline Specific Elective Course-III (DSE)	A. Analytical Skills for Competitive Examinations	22PMA3DSE3A	4	3	3	-	100	100
		B. Stochastic Processes	22PMA3DSE3B			3	25	75	
		C. Fuzzy Sets and their Applications	22PMA3DSE3C						
Generic Elective Course -I (GEC)	Foundation for Logical Thinking	22PMA3GEC1	3	2	3	25	75	100	
Extra Credit Course	SWAYAM	As per UGC Recommendation							
Total				30	24	-	-	-	600

IV	Core Course–XI(CC)	Complex Analysis	22PMA4CC11	6	5	3	25	75	100
	Core Course - XII(CC)	Functional Analysis	22PMA4CC12	6	5	3	25	75	100
	Core Choice Course– III (CCC)	A. Differential Geometry	22PMA4CCC3A	6	4	3	25	75	100
		B. Formal Language and Automata Theory	22PMA4CCC3B						
		C. Functional Analysis	22PMA4CCC3C						
	Generic Elective Course-II (GEC)	Optimization Techniques	22PMA4GEC2	3	2	3	25	75	100
Project	Project Work	22PMA4PW	9	5	-	-	100	100	
Total				30	21	-	-	-	500
Grand Total				120	92	-	-	-	2200

Courses & Credits for PG and Research Department of Mathematics

S. No	Courses	No of Courses	No of Credits	Marks
1.	Core Course– (CC)	12	60	1200
2.	Core Choice Course– (CCC)	3	12	300
3.	Discipline Specific Elective- (DSE)	3	9	300
4.	Generic Elective Course - (GEC)	2	4	200
5.	Project	1	5	100
6.	Internship	1	2	100
	Total	22	92	2200

Students will go for internship after completing the I Semester exams and the internship will be calculated in the II Semester and credits for internship is 02.

For each semester marks will be for 500(600 for II Semester due to internship)

The internal and external marks for theory and practical papers are as follows:

Subject	Internal	External
Theory	25	75
Practical	40	60

Separate passing minimum is prescribed for Internal and External

For Theory:

- a) The passing minimum for CIA shall be 40% out of 25 marks (i.e. 10 marks).
- b) The passing minimum for End Semester Examination shall be 40% out of 75 marks (i.e. 30 marks).
- c) The passing minimum not less than 50% in the aggregate.

For Practical:

- a) The passing minimum for CIA shall be 40% out of 40 marks (i.e. 16 marks)
- b) The passing minimum for End Semester Examinations shall be 40% out of 60 marks (i.e. 24 marks)
- c) The passing minimum not less than 50% in the aggregate.

For Project:

Project : 100 Marks
 Dissertation : 80 Marks
 Viva Voce : 20 Marks

Semester I	Internal Marks: 25		External Marks: 75	
COURSECODE	COURSETITLE	CATEGORY	Hrs / WEEK	CREDITS
22PMA1CC1	ALGEBRA- I	CORE	6	5

Course Objective

- **Gain** expertise and confidence in proving theorems to progress in mathematical studies.
- **Acknowledge** the students with experience in axiomatic mathematics while keeping in close touch with the computational aspects of the subject.
- **Enhance** students to understand principles, concepts necessary to formulate, solve and analyze Algebra.

Prerequisite:

- Basic knowledge of sets, relations and functions.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
CO1	Apply the basic concepts of group theory with the help of numerous examples	K3
CO2	Examine in detail about Permutation Groups and Normal Groups and discuss about counting tricks in algebra	K4
CO3	Solve problems related to theorems	K3
CO4	Classify groups of finite order using Sylow's theorems	K4
CO5	Analyze the Field of Quotients of an integral domain	K4

Mapping of CO with POs and PSOs

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	3	3	3	2	2	2	3
CO2	2	3	3	2	2	2	3	2	2	3
CO3	2	2	3	3	3	3	3	2	3	3
CO4	3	3	2	2	3	3	3	3	2	2
CO5	2	2	3	3	2	3	2	2	2	3

Syllabus

Unit I

(17 Hours)

Binary Operations – Groups – Subgroups - Permutations I - Permutations II.

Unit II

(18 Hours)

Isomorphism - Direct products - Finitely Generated Abelian Groups - Groups of Cosets- Normal Subgroups and Factor Groups.

Unit III

(17 Hours)

Series of Groups - Isomorphism Theorems; Proof of the Jordan - Holder Theorem - Sylow Theorems.

Unit IV

(20 Hours)

Rings - Integral domains - The Field of Quotients of an Integral Domain - Quotient Rings and Ideals.

Unit V

(18 Hours)

Factorization of Polynomials over a Field - Unique Factorization Domains -Euclidean Domains -Gaussian Integers and Norms.

Unit VI- Self-Study for Enrichment (Not included for End Semester Examinations)

Cyclic Groups – Homomorphisms - Applications of the Sylow Theorem - Some Noncommutative examples - Homomorphism of Rings.

Text Book

1. John B. Fraleigh,(2018(Reprint)), *A First Course in Abstract Algebra*, Narosa Publishing House, Third edition.

Chapters and Sections

UNIT-I	Chapters 1 to 5[1]
UNIT-II	Chapters 7,8,9,11 and 12[1]
UNIT-III	Chapter 14,15 and 18[1]
UNIT-IV	Chapter 23,24,26 and 28[1]
UNIT-V	Chapter 31 to 34[1]

Reference Books

1. David S. Dummit and Richard M. Foote, (2004), *Abstract Algebra*, Wiley and Sons, Third Edition.
2. Joseph A. Gallian, (1999), *Contemporary Abstract Algebra*, Narosa Publishing House, Fourth Edition.
3. Herstein. I.N, (1975), *Topics in Algebra*, John Wiley, Second Edition.

Web References

1. https://www.youtube.com/watch?v=g7L_r6zw4-c
2. <https://www.youtube.com/watch?v=VSB8jjsn9xI>
3. <https://www.youtube.com/watch?v=WwndchnEDS4>
4. <https://www.youtube.com/watch?v=xTCxmr4ISU4>
5. <https://www.youtube.com/watch?v=iobTKR4-19o>
6. <https://www.youtube.com/watch?v=NfmJQ1ah4vM>
7. <https://www.youtube.com/watch?v=vrFd-5uEv4k>

Pedagogy

Power Point Presentations, Group Discussions, Seminar, Quiz, Assignment.

Course Designer

Dr. K. Kalaiarasi.

Semester I	Internal Marks: 25		External Marks: 75	
COURSECODE	COURSETITLE	CATEGORY	Hrs / Week	CREDITS
22PMA1CC2	ORDINARY DIFFERENTIAL EQUATIONS	CORE	6	5

Course Objective

- **Recognize** certain basic types of first order ODEs for which exact solutions may be obtained and to apply the corresponding methods of solution
- **Qualitative Analysis** of Solutions of First Order Autonomous Equations.
- **Analyze** the concepts of existence and uniqueness of solutions.

Prerequisite

- Fundamental knowledge of ordinary differential equations in UG.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
	On successful completion of this work, students will be able to	
CO1	Define linear, non-linear, homogeneous and autonomous system of ordinary differential equations.	K1
CO2	Understand the Qualitative properties of solutions by Sturm separation and Sturm comparison theorems.	K2
CO3	Diagnose the power series solution for ordinary differential equations such as Gauss Hyper Geometric, Bessel's and Legendre equations.	K4
CO4	Discriminate the Qualitative properties of solutions for Boundary value problems by using Sturm theorems.	K4
CO5	Analyze the Stability nature of Linear and Non-Linear system for various methods.	K4

Mapping of CO with POs and PSOs

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3	3	3	3	2	3
CO2	3	3	3	3	3	3	3	3	2	3
CO3	3	3	3	3	3	3	3	3	2	3
CO4	3	3	2	3	3	3	3	3	2	3
CO5	3	3	3	3	3	3	3	3	2	3

Syllabus

UNIT I

(18 Hours)

The General Solution of the Homogeneous Equation – The Use of a Known Solution to Find Another – The Method of Variation of Parameters – Power Series Solutions and Special Functions: Introduction: A Review of Power Series – Series Solutions of First Order Equations – Second Order Linear Equations. Ordinary Points.

UNIT II

(18 Hours)

Regular Singular Points – Gauss's Hypergeometric Equation – The Point at Infinity. Legendre Polynomials – Properties of Legendre Polynomials - Bessel Functions. The Gamma Function, Properties of Bessel Functions.

UNIT III

(18 Hours)

Linear Systems – Homogeneous Linear Systems with Constant Coefficients – The Existence and Uniqueness of Solutions: The Method of Successive Approximations - Picard's Theorem.

