CAUVERY COLLEGE FOR WOMEN (AUTONOMOUS)

Nationally Accredited with 'A+' Grade by NAAC

TIRUCHIRAPPALLI

PG AND RESEARCH DEPARTMENT OF MATHEMATICS

M. Sc. MATHEMATICS

AUTONOMOUS SYLLABUS

2026 – 2027 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 tonurture 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)

PG AND RESEARCH DEPARTMENT OF MATHEMATICS

M.Sc Mathematics

CHOICE-BASED CREDIT SYSTEM-LEARNING OUTCOME-BASED CURRICULUM FRAMEWORK (CBCS – LOCF)

(For the Candidates admitted from the Academic year 2026-2027 onwards)

Semester	Course	Course Title	Course Code	Inst. Hrs. / week	Credits	Exam			Total
						Hrs.	Marks		
							Int.	Ext.	
I	Core Course– I (CC-I)	Algebra-I	26PMA1CC1	6	5	3	30	70	100
	Core Course – II (CC-II)	Real Analysis-I	26PMA1CC2	6	5	3	30	70	100
	Core Course –III(CC-III)	Ordinary Differential Equations	26PMA1CC3	6	5	3	30	70	100
	Discipline Centric Elective Course-I (DCEC-I)	A. Linear Algebra	26PMA1DCE1A	5	3	3	30	70	100
		B. Graph Theory	26PMA1DCE1B						
		C. Programming in C++ and Numerical Methods	26PMA1DCE1C						
	Generic Elective Course -I (GEC-I)	A. Number Theory and Cryptography	26PMA1GEC1A	4	2	3	30	70	100
		B. Classical Dynamics	26PMA1GEC1B						
	Non-Major Elective Course -I (NMEC-I)	Foundation for logical Thinking	26PMA1NME1	3	2	3	30	70	100
	Total			30	22				**600**
II	Core Course –IV (CC-IV)	Algebra-II	26PMA2CC4	6	5	3	30	70	100
	Core Course - V (CC-V)	Real Analysis-II	26PMA2CC5	6	5	3	30	70	100
	Core Course - VI (CC-VI)	Topology	26PMA2CC6	6	5	3	30	70	100
	Discipline Centric Elective Course-II (DCEC-II)	A. Partial Differential Equations	26PMA2DCE2A	5	3	3	30	70	100
		B. Tensor Analysis	26PMA2DCE2B						
		C. Difference Equations	26PMA2DCE2C						
	Generic Elective Course -II (GEC-II)	A. Mathematical Programming	26PMA2GEC2A	4	2	3	30	70	100
		B. Fluid Dynamics	26PMA2GEC2B						
	Non-Major Elective Course –II (NMEC-II)	Optimization Techniques	26PMA2NME2	3	2	3	30	70	100
	Extra Credit Course	SWAYAM	As per UGC Recommendation						
	Total			30	22				**600**

30 Days INTERNSHIP during Semester Holidays

III	Core Course- VII (CC-VII)	Complex Analysis	26PMA3CC7	6	5	3	30	70	100
	Core Course-VIII (CC-VIII)	Measure Theory and Integration	26PMA3CC8	6	5	3	30	70	100
	Core Practical -I (CP-I)	Numerical Analysis using SAGEMATH	26PMA3CP1	6	5	3	40	60	100
	Discipline Centric Elective Course-III (DCEC-III)	A. Discrete Mathematics	26PMA3DCE3A	5	3	3	30	70	100
		B. Formal Language and Automata Theory	26PMA3DCE3B						
		C. Fuzzy Sets and their Applications	26PMA3DCE3C						
	Generic Elective Course –III (GEC-III)	A. Calculus of variations and Integral equations	26PMA3GEC3A	3	2	3	30	70	100
		B. Introduction to Coding Theory	26PMA3GEC3B						
	Skill Enhancement Course –I (SEC-I)	Analytical Skills for Competitive Examinations	26PMA3SEC1	4	2	2	-	-	100
	Internship	Internship	26PMA3INT	-	2	-	20	80	100
	Extra Credit Course	SWAYAM	As per UGC Recommendation						
	Total			30	24				**700**