UNIT IV

(18 Hours)

Qualitative Properties of Solutions: Oscillations and the Sturm Separation Theorem – The Sturm Comparison Theorem – Eigen Values , Eigen Functions and the Vibrating String.

UNIT V

(18 Hours)

Nonlinear Equations: Autonomous Systems. The Phase Plane and Its Phenomena – Types of Critical Points. Stability – Critical Points and Stability for Linear Systems – Stability by Liapunov's Direct Method - Simple Critical Points of Nonlinear Systems.

UNIT VI - Self- Study for Enrichment(Not included for End Semester Examinations)

The Homogeneous Equation with Constant Coefficients - Regular Singular Points (Continued) – Systems. The Second Order Linear Equation - Sturm Liouville Problems - Nonlinear Mechanics, Conservative systems.

Text Book

1. George F. Simmons (2003). Differential Equations with Applications and Historical Notes, Second Edition. Tata McGraw- Hill Editions.

Chapters and Sections

UNIT – I	Chapter 3	Sections 15, 16, 19
	Chapter 5	Sections 26 to 28
UNIT – II	Chapter 5	Sections 29, 31, 32
	Chapter 8	Sections 44 to 47
UNIT – III	Chapter 10	Sections 55, 56
	Chapter 13	Sections 68, 69
UNIT – IV	Chapter 4	Sections 24, 25
	Chapter 7	Sections 40
UNIT –V	Chapter 11	Sections 58 to 62

Reference Books

1. Raisinghania M.D. (2006), Ordinary and Partial Differential Equations,1st Edition, S.Chand & Co.
2. Coddington E.A. and Levinson N. (2002), Theory of Ordinary Differential Equations, McGraw Hill Publishing Company, NewYork.
3. Chicone, Carmen. (2006), A Ordinary Differential Equations With Applications,2nd Edition, Spring Verlag, NewYork.

Web References

1. <https://www.youtube.com/watch?v=gd1FYn86P0c>
2. <https://www.youtube.com/watch?v=6o7b9yyhH7k>
3. <https://www.youtube.com/watch?v=HAb9JbBD2ig>
4. <https://www.youtube.com/watch?v=kj-qTWhH5N4>
5. <https://www.youtube.com/watch?v=CV81OjuHUS8>
6. <https://www.youtube.com/watch?v=oTN7hGoSPMw>
7. https://www.youtube.com/watch?v=IWm6Coa3_bQ
8. <https://www.youtube.com/watch?v=1HUnrokDN0U>
9. <https://www.youtube.com/watch?v=1HUnrokDN0U>

Pedagogy

Chalk and Talk method, Power point presentations, Group Discussions, Seminar, Quiz, Assignment.

Course Designer

Dr. G. JANAKI

Semester I	Internal Marks: 25		External Marks: 75	
COURSECODE	COURSETITLE	CATEGORY	Hrs / Week	CREDITS
22PMA1CC3	INTEGRAL EQUATIONS, CALCULUS OF VARIATIONS AND TRANSFORMS	CORE	6	5

Course Objective

- To introduce the concept of calculus of variations and integral equations and their applications.
- To learn the different types of transforms and their properties.
- To give an experience in the implementation of Mathematical concepts like integral transforms, integral equations and calculus of variations in various field of Engineering.

Prerequisite

- Basic Knowledge of Integral Calculus and Fourier Series

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
CO1	Apply the concepts of calculus of variations to find the maxima and minima of quantities defined as integrals containing unknown functions.	K3
CO2	Classify various kinds of Fourier sine and cosine transforms with their properties and simple problems.	K3
CO3	Explain the concept of Fourier transform, Hankel transform and its inverse transform.	K3
CO4	Recognize and solve particular cases of Fredholm and Volterra integral equations and variational problem	K4
CO5	Evaluate the integral equations by the method of successive approximations.	K5

Mapping of CO with POs and PSOs

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	3	3	3	2	2	2	3
CO2	2	3	3	2	2	2	3	2	2	3
CO3	2	2	3	3	3	3	3	2	2	3
CO4	3	3	2	2	3	3	3	2	2	2
CO5	2	2	3	3	2	3	2	2	2	3

Syllabus

UNIT I

(18 Hours)

Calculus of variations and applications: Maxima and Minima – The simplest case – Illustrative examples - Natural boundary conditions and transition conditions – The Variational notation – The More general case – constraints and Lagrange multipliers – variable end points – Sturm-Liouville problems.

UNIT – II

(18 Hours)

Fourier transforms: Dirichlet's conditions – Fourier series – Fourier's Integral formula – Fourier transform or complex Fourier transform – Inversion theorem for complex Fourier transform – Fourier sine transform - Inversion formula for Fourier sine transform - Fourier cosine transform - Inversion formula for Fourier cosine transform – Linearity property of Fourier transform – Change of scale property – Shifting Property – Modulation Theorem – Multiple Fourier transforms - Convolution - The convolution or Faltung theorem for Fourier transforms - Parseval's identity for transforms – Relationship between Fourier and Laplace transforms – Fourier transform of the derivatives of a function – Problems related to integral equations.

UNIT III

(18 Hours)

Hankel Transforms :Definition – Inverse formula for the Hankel transform – Some important results for Bessel function – Linearity property – Hankel Transform of the derivatives of the function – Hankel Transform of differential operators.

UNIT IV

(18 Hours)

Definition, Regularity Conditions – Special Kind of Kernels – Eigen values and Eigen functions – Convolution Integral – The Inner or Scalar Product of Two Functions – Notation – Integral Equations with Separable Kernels: Reduction to a System of Algebraic Equations – Examples– Fredholm Alternative – Examples.

UNIT V

(18 Hours)

Method of Successive Approximations: Iterative Scheme – Examples – Volterra Integral Equation – Examples – Some Results about the Resolvent Kernel - Classical Fredholm Theory: The Method of Solution of Fredholm – Fredholm’s First Theorem – Examples – Fredholm’s Second Theorem.

UNIT VI - Self-Study for Enrichment(Not included for End Semester Examinations)

Hamilton’s Principle - Finite Fourier transforms- Parseval’s Theorem- An Approximate Method – Fredholm Integral Equation of the First Kind - Fredholm’s Third Theorem.

Text books

1. Francis.B. Hildebrand,(1972), Methods of Applied Mathematics, Prentice – Hall of India Pvt Ltd, New Delhi.
2. Vasishtha.A.R. and Gupta.R.K,(2002), Integral Transforms, Krishna Prakashan Media Pvt Ltd
3. Ram.P.Kanwal,(1971), Linear Integral Equations, Academic Press.

Chapters and Sections

Unit I	Chapter 2	Sections 2.1 to 2.8 [1]
Unit II	Chapter 6	Sections 6.1 to 6.20[2]
Unit III	Chapter 9	Sections 9.1 to 9.6[2]
Unit IV	Chapter 1	Sections 1.1 to 1.7[3]
	Chapter 2	Sections 2.1 to 2.4[3]
Unit V	Chapter 3	Sections 3.1 to 3.5[3]
	Chapter 4	Sections 4.1 to 4.4[3]

Reference Books

1. Gupta,A.S.(2006), Calculus of Variations with Applications, Prentice Hall of India Private Limited, New Delhi.
2. Raisinghania,M.D. (2007), Integral Equations and Boundary Value Problems, S.Chand & Company Ltd, New Delhi.
3. Gupta.P.P and Sunjay Gupta,(2003), Integral Transforms, Kedarnath Ram Nath , Meerut.

Web References

1. <https://youtu.be/70lYJs2xL6Q>
2. <https://youtu.be/HlwYQqUdrQs>
3. <https://youtu.be/6HeQc7CSkZs>
4. <https://youtu.be/UKHBWzoOKsY>
5. <https://youtu.be/3OCYjT5h23w>
6. <https://youtu.be/pAwvErIGIV8>
7. <https://youtu.be/HH9QH692AZE>

Pedagogy

Chalk and talk, Power point presentation, Discussion, Assignment, Quiz, Seminar.

Course Designers

1. Dr. S. Sasikala.
2. Dr. R. Radha.

Semester I	Internal Marks: 25		External Marks: 75	
COURSE CODE	COURSE TITLE	CATEGORY	Hrs / Week	CREDITS
22PMA1CC4	ALGEBRAIC NUMBER THEORY	CORE	6	5

Course Objective

- **Explore** fundamental concepts of divisibility, Congruences and primes.
- **Analyze** the quadratic Residues, The Mobius Inversion formula, Diophantine equations and their problems.
- **Apply** the ideas of Pythagorean triangle and The Chinese remainder theorem to solve problems.