IV	Core Course-IX(CC-IX)	Differential Geometry	26PMA4CC9	6	5	3	30	70	100
	Core Course -X (CC-X)	Functional Analysis	26PMA4CC10	6	5	3	30	70	100
	Discipline Centric Elective Course-IV (DCEC-IV)	A. Probability Theory	26PMA4DCE4A	5	3	3	30	70	100
		B. Combinatorics	26PMA4DCE4B						
		C. Mathematical Modelling	26PMA4DCE4C						
	Generic Elective Course –IV (GEC-IV)	A. Stochastic Processes	26PMA4GEC4A	3	2	3	30	70	100
		B. Algebraic Topology	26PMA4GEC4B						
	Skill Enhancement Course -II (SEC-II)	Mathematical Computing using Python	26PMA4SEC2P	3	2	3	40	60	100
	Entrepreneurship/Industry Based Course	Industrial Statistics	26PMA4ENT	3	2	3	30	70	100
	Project	Project Work	26PMA4PW	4	4	-	-	100	100
	Total			30	23				**700**
	Grand Total			120	91				**2600**

Courses & Credits for PG Science Programmes

Sl. No	Courses	No of Courses	Hours Allocated	No of Credits	Marks
1.	Core Course – (CC)	10	6	10*5=50	1000
2.	Core Practical – (CP)	1	6	1*5=5	100
3.	Discipline Centric Elective Course - (DCEC)	4	5	4*3=12	400
4.	Generic Elective Course - (GEC)	4	3/4	4*2=8	400
5.	Non-Major Elective Course-(NMEC)	2	3	2*2=4	200
6.	Skill Enhancement Course- (SEC)	2	3/4	2*2=4	200
7.	Project	1	4	4	100
8.	Internship	1	-	2	100
9.	Entrepreneurship/Industry Based Course	1	3	2	100
	Total	**26**		**91**	**2600**

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

For each Semester marks will be 600 (700 for III Semester due to internship and 700 for IV Semester also)

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

Subject	Internal	External
Theory	30	70
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 30 marks (i.e. 12 marks).
b) The passing minimum for End Semester Examination shall be 40% out of 70 marks (i.e. 28 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

For Internship:

Internship : 100 Marks
Internal : 20 Marks
External : 80 Marks

CORE COURSE – I (CC– I)
ALGEBRA-I
(2026-2027 Onwards)

Semester I	Internal Marks: 30		ExternalMarks:70	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**Hrs /Week**	**CREDITS**
26PMA1CC1	**ALGEBRA-I**	**CORE**	**6**	**5**

Course Objective

- An introduction to the concepts and development of working knowledge on class equation, Counting Principle, and Sylow's theorem.
- A study of groups, with emphasis on finite Abelian groups
- Exploring the properties of Linear Transformation, Real Quadratic form.

Prerequisite:

- UG level Modern Algebra.

S.No.	Course Features	Relevance Status
1	Course emphasis on Employability/Entrepreneurship/Skill Development	Employability, Skill Development
2	Course integrates cross cutting issues relevant to Professional Ethics/Gender sensitization/Environment and Sustainability/Human Values/Indian Knowledge System	Professional Ethics
3	Course relevant to Local/Regional/National/Global needs	Global needs
4	Course focus on Sustainable Development Goals	SDG 4, 9, 11 & 13

Course Outcome and Cognitive Level Mapping

CONumber	COStatement On the successful completion of the course, students will be able to	CognitiveLevel
CO1	Apply the Basic Concepts of Counting Principle, Sylow's Theorems, field Linear Transformations and Real Quadratic Forms.	K1,K2,K3
CO2	Examine in detail about Direct Products, Fields, Canonical Forms, and Normal Transformations.	K3
CO3	Solve problems related to Sylow's theorems, Fields, Canonical Forms and Linear Transformations.	K4
CO4	Classify the Counting Principle, Linear and Normal Transformation.	K4
CO5	Analyze the concepts of Sylow's Theorems, Field, Solvability by Radicals, Canonical Forms, Linear and Normal Transformation.	K5