Prerequisite

Theory of Numbers, Abstract Algebra

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
CO1	Apply the concepts of divisibility, congruences, primes, primitive roots, quadratic residues, greatest integer functions and linear equations.	K3
CO2	Explore the concepts of arithmetic functions, prime modulus and congruences of Degree two.	K3
CO3	Relate the ideas of Chinese remainder theorem, quadratic reciprocity and The Mobius Inversion formula.	K3
CO4	Determine the solutions of congruences, techniques of numerical calculations, Jacobi symbol, recurrence functions and simultaneous linear equations.	K4
CO5	Examine the conceptual understanding in Pythagorean triangles, Legendre Symbol and related problems.	K4

Mapping of CO with POs and PSOs

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3	3	3	2	2	3
CO2	2	3	2	3	2	2	2	2	2	3
CO3	3	3	2	3	3	3	2	2	2	3
CO4	3	3	3	3	3	3	3	2	2	3
CO5	3	3	3	3	3	3	3	2	2	3

Syllabus

UNIT I

(18 Hours)

Divisibility and Congruences

Introduction – Divisibility – The Binomial Theorem – Congruences – Solutions of Congruences – The Chinese Remainder Theorem.

UNIT II

(18 Hours)

Congruences

Techniques of Numerical Calculation — Prime Power Moduli – Prime Modulus – Congruences of Degree Two, Prime Modulus – Public Key Cryptography.

UNIT III

(18 Hours)

Quadratic Reciprocity and Quadratic Forms

Quadratic Residues – Quadratic Reciprocity – The Jacobi Symbol – Binary Quadratic Forms – Equivalence and Reduction of Binary Quadratic Forms – Sums of Two Squares.

UNIT IV

(18 Hours)

Some Functions of Number Theory

Greatest Integer Function – Arithmetic Functions – The Mobius Inversion Formula.

UNIT V

(18 Hours)

Some Diophantine Equations

The Equation $ax + by = c$ – Simultaneous Linear Equations – Pythagorean Triangles.

UNIT VI - Self-Study for Enrichment (Not included for End Semester Examinations)

Primes - Primitive Roots and Power Residues - Positive Definite Binary Quadratic Forms
- Recurrence Functions - Assorted Examples.

Text Books

1. Ivan Niven, Herbert S. Zuckerman & Hugh L. Montgomery (2016) Reprint, *An Introduction to the Theory of Numbers, (Fifth Edition, Reprint 2016)*. Wiley Publishers.

UNIT – I	Chapter 1	Sections 1.1, 1.2 & 1.4
	Chapter 2	Sections 2.1 to 2.3
UNIT – II	Chapter 2	Sections 2.4 to 2.7 & 2.9
UNIT – III	Chapter 3	Sections 3.1 to 3.6
UNIT – IV	Chapter 4	Sections 4.1 to 4.3
UNIT – V	Chapter 5	Sections 5.1 to 5.3

Reference Books

1. David M. Burton (2012), *Elementary Number Theory (Sixth Edition)*, Tata McGraw Hill Education Private Limited, New Delhi.
2. Telang S. G. (2005), *Number Theory* (Reprint 2001), Tata McGraw Hill Education Private Limited, New Delhi.
3. Melvyn B. Nathanson (2005), *Methods in Number Theory* (Reprint 2006), Springer-Verlag, New York, Inc.

Web References

1. https://www.youtube.com/watch?v=ChG_7jeNRHo
2. <https://www.youtube.com/watch?v=e8DtzQkjOMQ>
3. <https://www.youtube.com/watch?v=3W91U-aNclQ>
4. <https://www.youtube.com/watch?v=bg6CksAkZ-k>
5. <https://www.youtube.com/watch?v=4dVTIX4bwP0>
6. <https://www.youtube.com/watch?v=khfIH1H6iUg>
7. <https://www.youtube.com/watch?v=BC2BdenKsYs>

Pedagogy

Power point Presentations, Group Discussions, Seminar, Quiz, Assignment.

Course Designer

Dr. S. Vidhya.

Semester I	Internal Marks: 25		External Marks: 75	
COURSE CODE	COURSE TITLE	CATEGORY	HRS /WEEK	CREDITS
22PMA1DSE1A	ADVANCED NUMERICAL ANALYSIS	DISCIPLINE SPECIFIC ELECTIVE	6	3

Course Objective

- To **know** the theory behind various numerical methods.
- To **apply** these methods to solve mathematical problems.
- To **train** the students to develop analytical thinking and the study of stability analysis.

Prerequisite

A reasonable background in linear algebra, numerical analysis, partial differential equations, and finite difference methods.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
CO1	Apply various methods to solve transcendental and polynomial equations	K3
CO2	Use the concepts of interpolation analyze Eigen value problem with Techniques for Mathematical Problems arising in various fields	K4
CO3	Classify the various techniques of interpolation and approximation	K3
CO4	Compute the numerical differentiation problems	K3
CO5	Apply the knowledge of various methods to solve numerical integration problems	K3

Mapping of CO with POs and PSOs

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	2	3	2	3	2	3	3
CO2	3	3	3	3	3	3	3	3	3	3
CO3	2	2	3	2	3	3	3	2	2	3
CO4	2	2	2	2	3	2	2	2	2	3
CO5	3	3	3	3	3	3	3	3	2	3

Syllabus

UNIT I

(18 Hours)

Transcendental and polynomial equations

Rate of convergence – Polynomial equations: Descartes' Rule of Signs - Iterative Methods: Birge-Vieta method - Bairstow's method.

UNIT II

(17 Hours)

System of Linear Algebraic equations and Eigen Value Problems

Error Analysis for Direct methods – Iteration methods - Eigen values and Eigen vectors – Jacobi method for symmetric matrices - Power method.

UNIT III

(18 Hours)

Interpolation and Approximation

Hermite Interpolation - Piecewise and Spline Interpolation.

UNIT IV

(17 Hours)

Differentiation

Numerical Differentiation – Optimum choice of Step length – Extrapolation methods.

UNIT V

(20 Hours)

Integration

Numerical Integration - Methods based on undetermined coefficients: Newton- Cotes methods: Trapezoidal Method - Simpson's Method - Gauss Legendre Integration Methods - Lobatto Integration Methods.

UNIT VI - Self -Study for Enrichment(Not included for End Semester Examinations)

Direct Method - Graeffe's root squaring method- Gauss Seidel Iteration method - Bivariate Interpolation: Lagrange Bivariate interpolation - Partial Differentiation - Gauss-Chebyshev Integration Methods.

Text Book

Jain. M. K, Iyengar. S. R. K. and Jain. R. K. (Sixth Edition), *Numerical Methods for Scientific and Engineering Computation*, New Age International (P) Limited Publishers, New Delhi.

Chapters and Sections

UNIT-I	Chapter 2	Sections 2.5 and 2.9(Page No. 83 - 93)
UNIT-II	Chapter 3	Sections 3.3 – 3.5, 3.7, 3.11
UNIT-III	Chapter 4	Sections 4.5 and 4.6
UNIT- IV	Chapter 5	Sections 5.2 - 5.4
UNIT- V	Chapter 5	Sections 5.6 (Page No. 348) and 5.8(Page No. 356-365, 380-382)

Reference Books

1. Jain. M. K, (1983), *Numerical Solution of Differential Equations*(2nd Edition), New Age International Pvt Ltd.,
2. Samuel. D. Conte and Carl. DeBoor, (1988), *Elementary Numerical Analysis*(3rd Edition), McGraw-Hill International.
3. Kendall E. Atkinson, (1989), *An Introduction to Numerical Analysis*(2nd Edition), John Wiley & Sons.

Web References

1. https://www.youtube.com/watch?v=hTVjuH6J_C8
2. <https://www.youtube.com/watch?v=EMPyjetvaDg>
3. <https://www.youtube.com/watch?v=YkrSgTBznek>
4. <https://www.youtube.com/watch?v=-fE3I-usIKk>
5. <https://www.youtube.com/watch?v=gyyKvonahXk>.

Pedagogy

Power point presentations, Group Discussions, Seminar, Quiz, Assignment.

Course Designers

1. Ms. R. Soundaria
2. Dr. P.Sudha

Semester I	Internal Marks: 25		External Marks: 75	
COURSE CODE	COURSE TITLE	CATEGORY	HRS /WEEK	CREDITS
22PMA1DSE1B	MATHEMATICAL MODELLING	DISCIPLINE SPECIFIC ELECTIVE	6	3

Course Objective

- **Analyze** the different mathematical models through Ordinary differential equation and Differential Equations.
- **Understand** the implementation of graph theoretical models.
- **Summarize** and implementation the kinds of Difference equations.