Mapping of COwithPO and PSO

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3	3	3	2	2	2
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	**Group Theory:** Counting Principle - Sylow's theorems - Direct products - Finite abelian groups	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
II	**Fields:** Extension fields – Roots of polynomials – Solvability by Radicals	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
III	**Linear Transformations:** Canonical forms : Triangular form - Canonical forms : Nilpotent transformations	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
IV	**Linear Transformations:** Canonical forms: A Decomposition of V: Jordan form - Canonical forms : Rational Canonical form	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	**Linear Transformations:** Trace and Transpose - Hermitian, Unitary and Normal Transformations - Real Quadratic Forms	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
VI	**Self-Study for Enrichment** **(Not included for End Semester Examinations)** Galois Groups over the Rationals - The Algebra of Linear Transformation – Characteristics Roots- Matrices – Determinants	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

Text Book

I.N. Herstein(2013), *Topics in Algebra (II Edition)*, Wiley Eastern Limited, New Delhi.

Chapters and Sections

UNIT-I Chapter 2: Sections 2.11 to 2.14
UNIT-II Chapter 5 : Section 5.1, 5.3 and 5.7
UNIT-III Chapter 6: Sections 6.4 and 6.5
UNIT-IV Chapter 6 : Sections 6.6 and 6.7
UNIT-V Chapter 6 : Sections 6.8, 6.10 and 6.11

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,4th Edition.
3. M.Artin,(1991), *Algebra*, Prentice Hall of India.

Web References

1. **https://www.youtube.com/watch?v=g7L_r6zw4-c**
2. **https://www.youtube.com/watch?v=VSB8jisn9xI**
3. **https://www.youtube.com/watch?v=WwndchnEDS4**
4. **http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics**
5. **http://www.opensource.org, www.algebra.com**

Pedagogy

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

Course Designer

Dr.K.Kalaiarasi

CORE COURSE – II (CC - II)
REAL ANALYSIS-I
(2026 - 2027 Onwards)

Semester I	Internal Marks: 30		External Marks: 70	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**Hrs /Week**	**CREDITS**
26PMA1CC2	**REAL ANALYSIS-I**	**CORE**	**6**	**5**

Course Objective

- **Define** the notion of limits, continuity, derivatives and Riemann – Stieltjes integrals.
- **Explore** the fundamental concepts of Riemann – Stieltjes integration and derivatives.
- **Apply** the idea of construction of limits and continuity in various fields.

Prerequisite

UG level real analysis concepts

S. No.	Course Features	Relevance Status
1.	Course emphasis on Analytical Thinking / Problem Solving / Mathematical Reasoning / Research Skill Development	Skill Development, Research, Higher Education & Employability
2.	Course integrates cross-cutting issues relevant to Professional Ethics, Logical Reasoning, Academic Integrity and Critical Thinking	Professional Ethics & Human Values
3.	Course relevant to Local / National / Global academic and research needs in Mathematics, Data Science, Engineering and Scientific Modelling	Global Need
4.	Course focus on Sustainable Development Goals (SDG 4, 8, 9, 12) through mathematical foundations supporting research, modelling and technological advancement	SDG 4, 8, 9, 12

Course Outcomes

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the course, students will be able to	Cognitive Level
CO1	Explain the concepts of limits, continuity, derivatives and Riemann-Stieltjes integrals.	K2
CO2	Apply the concepts of functions of limits, continuity, derivatives and Riemann-Stieltjes integrals and its properties in various fields.	K3
CO3	Classify the concepts of limits, continuity, derivatives and Riemann-Stieltjes integrals.	K4
CO4	Evaluate Riemann-Stieltjes integral, limits, continuity and derivatives.	K5
CO5	Construct various mathematical proofs using the properties of Riemann-Stieltjes integral, limits, continuity and derivatives.	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	3	3	3
CO2	3	3	3	3	3	2	3	3	2	3
CO3	3	3	3	3	3	2	3	2	3	3
CO4	3	3	3	3	3	3	3	2	2	3
CO5	3	3	3	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	**Limits:** Introduction – Convergent sequences in a metric space – Cauchy sequences – Complete metric spaces – Limit of a function – Limits of complex-valued functions. **Continuity:** Continuous functions – Continuity of composite functions – Continuous complex-valued and vector-valued functions – Examples of continuous functions.	18	CO1, CO2, CO3, CO4, CO5	K2, K3, K4, K5, K6
II	**Continuity:** Continuity and inverse images of open or closed sets – Functions continuous on compact sets – Topological mappings (homeomorphisms) – Bolzano's theorem – Connectedness – Components of a metric space – Arcwise connectedness – Uniform continuity – Uniform Continuity and compact sets – Fixed-point theorem for contractions.	18	CO1, CO2, CO3, CO4, CO5	K2, K3, K4, K5, K6
III	**Derivatives:** Introduction – Definition of derivative – Derivatives and continuity – Algebra of derivatives – The chain rule – One-sided derivatives and infinite derivatives – Functions with nonzero derivative – Zero derivatives and local extrema – Rolle's theorem – The Mean-Value Theorem for derivatives – Intermediate-value theorem for derivatives – Taylor's formula with remainder – Partial derivatives – Differentation of functions of a complex variable – The Cauchy-Riemann equations.	18	CO1, CO2, CO3, CO4, CO5	K2, K3, K4, K5, K6
IV	**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 – Step functions as integrators – Reduction of a Riemann – Stieltjes integral to a finite sum - Euler's summation formula - Monotonically increasing integrators. Upper and lower integrals - Additive and linearity properties of upper and lower integrals - Riemann's condition - Comparison theorems.	18	CO1, CO2, CO3, CO4, CO5	K2, K3, K4, K5, K6
V	**The Riemann-Stieltjes Integral:** Integrators of bounded variation - Sufficient conditions for existence of Riemann-Stieltjes integrals - Necessary conditions for the existence of Riemann-Stieltjes integrals - Mean value theorems for Riemann-Stieltjes integrals – The integral as a function of the interval – Second fundamental theorem of integral calculus - Change of variable in a Riemann integral - Second Mean-Value Theorem for Riemann integrals.	18	CO1, CO2, CO3, CO4, CO5	K2, K3, K4, K5, K6

VI	**Self Study for Enrichment:** **(Not included for End Semester Examinations)** Limits of vector-valued functions – Discontinuities of real-valued functions – Derivatives of vector-valued functions – Riemann-Stieltjes integrals depending on a parameter - Complex-valued Riemann-Stieltjes integrals.	-	CO1, CO2, CO3, CO4, CO5	K2, K3, K4, K5, K6

Text Books

1. Tom M. Apostol. (2002). *Mathematical Analysis (Second Edition)*. Narosa Publishing House.

Chapters and Sections

UNIT-I Chapter 4: Sections 4.1 – 4.6, 4.8 – 4.11
UNIT-II Chapter 4: Sections 4.12 – 4.21
UNIT-III Chapter 5: Sections 5.1 – 5.12, 5.14 – 5.16
UNIT- IV Chapter 7: Sections 7.1 – 7.14
UNIT- V Chapter 7: Sections 7.15 – 7.22

Reference Books

1. Robert G. Bartle and Donald R. Sherbert. (2019). *Introduction to Real Analysis (Fourth Edition)*. Wiley India Pvt. Limited.
2. Walter Rudin. (1986). *Principles of Mathematical Analysis (Third Edition)*. McGraw-Hill Book Company.
3. Royden H.L. (2003). *Real Analysis (Third Edition, Nineth Reprint)*. PHI Learning Private Limited, New Delhi.

Web References

6. **https://youtu.be/SMSzqCV91rQ**
7. **https://youtu.be/qVaFEF1NpLY**
8. **https://tinyurl.com/yu8vrpnt**
9. **https://tinyurl.com/236r88xp**
10. **https://tinyurl.com/4y3m4daj**

Pedagogy

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

Course Designer

Dr. S. Vidhya

CORE COURSE – III (CC-III)
ORDINARY DIFFERENTIAL EQUATIONS
(2026-2027 Onwards)

SEMESTER I	INTERNAL MARKS: 30	EXTERNAL MARKS:70		
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS /WEEK**	**CREDITS**
26PMA1CC3	**ORDINARY DIFFERENTIAL EQUATIONS**	**CORE**	**6**	**5**

Course Objectives

- **Develop** the fundamental concepts and solution techniques of ordinary differential equations, including linear differential equations with constant and variable coefficients.
- **Analyze** higher order differential equations, special functions, and equations with regular singular points using analytical methods.
- **Apply** the theory of linear and nonlinear differential equations in studying stability, phase plane analysis, and mathematical models arising in science and engineering**.**

Prerequisite

UG level Calculus and Differential Equations.