Prerequisite

Classification of ordinary differential equations.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
CO1	Classify the models through Ordinary Differential equations.	K3
CO2	Evaluate the systems of Ordinary Differential equations for various models.	K4
CO3	Examine the Planetary motions through Ordinary Differential equations of second order.	K4
CO4	Explain the basic concepts of Difference equation.	K4
CO5	Compute various types of models through Difference equation.	K3

Mapping of CO with POs and PSOs

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	3	3	3	2	2	2	3
CO2	2	3	3	2	2	2	3	2	2	3
CO3	2	2	3	3	3	3	3	2	3	3
CO4	3	3	2	2	3	3	3	3	2	2
CO5	2	2	3	3	2	3	2	2	2	3

Syllabus

UNIT I

(18 Hours)

Mathematical Modelling through Ordinary Differential Equations of First order

Mathematical Modelling Through Differential Equations- Linear Growth and Decay Models – Non-Linear Growth and Decay Models – Compartment Models – Mathematical Modelling in Dynamics Through Ordinary Differential Equations of First Order.

UNIT II

(18 Hours)

Mathematical Modelling through Systems of Ordinary Differential Equations of First Order

Mathematical Modelling in Population Dynamics – Mathematical Modelling of Epidemics Through Systems of Ordinary Differential Equations of First Order – Compartment Models Through Systems of Ordinary Differential Equations – Mathematical Modelling in Medicine, Arms Race, Battles and International Trade in Terms of Systems of Ordinary Differential Equations – Mathematical Modelling in Dynamics Through Systems of Ordinary Differential Equations of First Order.

UNIT III

(20 Hours)

Mathematical Modelling Through Ordinary Differential Equations of Second Order

Mathematical Modelling in Planetary Motions – Mathematical Modelling in Circular Motion and Motion of Satellites – Mathematical Modelling Through Linear Differential Equations of Second Order.

UNIT IV

(17 Hours)

Mathematical Modelling Through Difference Equations

The Need for Mathematical Modelling Through Differential Equations: Some Simple Models – Basic Theory of Linear Difference Equations with Constant Coefficients – Mathematical Modelling Through Differential Equations in Economics and Finance– Mathematical Modelling Through Differential Equations in Probability Theory.

UNIT V

(17 Hours)

Mathematical Modelling through Graphs

Situations that can be Modelled Through Graphs – Mathematical Models in Terms of Directed Graphs–Mathematical Models in Terms of Signed Graphs–Mathematical Models in Terms of Weighted Digraphs.

UNIT VI - Self-Study for Enrichment(Not included for End Semester Examinations)

Mathematical Modelling of Geometrical problems Through Ordinary Differential Equations of First Order - Mathematical Modelling in Economics Through Systems of Ordinary Differential Equations of First Order - Miscellaneous Mathematical Models Through Systems of Ordinary Differential Equations of Second Order - Mathematical Modelling Through Differential Equations in Population Dynamics and Genetics - Mathematical Modelling in Terms of Unoriented Graphs.

Text Books

1. J N Kapur, (Reprint 2001). *Mathematical Modelling*. New Age International (P) Limited, Publishers, New Delhi.

UNIT-I Chapter 2: Sections 2.1 to 2.5

UNIT-II Chapter 3 Sections 3.1 to 3.3 & 3.6

UNIT-III Chapter 4 Sections 4.1 to 4.3

UNIT- IV Chapter 5 Sections 5.1 to 5.3&5.5

Chapter 7 Sections 7.1 to 7.4

UNIT- V Chapter 15 Sections 15.1 to 15.3.6 [2]

Chapter 16 Sections 16.2 to16.2.5, 16.5, 16.5.1 to 16.5.3 [2].

Reference Books

1. Bimal K.Mishra & Dipak K.Satpathi (First Edition, Reprint 2009). *Mathematical Modeling Applications, Issues and Analysis(1st Edition)*. Ane Books Pvt. Ltd.
2. Edward A. Bender. *An Introduction to Mathematical Modelling*(Reprint 2000).Dover Publications.
3. Rutherford A. *Mathematical Modelling Techniques*(Revised Edition 2012).Dover Publications.

Web References

1. <https://www.youtube.com/watch?v=3Yfsh1SnGIw>
2. <https://www.youtube.com/watch?v=EdtwK8KSwOo>
3. <https://www.youtube.com/watch?v=zcz5Ghkv1Y>
4. <https://www.youtube.com/watch?v=-wVCKOvceok>
5. <https://www.youtube.com/watch?v=BZwp8gAxvUc>

Pedagogy

Power point Presentations, Group Discussions, Seminar, Quiz, Assignment and Smart Classroom.

Course Designer

1. Dr R. Buvaneswari.

Semester I	Internal Marks: 25		ExternalMarks:75	
COURSE CODE	COURSE TITLE	CATEGORY	HRS /WEEK	CREDITS
22PMA1DSE1C	BOUNDARY VALUE PROBLEMS	DISCIPLINE SPECIFIC ELECTIVE	6	3

Course Objective

- **Gain** expertise and confidence in proving theorems to progress in mathematical studies.
- **Analyze** the implementation of boundary value problem through various models.
- **Summarize** the various aspects of boundary value problem.

Prerequisite:

- Exposure on Fourier series and Differential Equations.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
CO1	Apply real world scenarios in order to solve the problems using multiple approaches.	K3
CO2	Classify Boundary value problems and learn their distinguishing qualitative properties.	K3
CO3	Relate the applications of Laplace and Poisson Equations	K3
CO4	Determine the understanding of Fourier Bessel Series	K4
CO5	Analyze Dirichlet Problems and its solutions in various Regions.	K4

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	3	3	3	2	2	2	3
CO2	2	3	3	2	2	2	3	2	2	3
CO3	2	2	3	3	3	3	3	2	3	3
CO4	3	3	2	2	3	3	3	3	2	2
CO5	2	2	3	3	2	3	2	2	2	3

Syllabus

UNIT I

(18 Hours)

One-sided Derivatives- An Integration Formula – Preliminary Theory –
A Fourier Theorem- Discussion of the Theorem.

UNIT II

(17 Hours)

Formal and Rigorous Solutions – The Vibrating String, Initially Displaced – Discussion
of the Solution – Prescribed Initial Velocity – Non homogeneous Differential Equations –
Elastic Bar- Temperatures in a Bar.

UNIT III

(18 Hours)

A Dirichlet Problem – Fourier Series in Two Variable – An Application of Fourier
Integrals – Temperatures $u(x,t)$ in an Unlimited Medium

Fourier-Bessel Series-Temperatures in a Long Cylinder-Heat Transfer at the Surface of
the Cylinder.

UNIT IV

(17 Hours)

Dirichlet Problems in Spherical Regions – Steady Temperature in a Hemisphere.

UNIT V

(20 Hours)

Cauchy Criterion for Uniform Convergence –Abel's Test for Uniform Convergence –
Uniqueness of Solutions of the Heat Equation – Example – Solutions of Laplace's or Poisson's
Equation.

UNIT VI - Self-Study for Enrichment(Not included for End Semester Examinations)

Other Forms of Fourier Series –The Orthonormal Trigonometric Functions - Other Boundary Conditions - Observations and Further Examples - Vibration of a circular Membrane - Other Orthogonal Sets - An Application.

Text Books

1. Ruel V Churchill. (1963). Fourier Series and Boundary Value Problems (Second Edition). McGraw-Hill Book Company.

UNIT-I	Chapter 4	Sections 38 to 42
UNIT-II	Chapter 7	Sections 55 to 61
UNIT-III	Chapter 7	Sections 63 to 66
	Chapter 8	Sections 78 to 80
UNIT-IV	Chapter 9	Sections 89 to 90
UNIT-V	Chapter 10	Sections 92 to 96

Reference Books

1. Raisinghania, M.D.(2014). Ordinary and Partial Differential Equations(1st Edition). S.Chand & Company Pvt.Ltd.
2. George F Simmons, (2003). Differential Equations with Applications and Historical Notes(2nd Edition). Tata McGraw-Hill Publishing Company.
3. Sankara Rao, K. (2019). Introduction to Partial Differential Equations(3rd Edition). Prentice-Hall of India.

Web References

1. <https://www.youtube.com/watch?v=m8aIO-GQkXE>
2. <https://www.youtube.com/watch?v=AgveJEO2a-k>
3. https://www.youtube.com/watch?v=O_HgMWx4a5w
4. <https://www.youtube.com/watch?v=1tDkXMDbvDg&t=119s>
5. <https://www.youtube.com/watch?v=USOmOW-IN3I>

Pedagogy

Power point presentations, Group Discussions, Seminar, Quiz, Assignment.

Course Designer

Ms. P. Geethanjali.

Semester II	Internal Marks: 25		External Marks:75	
COURSE CODE	COURSE TITLE	CATEGORY	Hrs /Week	CREDITS
22PMA2CC5	ALGEBRA – II	CORE	6	5

Course Objective

- Learn the fundamentals in Galois theory
- Expertise and confidence in proving theorems to progress in Galois theory
- Familiarize the concepts of Galois group

Prerequisite:

- Basic knowledge of algebra.

Course Outcomes

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
	On the successful completion of the course, students will be able To	
CO1	Analyse the important concepts of Galois theory and identify through various examples	K1, K2, K3
CO2	Predict the notions and their connections of Galois theory	K3
CO3	Examine the proof of solvability by Galois theory	K4
CO4	Evaluate clear cut idea in Galois theory extensions and illustrate through examples	K5
CO5	Learn and conclude Galois theory correspondence theorem of algebra	K5

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	2	2	3	2	2	2	2
CO2	3	3	3	2	2	3	3	3	2	2
CO3	3	3	3	3	3	3	3	2	3	3
CO4	2	2	3	3	3	2	2	3	3	3
CO5	2	2	3	3	3	2	3	2	3	3

“1” – Slight (Low) Correlation – “2” – Moderate (Medium) Correlation –

“3” – Substantial (High) Correlation – “-” indicates there is no correlation.

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	Prime Ideals and Maximal Ideals - Irreducible Polynomials.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
II	Classical Formulas - Splitting Fields.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
III	The Galois Group - Roots of Unity - Solvability by Radicals.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
IV	Independence of Characters - Galois Extensions.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	The Fundamental Theorem of Galois Theory – Applications – Galois’s Great Theorem.	18	CO1, CO2, CO3,	K1, K2, K3,

			CO4, CO5	K4, K5
VI	Self-Study for Enrichment (Not included for End Semester Examinations) Rings - Domains and Fields - Homomorphism and Ideals - Quotients Rings- Polynomial Rings over Fields.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

Text Books

Joseph Rotman (2006), *Galois Theory*, 2nd Edition, Springer Verlag

Chapters and Pages

UNIT I Pages 31- 43

UNIT II Pages 44-58

UNIT III Pages 59-75

UNIT IV Pages 76-82

UNIT V Pages 83-95

Reference Books

1. David S. Dummit and Richard M. Foote (Reprint 2017), *Abstract Algebra*, Wiley and Sons, Third Edition
2. John B. Fraleigh (2018), *A First Course in Abstract Algebra*, Narosa Publishing House, Seventh edition
3. I. N. Herstein (2006), *Topics in Algebra*, John Wiley, Second Edition

Web References

1. <https://nrich.maths.org/1422>
2. <https://www.math3ma.com/blog/what-is-galois-theory-anyway>
3. https://people.math.harvard.edu/~elkies/M250.01/galois_topix.html
4. <https://www.maths.ed.ac.uk/~tl/gt/gt.pdf>
5. <https://mathoverflow.net/questions/34125/is-galois-theory-necessary-in-a-basic-graduate-algebra-course>

Pedagogy

Power point presentations, Group Discussions, Seminar, Quiz, Assignment.

Course Designer

Dr. K. Kalaiarasi

Semester II	Internal Marks: 25		External Marks:75	
COURSE CODE	COURSE TITLE	CATEGORY	Hrs /Week	CREDITS
22PMA2CC6	REAL ANALYSIS	CORE	6	5

Course Objective

- **Identify** the elements and importance of real numbers.
- **Provide** students with the specialist knowledge necessary for basic concepts in Real Analysis.
- **Apply** the proof techniques in analysis to be well prepared for the advanced courses.

Prerequisites

Basic set theory and Calculus

Course Outcomes

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
	On the successful completion of the course, students will be able to	
CO1	Describe fundamental properties of the real numbers that lead to the formal development of real analysis.	K2
CO2	Construct the important concepts of real analysis.	K3
CO3	Ascertain the concepts of basic topology, continuity, differentiation, The Riemann-Stieltjes Integral, sequences and series of functions, functions of several variables.	K4
CO4	Explain various mathematical proofs of basic results in real analysis.	K5
CO5	Develop the abstract ideas and various methods in mathematical analysis that can be applied to important practical problems.	K6

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3	3	2	2	2	3
CO2	3	2	3	3	3	3	2	3	2	3
CO3	3	3	3	3	3	3	2	3	3	3
CO4	3	2	3	3	2	3	2	2	2	3
CO5	3	3	3	3	2	3	2	3	3	3

“1” – Slight (Low) Correlation – “2” – Moderate (Medium) Correlation –

“3” – Substantial (High) Correlation – “-” indicates there is no correlation.

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	Basis Topology: Finite, Countable and Uncountable Sets – Metric Spaces – Compact Sets – Connected Sets.	18	CO1, CO2, CO3, CO4, CO5	K2, K3, K4, K5, K6
II	Continuity and Differentiation: Limits of Functions – Continuous Functions – Continuity and Compactness – Continuity and Connectedness – Discontinuities – Monotonic Functions – The Derivative of a Real Function – Mean value Theorems – The Continuity of Derivatives – L’ Hospital’s Rule – Derivatives of Higher Order – Taylor’s Theorem.	18	CO1, CO2, CO3, CO4, CO5	K2, K3, K4, K5, K6
III	The Riemann-Stieltjes Integral: Definition and Existence of the Integral – Properties of the Integral – Integration and Differentiation.	18	CO1, CO2, CO3, CO4, CO5	K2, K3, K4, K5, K6
IV	Sequences and Series of Functions: Discussion of Main Problem – Uniform Convergence – Uniform Convergence and Continuity – Uniform Convergence and Integration – Uniform	18	CO1, CO2, CO3, CO4, CO5	K2, K3, K4, K5, K6

	Convergence and Differentiation – The Stone-Weierstrass Theorem.			
V	Functions of Several Variables Differentiation – The Contraction Principle – The Inverse Function Theorem – The Implicit Function Theorem.	18	CO1, CO2, CO3, CO4, CO5	K2, K3, K4, K5, K6
VI	Self Study for Enrichment: (Not included for End Semester Examinations) Perfect Sets – Infinite Limits and Limits at Infinity – Integration of Vector-valued Functions – Equicontinuous Families of Functions - Linear Transformations.	-	CO1, CO2, CO3, CO4, CO5	K2, K3, K4, K5, K6

Text Books

1. Walter Rudin (1986). *Principles of Mathematical Analysis (Third Edition)*. McGraw-Hill Book Company.

Chapters and Sections

UNIT-I	Chapter 2: Sections 2.1 – 2.42, 2.45 – 2.47
UNIT-II	Chapter 4: Sections 4.1 – 4.31 Chapter 5: Sections 5.1 – 5.15
UNIT-III	Chapter 6: Sections 6.1 – 6.22
UNIT- IV	Chapter 7: Sections 7.1 – 7.18, 7.26 – 7.33
UNIT- V	Chapter 9: Sections 9.10 – 9.29

Reference Books

1. Robert G. Bartle and Donald R. Sherbert. (2019). *Introduction to Real Analysis (Fourth Edition)*. Wiley India Pvt. Limited.
2. Tom M. Apostol. (2002). *Mathematical Analysis (Second Edition)*. Narosa Publishing House.
3. H.L. Royden. (2003). *Real Analysis (Third Edition, Ninth Reprint)*. PHI Learning Private Limited, New Delhi.

Web References

1. <https://youtu.be/mfoVRabIpQI>
2. <https://tinyurl.com/c756hc6k>
3. <https://youtu.be/6mNGn8dTnJw>
4. https://youtu.be/xIwg_w2quRE
5. <https://youtu.be/yLbgdL9HAeg>
6. <https://tinyurl.com/mux7d53w>
7. <https://youtu.be/8VTG6EsyJh4>

Pedagogy

Power Point Presentations, Group Discussions, Seminar, Quiz, Assignment.

Course Designer

Dr. S. Vidhya

Semester II	Internal Marks: 25		External Marks: 75	
COURSE CODE	COURSE TITLE	CATEGORY	Hrs /Week	CREDITS
22PMA2CC7	LINEAR ALGEBRA	CORE	6	5

Course Objectives

- **Acquire** knowledge related to basic concepts.
- **Develop** rational thinking patterns in terms of problem solving in competitive exam.
- **Emphasis** knowledge of the various aspects of Linear Algebra.

Prerequisite

Basic Knowledge of algebra and vector space.

Course Outcomes

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
	On the successful completion of the course, students will be able to	
CO1	Remember and recall the basic concepts of vector space	K1
CO2	Illustrate the various techniques of problem solving in respective stream	K2
CO3	Apply different terminologies of linear algebra	K3
CO4	Classify the various properties in transformation	K4
CO5	Interpret the problems involved in vector spaces	K5

Mapping of CO with PO and PSO

os	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	2	3	2	3	2	3	3
CO2	3	3	3	3	3	3	3	3	3	3
CO3	2	2	3	2	3	3	3	2	2	3
CO4	2	2	2	2	3	2	2	2	2	3
CO5	3	3	3	3	3	3	3	3	2	3

“1” – Slight (Low) Correlation – “2” – Moderate (Medium) Correlation –

“3” – Substantial (High) Correlation – “-” indicates there is no correlation.