S. No.	Course Features	Relevance Status
1	Course emphasis on Employability / Entrepreneurship / Skill Development	Employability, Skill Development
2	Course integrates cross cutting issues relevant to Professional Ethics/ Gender sensitization / Environment and Sustainability/ Human Values/ Indian Knowledge System	Professional Ethics, Human Values, Indian Knowledge System
3	Course relevant to Local / Regional / National / Global needs	National and Global Need
4	Course focus on Sustainable Development Goals	SDG 4, 8, 9

Course Outcomes

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the course, students will be able to	Cognitive Level
CO1	Explain the fundamental concepts of ordinary differential equations, linear dependence, Wronskian, singular points, and stability theory related to linear and nonlinear systems.	**K2**
CO2	Solve second and higher order linear differential equations with constant coefficients using complementary functions, particular integrals, and operator methods.	**K3**
CO3	Apply suitable analytical techniques such as reduction of order, variation of parameters, Frobenius method, and series solutions to solve differential equations with variable coefficients and regular singular points.	**K3**
CO4	Analyze the properties and behavior of solutions of Legendre equations, Bessel equations, and nonlinear autonomous systems using Wronskian and phase plane methods.	**K4**
CO5	Evaluate the stability of linear and nonlinear systems using eigenvalue analysis and Liapunov's direct method, and interpret their applications in science and engineering problems.	**K5**

Mapping of CO with PO and PSO

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	3	1	1	2	3	2	1	1	2
CO2	3	3	2	1	3	3	3	1	1	2
CO3	3	3	2	1	3	3	3	1	1	2
CO4	3	2	3	2	3	3	3	2	1	2
CO5	3	2	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	**Linear Equations with Constant Coefficients:** Introduction – The Secondorder homogeneous equations – Initial value problems for second order equations – Linear dependence and independence – A formula for the Wronskian – The Non-homogeneous equation of order two.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
II	**Linear Equations with Constant Coefficients:** The Homogeneous equation of order *n* – Initial value problems for *n*-th order equations – Equations with real constants – The non-homogeneous equation of order *n* – A special method for solving the non-homogeneous equation – Algebra of constant coefficient operators.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
III	**Linear Equations with Variable Coefficients:** Introduction – Initial value problems for the homogeneous equation – Solutions of the homogeneous equation – The Wronskian and linear independence – Reduction of the order of a homogeneous equation – The non-homogeneous equation – Homogeneous equations with analytic coefficients – The Legendre equation.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
IV	**Linear Equation with Regular Singular Points:** Introduction – The Euler equation – Second order equations with regular singular points - an example – Second order equations with regular singular points - the general case – The Exceptional cases – The Bessel equation – The Bessel equation (continued).	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	**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.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
VI	**Self-Study for Enrichment :** **(Not included for End Semester Examinations)** Justification of the power series method – A convergence proof – Regular singular points at infinity– Equations with variables separated – Exact equations – Nonlinear Mechanics, Conservative systems.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

Text Books

1. Coddington, E. A. (2005). *An Introduction to Ordinary Differential Equations*. Prentice-Hall of India Private Ltd., New Delhi.
2. Simmons, G. F. (2003). *Differential Equations with Applications and Historical Notes*. Tata McGraw Hill., New Delhi.