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	Matrices: Systems of Linear Equations – Matrices and Elementary Row Operations – Row reduced Echelon Matrices – Invertible Matrices – Bases and Dimension.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
II	Linear Transformations: Linear Transformations - The Algebra of Linear Transformations – Isomorphism of Vector Spaces – Representation of Transformations by Matrices – Linear Functionals – The Transpose of a Linear Transformation.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
III	Polynomials:	18	CO1, CO2, CO3,	K1, K2, K3,

	Algebras - The Algebra of Polynomials – Polynomial Ideals – The Prime Factorization of a Polynomial . Determinants: Commutative rings – Determinant functions.		CO4, CO5	K4, K5
IV	Determinants: Permutations and the Uniqueness of Determinants — Introduction - Characteristic values – Annihilating Polynomials.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	Elementary Canonical Forms: Invariant Subspaces –Direct – Sum Decompositions – Invariant Direct Sums – The Primary Decomposition Theorem.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
VI	Self -Study for Enrichment: (Not included for End Semester Examination) Matrix Multiplication - The Double Dual - Lagrange Interpolation - Additional Properties of Determinants - Simultaneous Triangulation and Simultaneous Diagonalization.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

Text Book

Kenneth Hoffman and Ray Alden Kunze (1975). *Linear Algebra*, Second Edition, Prentice Hall of India Private Limited, New Delhi.

Chapters and Sections

UNIT-I	Chapter 1: Sections 1.2 – 1.4, 1.6 Chapter 2: Sections 2.3
UNIT-II	Chapter 3: Sections 3.1 – 3.5, 3.7
UNIT-III	Chapter 4: Sections 4.1, 4.2, 4.4, 4.5 Chapter 5: Sections 5.1 – 5.2
UNIT- IV	Chapter 5: Sections 5.3 Chapter 6: Sections 6.1 – 6.3
UNIT- V	Chapter 6: Sections 6.4, 6.6 – 6.8

Reference Books

1. Kumaresan S(2004). *Linear Algebra: A Geometric Approach*, Prentice – Hall of India Ltd.
2. Rao A. R, Bhimashankaram P(2000). *Linear Algebra, Second Edition*, Tata McGraw Hill.
3. Edgar Goodaire G(2014). *Linear Algebra*, Pure & Applied World Scientific, Cambridge University Press India Ltd.

Web References

1. <https://youtu.be/Pc2dWW3aSrK>
2. <https://youtu.be/shs8lWDOBHO>
3. <https://youtu.be/nPOooyrM5is>
4. <https://youtu.be/uJNQPgYjlQc>
5. <https://youtu.be/6PEKr7vWsrw>
6. <https://ksuweb.kennesaw.edu>

Pedagogy

Power Point Presentations, Group Discussions, Seminar, Quiz, Assignment.

Course Designer

Dr. P.Shalini

Semester II	Internal Marks: 25		External Marks: 75	
COURSE CODE	COURSE TITLE	CATEGORY	Hrs /Week	CREDITS
22PMA2CCC1A	PARTIAL DIFFERENTIAL EQUATIONS	CORE CHOICE	6	4

Course Objective

- **Recognize** certain basic types of first and second order PDEs and an in-depth knowledge of solving them by various methods.
- **Analyze** the Characteristics and Compatibility of PDE's.
- **Qualitative Analysis** of the solutions of Boundary value Problems.

Prerequisite

Fundamental knowledge of Partial differential equations in UG.

Course Outcomes

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
	On the successful completion of the course, students will be able to	
CO1	Interpret the solutions of hyperbolic, linear and second order partial differential equations, Exterior, Interior and boundary value problems using various Methods.	K2
CO2	Develop the various type of first and second order equations, Interior and Exterior value problems and Determine the higher order equations in physics, Characteristics of Equations in Three Variables, Linear Hyperbolic Equations and Elementary Solutions of Laplace's Equation.	K3
CO3	Diagnose the orthogonally, compatibility and characteristics of the partial differential equations with constant and variable coefficients, method of Integral transforms and Families of Equipotential Surfaces.	K3
CO4	Discriminate the solutions of first, second order and hyperbolic equations, Integral Surfaces Passing through a Given Curve, Surfaces Orthogonal to a Given System of Surfaces, Characteristics of Equations in Three Variables, The Solution of Linear Hyperbolic Equations, Separation of Variables	K4
CO5	Ascertain the concepts of Laplace equation to find the solution of boundary value problems, Special Types of First-Order Equations, Linear Partial Differential Equations with Constant Coefficients, Equations with Variable Coefficients, The Method of Integral Transforms, Families of Equipotential Surfaces.	K4

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3	3	3	2	2	1
CO2	3	2	3	3	3	3	3	3	2	3
CO3	3	3	3	3	3	3	3	3	3	3
CO4	3	2	3	3	2	3	3	2	2	3
CO5	3	2	3	3	2	3	3	3	3	2

“1” – Slight (Low) Correlation – “2” – Moderate (Medium) Correlation –

“3” – Substantial (High) Correlation – “-” indicates there is no correlation.

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	Partial Differential Equations of The First Order: 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 - Surfaces Orthogonal to a Given System of Surfaces.	18	CO1, CO2, CO3, CO4, CO5	K2, K3, K4
II	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 - Jacobi’s Method.	18	CO1, CO2, CO3, CO4, CO5	K2, K3, K4
III	Partial Differential Equations of the Second Order: The Origin of Second-order Equations – Second-order Equations in Physics – Higher-order Equations in Physics - Linear Partial Differential Equations with Constant Coefficients - Equations with Variable Coefficients.	18	CO1, CO2, CO3, CO4, CO5	K2, K3, K4

IV	Partial Differential Equations of the Second Order: Characteristics of Equations in Three Variables - The Solution of Linear Hyperbolic Equations - Separation of Variables - The Method of Integral Transforms.	18	CO1, CO2, CO3, CO4, CO5	K2, K3, K4
V	Laplace's Equation: Elementary Solutions of Laplace's Equation - Families of Equipotential Surfaces - Boundary Value Problems - Separation of Variables.	18	CO1, CO2, CO3, CO4, CO5	K2, K3, K4
VI	Self Study for Enrichment: (Not included for End Semester Examinations) Nonlinear Partial Differential Equations of the First Order - Solutions Satisfying Given Conditions - Characteristic Curves of Second-Order Equations – Nonlinear Equations of the Second Order– Problems with Axial Symmetry.	-	CO1, CO2, CO3, CO4, CO5	K2, K3, K4

Text Book

1. Ian N. Sneddon (2006), *Elements of Partial Differential Equations*, Dover Publication – INC. Mineola, Newyork.

Chapters and Sections

UNIT- I	Chapter 2:	Sections 1 to 6
UNIT- II	Chapter 2:	Sections 8 to 11, 13
UNIT- III	Chapter 3:	Sections 1 to 5
UNIT- IV	Chapter 3:	Sections 7 to 10
UNIT- V	Chapter 4:	Sections 2 to 5

Reference Books

1. M.D.Raisinghania (2001), *Advanced Differential Equations*, Eighth Edition, S.Chand and Company Ltd., NewDelhi.
2. T.Amarnath (2003), *Elementary Course in Partial Differential Equations*, Second Edition, Narosa Publishing House, New Delhi.
3. Sauvigny, Friedrich (2006), *A Partial Differential Equations 2: Functional Analytic Methods*, Springer, Arizona.

Web References

1. <https://people.bath.ac.uk/mir20/images/odenotes.pdf>
2. <https://pages.pomona.edu/~ajr04747/Spring2014/Math182/Notes/Math182Spring2014Notes.pdf>
3. <https://www.youtube.com/watch?v=VBn1diQCykQ>
4. <https://www.youtube.com/watch?v=f0FeWyloHrs>
5. <https://nptel.ac.in/courses/111106139>

Pedagogy

Power Point Presentations, Group Discussions, Seminar, Quiz, Assignment.

Course Designer

Dr. G. Janaki

Semester II	Internal Marks: 25		External Marks:75	
COURSE CODE	COURSE TITLE	CATEGORY	Hrs /Week	CREDITS
22PMA2CCC1B	MATHEMATICAL PROGRAMMING	CORE CHOICE	6	4

Course Objectives

- Ability to **Understand** and **Analyze** managerial problems in industry so that they are able to use resources (capitals, materials, staffing, and machines) more effectively.
- **Knowledge** of formulating mathematical models for quantitative analysis of managerial problems in industry.
- **Allows** a quantitative technique or a scientific approach for making better decisions for operations under the control.