Chapters and Sections

UNIT- I Chapter 2: Sections 1 to 6 [1]
UNIT- II Chapter 2: Sections 7 to 12 [1]
UNIT- III Chapter 3: Sections 1 to 8 [1]
UNIT- IV Chapter 4: Sections 1 to 4 and 6 to 8 [1]
UNIT- V Chapter 11: Sections 58 to 62 [2]

Reference Books

1. Raisinghania, M. D. (2001). *Advanced Differential Equations*. S. Chand & Company Ltd., New Delhi.
2. Rai, B., Choudary, D. P., and Freedman, H. I. (2002). *A Course in Ordinary Differential Equations*. Narosa Publishing House., New Delhi.
3. Coddington E.A. and Levinson N. (2002). *Theory of Ordinary Differential Equations.* Mc- Graw Hill Publishing Company., NewYork.
4. Chicone, Carmen. (2006). *A Ordinary Differential Equations With Applications*. 2nd Edition. Spring Verlag. , NewYork.

Web References

1. **https://ocw.mit.edu/courses/18-03-differential-equations-spring-2010/**
2. **https://nptel.ac.in/courses/111106100**
3. **https://tutorial.math.lamar.edu/Classes/DE/DE.aspx**
4. **https://www.youtube.com/playlist?list=PLUl4u3cNGP61oFEqvM5a2d2gK5tWz6k8n**
5. **https://www.youtube.com/playlist?list=PLbMVogVj5nJQbmJfB4f0Lh5Zq8J0y9u3K**

Pedagogy

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

Course Designer

Dr. C.Saranya

DISCIPLINE CENTRIC ELECTIVE COURSE –I(DCEC-I)

LINEAR ALGEBRA

(2026-2027 and Onwards)

Semester I	**Internal Marks: 30**			**External Marks:70**
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**Hrs / Week**	**CREDITS**
26PMA1DCE1A	**LINEAR ALGEBRA**	**DISCIPLINE CENTRIC ELECTIVE COURSE-I**	**5**	**3**

Course Objectives

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

Prerequisite

Basic Knowledge of algebra and vector space.

S. No.	**Course Features**	**Relevance Status**
1.	Course emphasis on Employability/Entrepreneurship/Skill Development	Employability, Skill Development
2.	Course integrates cross cutting issues relevant to Professional Ethics/Gender sensitization/ Environment and Sustainability/ Human Values/ Indian Knowledge System	Professional Ethics, Human Values
3.	Course relevant to Local/Regional/National/ Global needs	National and Global Need
4.	Course focus on Sustainable Developmental Goals	SDG 4,8,9

Course Outcomes

Course Outcome and Cognitive Level Mapping

CO Number	**CO Statement** On the successful completion of the course, students will be able to	**Cognitive Level**
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

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

"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	**Linear Equations:** Systems of Linear Equations – Matrices and Elementary Row Operations – Row - Reduced Echelon Matrices – Invertible Matrices . **Vector Spaces**:Vector Spaces– Subspaces–Bases and Dimension.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
II	**Linear Transformations:** Linear Transformations - The Algebra of Linear Transformations – Isomorphism – Representation of Transformations by Matrices – Linear Functionals –The Transpose of a Linear Transformation.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
III	**Determinants:** Commutative Rings – Determinant Functions - Permutations and the Uniqueness of Determinants – Additional Properties of Determinants.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
IV	**Elementary Canonical Forms:** Characteristic Values – Annihilating Polynomials - Invariant Subspaces.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	**Elementary Canonical Forms:** Direct-Sum Decompositions– Invariant Direct Sums–The Primary Decomposition Theorem.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
VI	**Self -Study for Enrichment:** **(Not included for End Semester Examination)** Fields-Matrix Multiplication –- The Double Dual – Simultaneous Triangulation; Simultaneous Diagonalisation.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

Text Books

Kenneth Hoffman and Ray Kunze (1975). *Linear Algebra*, Second Edition, PHI Learning Private Limited, New Delhi.

Chapters and Sections

UNIT-I	Chapter 1: Sections 1.2 – 1.4, 1.6.
	Chapter 2: Sections 2.1– 2.3.
UNIT-II	Chapter 3: Sections 3.1 – 3.5.
UNIT-III	Chapter 5: Sections 5.1 – 5.4.
UNIT- IV	Chapter 6: Sections 6.2 – 6.4.
UNIT- V	Chapter 6: Sections 6.6 – 6.8.