Prerequisite

Basic Knowledge of Operations Research.

Course Outcomes

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
	On the successful completion of the course, students will be able to	
CO1	Recognize the importance and value of Operations Research and mathematical modeling in solving practical problems in industry	K1, K2
CO2	Know how to use variables for formulating complex mathematical models in management science, industrial engineering and Transportation science and in real life.	K3
CO3	Analyze a managerial decision problem and formulate into a mathematical model	K4
CO4	To design, improve and operate complex systems in the best possible way	K4, K5
CO5	Determine the solution of NonLinear Programming based on Various Method.	K5

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	3	3	3	3	3	2	3
CO2	3	3	3	3	3	3	3	3	2	3
CO3	3	2	3	3	3	3	3	3	3	3
CO4	3	3	3	2	3	3	3	3	3	3
CO5	3	3	2	3	3	3	2	3	3	3

“1” – Slight (Low) Correlation – “2” – Moderate (Medium) Correlation –

“3” – Substantial (High) Correlation – “-” indicates there is no correlation.

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	Advanced Linear Programming: From Extreme Points to Basic Solutions - Generalized Simplex Tableau in Matrix form - Development of the Optimality and Feasibility Conditions - Revised Simplex Algorithm.	17	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
II	Integer Linear Programming: Integer Programming Algorithms – Cutting Plane Algorithm. Deterministic Dynamic Programming: Recursive Nature of Dynamic Programming(DP) Computations.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
III	Simulation Modeling : Monte Carlo Simulation – Types of Simulation – Sampling from Probability Distribution.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
IV	Classical Optimization Theory: Unconstrained Problems – Necessary and Sufficient Conditions – The Newton – Raphson Method – Constrained Problems – Equality Constraints (Jacobi Method).	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

V	Non Linear Programming Algorithms: Unconstrained Algorithms – Direct Search Method – Gradient Method - Constrained Algorithms – Quadratic Programming.	19	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
VI	Self -Study for Enrichment: (Not included for End Semester Examinations) Duality – Matrix Definition of the Dual Problem – Optimal Dual Solution – Forward and Backward Recursion – Generation of Random Numbers – Equality Constraints (Lagrangean Method) – Chance-Constrained Programming.		CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

Text Book

Hamdy A.Taha, Ninth Edition, (2014), *Operations Research*, Dorling Kindersley (India) Pvt. Ltd.

Chapters and Sections

UNIT-I	Chapter 7: Sections 1.1, 1.2, 2.1 - 2.2 (Page No. 299 - 313)
UNIT-II	Chapter 8: Sections 2, 2.2 (Page No. 355, 364 - 373), Chapter 11: Sections1 (Page No. 461 - 464)
UNIT-III	Chapter 17: Sections 1, 2, 3.2 (Page No. 681 – 686, 688 - 694)
UNIT- IV	Chapter 18: Sections 1, 1.1, 1.2, 2, 2.1(Page No. 713 - 726)
UNIT- V	Chapter 19: Sections 1, 1.1, 1.2, 2, 2.2 (Page No. 737 – 744, 753 – 758)

Reference Books

1. KantiSwarup, P.K. Gupta, ManMohan, Nineteenth Edition (2017), *Operations Research*, Sultan Chand and Sons Publishers.
2. J.K. Sharma, Fourth Edition (2009), *Operations Research Theory and Applications*, Macmillan India Limited.
3. S.S. Rao, Second Edition (1985), *Optimization Theory and Applications*, New Age International Ltd.

Web References

1. https://www.youtube.com/watch?v=ii_oSKROeRI
2. <https://www.youtube.com/watch?v=NSrIb7mKtwg>
3. <https://faculty.ksu.edu.sa/sites/default/files/index.pdf>
4. <https://www.youtube.com/watch?v=eo2tOPV3AoE>
5. <https://www.youtube.com/watch?v=9ESUw4azhKE>

Pedagogy

Power point presentations, Group Discussions, Seminar, Quiz, Assignment.

Course Designer

Dr. E. Litta.

Semester II	Internal Marks: 25		ExternalMarks:75	
COURSE CODE	COURSE TITLE	CATEGORY	HRS /WEEK	CREDITS
22PMA2CCC1C	DIFFERENCE EQUATIONS	CORE CHOICE	6	4

Course Objective

- **Analyze** the linear difference equations of higher order.
- **Understand** the implementation of nonlinear difference equations..
- **Summarize** the results of oscillation for linear difference equations with systems of variables..

Prerequisite

Classification of linear difference equations.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
CO1	Recall and Classify the models through linear difference equations of high- order..	K1, K2
CO2	Interpret the systems of two or more dependent variables for various models.	K2
CO3	Solve the Planetary motions through the study of a linear difference or differential equations to examination of an associated complex function..	K3
CO4	Analyze the basic concepts of Difference equations.	K4
CO5	Determine various types of models through the solutions oscillate around zero or eventually positive or eventually negative and also oscillation theory for self-adjoint equations	K5

Mapping of CO with POs and PSOs

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	3	3	3	2	2	2	3
CO2	2	3	3	2	2	2	3	2	2	3
CO3	2	2	3	3	3	3	3	2	3	3
CO4	3	3	2	2	3	3	3	3	2	2
CO5	2	2	3	3	2	3	2	2	2	3

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	<p>Linear Difference Equations of Higher Order</p> <p>Difference Calculus: The power Shift, Factorial Polynomials and The Antidifference Operator - General Theory of Linear Difference Equations - Linear Homogeneous Equations with Constant Coefficients</p> <p>Nonhomogeneous Equations: Method of Undetermined coefficients : The Method of Variation of Constants (Parameters)</p>	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
II	<p>System of Linear Difference Equations</p> <p>Autonomous (Time –Invariant) Systems : The Discrete Analogue of the Putzer Algorithm, The Development of the Algorithm for A^n – the Basic Theory</p> <p>The Jordan form: Autonomous (Time – Invariant) Systems Revisited : Diagonalizable Matrices, The Jordan Form and Block-Diagonal Matrices.</p>	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
III	<p>The Z-Transform Method and Volterra Difference Equations</p> <p>Definition and Examples : Properties of the Z-Transform – The Inverse Z-transform and Solutions of Difference Equations : The Power Series Method, The Partial Fractions Method and The Inversion Integral Method</p> <p>Volterra Difference Equations of convolution types: The Scalar Case.</p>	20	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
IV	<p>Oscillation Theory</p> <p>Three-Term Difference Equations – Self-Adjoint Second- Order Equations.</p>	17	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

V	Asymptotic Behavior of Difference Equations Tools and Approximation – Poincare’s theorem : Infinite Products and Perron’s Example – Asymptotically Diagonal Systems – High- Order Difference Equations	17	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
VI	Self Study for Enrichment: (Not included for End Semester Examination) Limiting behavior of solutions – Linear Periodic System - Volterra Systems - Nonlinear Difference Equations - Second- Order Difference Equations : A Generalization of the Poincare Perron Theorem.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

Text Books

1. Saber N Elaydi, Third Edition, (2004), *An Introduction to Difference Equations*, Springer Verlag, New York.

UNIT-I	Chapter 2	Section 2.1 - 2.4
UNIT-II	Chapter 3	Sections 3.1 - 3.3
UNIT-III	Chapter 6	Sections 6.1 - 6.3
UNIT- IV	Chapter 7	Sections 7.1 & 7.2 (Page No. 313 – 320)
UNIT- V	Chapter 8	Sections 8.1 - 8.4

Reference Books

1. Ravi P. Agarwal and Kanishka Perera, Reprint, (2006), *Proceedings of the Conference on Differential and Difference Equations and Applications*, Hindawi Publishing Corporation.
2. Ravi P. Agarwal, Second Edition, (2000), *Difference Equations and Inequalities*, Marcel Dekker, Inc., New York.
3. Klaus Neusser, Reprint, (2021), *Difference Equations for Economists* RePEc/ IDEAS.

Web References

1. <https://www.youtube.com/watch?v=zw8xM5GHvZQ>
2. <https://www.youtube.com/watch?v=MtHpbGUIGaA>
3. <https://www.youtube.com/watch?v=ESKx8PEJCB4>
4. https://www.youtube.com/watch?v=_Xub0zCmlXk
5. <https://www.youtube.com/watch?v=IKtROKsWVR4>
6. <https://eprints.kfupm.edu.sa/id/eprint/9906/1/9906.pdf>

Pedagogy

Power point Presentations, Group Discussions, Seminar, Quiz, Assignment and Smart Classroom.

Course Designer

Dr R. Buvaneswari.

Semester II	Internal Marks: 40		External Marks:60	
COURSE CODE	COURSE TITLE	CATEGORY	Hrs /Week	CREDITS
22PMA2DSE2AP	COMPUTATIONAL MATHEMATICS USING MATLAB - PRACTICAL	DISCIPLINE SPECIFIC ELECTIVE	6	3

Course Objectives

- To Provide Software that can be used to explore and experiment with Mathematical Constructions.
- Flexible for users to solve the various system of equations.
- To attain a high level of user support.

Prerequisite

- Basic knowledge of Higher Mathematics

Course Outcomes

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
	On the successful completion of the course, students will be able to	
CO1	Remember the concepts of Algebra, Geometry, Numerical Analysis, Calculus, etc.	K1
CO2	Understand the calculation by reading documented source code	K2
CO3	Relate the mathematical thinking that is applicable to daily life	K3
CO4	Associate technological tools for graphical visualization	K4
CO5	Develop skills with core elements of MATLAB and gain an appreciation of social scientific work	K6

Mapping of CO with PO and PSO

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	2	2	3	3	2	2	2
CO2	3	3	3	2	2	2	3	2	2	3
CO3	2	2	2	2	2	2	2	2	2	2
CO4	2	3	2	3	2	3	2	3	2	2
CO5	2	2	2	2	2	2	2	2	2	2

“1” – Slight (Low) Correlation – “2” – Moderate (Medium) Correlation –

“3” – Substantial (High) Correlation – “-” indicates there is no correlation.

LIST OF PROGRAMS

1. Mathematical operations
2. Finding GCD and LCM
3. Finding roots and solving the system of equations
4. Matrix Operations
5. Decision Making
6. Loop Types
7. Vector Operations
8. Working with Arrays
9. Plotting 2D Graphs
10. Plotting 3D Graphs
11. Importing and Exporting data in Excel
12. Integration
13. Differentiation and Finding Maxima and Minima
14. Manipulating strings
15. Laplace Transform and Fourier Transform

Web References

1. <https://www.mathworks.com/products/matlab.html>
2. <https://www.mathworks.com/help/matlab/ref/plot.html>
3. <https://www.mathworks.com/help/stateflow/ug/operations-for-vectors-and-matrices.html>
4. https://www.tutorialspoint.com/matlab/matlab_matrices.htm
5. <https://www.javatpoint.com/matlab-numerical-integration>

Pedagogy

Power point presentations and Assignment.

Course Designers

1. Dr. S. Sasikala
2. Ms. R. Soundaria

Semester II	Internal Marks: 40 Marks:60		External	
COURSE CODE	COURSE TITLE	CATEGORY	Hrs / Week	CREDITS
22PMA2DSE2BP	MATHEMATICAL MODELLING USING MATLAB– PRACTICAL	DISCIPLINE SPECIFIC ELECTIVE	6	3

Course Objective

- **Analyze** the concepts and use the necessary to the real-life problems using MATLAB.
- **Apply** the technical knowledge to **interpret** and **solve** the problems using MATLAB.
- **Explore** the ideas of MATLAB in Mathematical modelling.

Prerequisite

Basic knowledge of Mathematical Modelling and MATLAB.

Course Outcomes

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
	On the successful completion of the course, students will be able to	
CO1	Understand the importance of Mathematical Modelling in the real world using MATLAB.	K2
CO2	Apply Mathematical concepts to identify the appropriate mathematics to realize a solution using MATLAB.	K3
CO3	Make use of formulas, familiar with memory and file management in MATLAB.	K4
CO4	Determine various types of models through Difference equation .	K5
CO5	Formulate, Analyse and simulate mathematical models using MATLAB.	K6

Mapping of CO with PO and PSO

	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	3	3	3	3	2	2	2
CO2	3	2	3	3	3	3	3	2	2	2
CO3	3	2	3	3	3	3	3	2	2	2
CO4	3	2	3	3	3	3	3	2	2	2
CO5	3	2	3	3	3	3	3	2	2	2

“1” – Slight (Low) Correlation

“2” – Moderate (Medium) Correlation

“3” – Substantial (High) Correlation

“-” indicates there is no correlation.

LIST OF PROGRAMS

- 1) Lagrange 's Formula for Area of a Rectangle.
- 2) Simple interest and Compound interest.
- 3) Integral equations.
- 4) Calculus of variations in functionals involving two and three independent variables.
- 5) Difference Equation of a System.
- 6) MATLAB programming in dynamic programming.
- 7) Delay differential equations.
- 8) Linear programming in MATLAB.
- 9) Mixed-Integer linear programming.
- 10) Application of Non-linear programming.
- 11) Simulating simple circuit.
- 12) Programming a simple markov model.
- 13) Design Optimization.
- 14) MATLAB solution of a diffusion equation.
- 15) Commodities trading with MATLAB.

Web References

1. <https://www.youtube.com/watch?v=Y93V9wOWETs>
2. <https://www.youtube.com/watch?v=ryxh5CoihwE>
3. <https://www.youtube.com/watch?v=K6vjDI4hzKo>
4. <https://www.youtube.com/watch?v=LpVv306NSnE>
5. <https://www.youtube.com/watch?v=z4aMBaTPW3I>
6. <https://www.youtube.com/watch?v=TCWrD3cZG9s>
7. https://www.youtube.com/watch?v=bJy_QJTOxQA
8. <https://www.mathworks.com/videos/mixed-integer-linear-programming-in-matlab-91541.html>
9. <https://www.youtube.com/watch?v=qTJDNXRfcsc>
10. <https://www.youtube.com/watch?v=yLIQ1dzAsl8>
11. <https://www.youtube.com/watch?v=wr35tzLMMfw>
12. <https://www.mathworks.com/videos/design-optimization-with-matlab-1601644975662.html>
13. <https://www.youtube.com/watch?v=S3DXGvrdx1w>
14. <https://www.youtube.com/watch?v=m6bkXNEKE7E>
15. <https://www.mathworks.com/videos/modeling-an-insulin-infusion-pump-87684.html>

Pedagogy

Power point presentations, Live Demo, Hands on training.

Course Designer

Dr. C. Saranya

Semester II	Internal Marks:40	External Marks:60		
COURSE CODE	COURSE TITLE	CATEGORY	Hrs/ Week	CREDITS
22PMA2DSE2CP	ORDINARY DIFFERENTIAL EQUATIONS AND PARTIAL DIFFERENTIAL EQUATIONS USING MATLAB PRACTICAL	DISCIPLINE SPECIFIC ELECTIVE	6	3

Course Objective

- To identify different ordinary and partial differential equation problems and reformulate them in a way that is appropriate for using MATLAB.
- Use functions from the programming language library for efficient calculations and visualization.
- Solve problems systematically and implement the solution in MATLAB.

Prerequisite

Fundamental knowledge of ordinary and partial differential equations.

Course Outcomes

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
CO1	Describe the use of fundamental data structures	K3
CO2	Apply MATLAB effectively to analyze and visualize data	K4
CO3	Solve scientific and mathematical problems	K4
CO4	Apply basic functions for ordinary and partial differential equations	K3
CO5	Compute programs in MATLAB	K5

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	2	2	2	3	2	2	3
CO2	3	2	3	2	3	2	3	3	3	3
CO3	3	3	3	2	3	2	3	3	3	2
CO4	3	3	2	3	3	3	2	3	3	3
CO5	3	3	2	3	3	3	2	3	3	3

“1”–Slight (Low)Correlation

“2”–Moderate (Medium)Correlation

“3”– Substantial (High)Correlation

“-” indicates there is no correlation.

LIST OF PROGRAMS

1. Computing the solutions of First Order Differential Equations.
2. Determine the solutions to Initial Value Problems.
3. Plotting the solutions of First Order Differential Equations.
4. Plotting the solution of the second-order equations.
5. Computing the Solutions of the heat equations.
6. Finding the solutions of the Poisson equations.
7. Determine the solutions of Laplace Equations by Direct Method.
8. Computing the solutions of Laplace Equations by Iterative Method.
9. Solving the nonlinear system of Partial Differential Equations.
10. Plotting for the single Partial Differential Equations with the initial conditions.

Web References

1. <https://in.mathworks.com/help/matlab/math/partial-differential-equations.html>
2. <https://www.math.tamu.edu/reu/comp/matode.pdf>
3. <https://www.math.tamu.edu/~phoward/m401/pdemat.pdf>
4. <https://www.youtube.com/watch?v=-DmTK868J4A>
5. <https://www.youtube.com/watch?v=rwC7YU2WUf4>

Pedagogy

Power point presentations, Live Demo, Hands on training.

Course Designers

1. Dr. G. Janaki
2. Ms. A. Gowri Shankari.