Reference Books

1. Kumaresan S(January 2018). *Linear Algebra: A Geometric Approach*, Prentice – Hall of India Ltd.
2. Keshawa Prasad Gupta(2008). *Linear Algebra*, Pragati Prakashan, Fifteenth Revised Edition.
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
7. https://www.math.hkust.edu.hk/~mabfchen/Math111/Week13-14.pdf

Pedagogy

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

Course Designer

Dr. S. Saridha

DISCIPLINE CENTRIC ELECTIVE COURSE – I (DCEC–I)
GRAPH THEORY
2026-2027 Onwards

Semester I	Internal Marks:30		External Marks:70	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/ WEEK**	**CREDITS**
26PMA1DCE1B	**GRAPH THEORY**	**DISCIPLINE CENTRIC ELECTIVE**	**5**	**3**

Course Objectives

- **Explore** the basic concepts of Graph Theory.
- **Understand** concepts that helps to model real life situation into graphs.
- **Formulate** and prove some theorems about trees, matching, connectivity, colouring and planarity of graphs.

Prerequisite

Basic Knowledge of Graph Theory.

S. No.	Course Features	Relevance Status
1.	Course emphasis on Employability/Entrepreneurship/Skill Development	Employability, Entrepreneurship, Skill Development
2.	Course integrates cross cutting issues relevant to Professional Ethics/Gender sensitization/ Environment and Sustainability/ Human Values/ Indian Knowledge System	Sustainability
3.	Course relevant to Local/Regional/National/ Global needs	Global need
4.	Course focus on Sustainable Developmental Goals	SDG 4,8,9,12

Course Outcomes

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the course, students will be able to	Cognitive Level
CO1	Define the various concepts in Graphs.	K1
CO2	Understand the different terminologies of Graphs.	K2
CO3	Apply the concepts of connectivity, Blocks and Hamilton cycles in the real life.	K3
CO4	Analyze the problems in different aspects and give solutions in their respective streams.	K4
CO5	Assess the concept of Planar Graphs and Euler formula.	K5

Mapping of CO with PO and PSO

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

"1"– Slight(Low) Correlation "2"–Moderate(Medium)Correlation

"3"–Substantial(High)Correlation "-"indicatesthereis no correlation.

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**Graphs and Subgraphs:**- Graphs and Simple Graphs- Graph Isomorphism - The Incidence and Adjacency Matrices –Subgraphs - Vertex Degrees–Paths and Connection– Cycles - The Shortest Path Problem	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
II	**Trees:** Trees–Cut Edges and Bonds – Cut Vertices – Cayley's Formula- The Connector Problem. **Connectivity:**- Connectivity - Blocks.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
III	**Euler Tour and Hamilton Cycles:**- Euler Tours- Hamilton Cycles - The Travelling Salesman Problem. **Matchings:** Matchings – Matchings and Coverings in Bipartite Graphs - Perfect Matchings.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
IV	**Edge Colourings:** Edge Chromatic Number– Vizing's Theorem. **Independent Sets and Cliques:** Independent Sets. **Vertex Colourings:** Chromatic Number - Brook's Theorem - Chromatic Polynomials.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	**Embeddings and Euler's Formula:** Drawings in the plane - Dual Graphs - Euler Formula. **Characterization of Planar Graphs:** Preparation of Kuratowski's Theorem - Convex Embeddings - Planarity Testing (Optional).	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
VI	**Self Study for Enrichment:** **(Not included for End Semester Examination)** Sperner's Lemma - Construction of Reliable Communication Networks - The Chinese Postman Problem - Hajo's Conjecture - A Storage Problem	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

Text Books

1. Bondy, J.A.and Murthy, U.S.R, (1976), *Graph Theory with Applications*, The Macmillan Press Ltd, London and Basing stoke.

2. Douglas B. West (2003), *Introduction to Graph Theory*, Prentice – Hall of India Private Limited, New Delhi.

Chapters and Sections

UNIT - I	Chapter 1:	Sections 1.1 - 1.8 [1]
UNIT - II	Chapter 2:	Sections 2.1 - 2.5 [1]
	Chapter 3:	Sections 3.1, 3.2 [1]
UNIT - III	Chapter 4:	Sections 4.1 - 4.2, 4.4 [1]
	Chapter 5:	Sections 5.1 - 5.3 [1]
UNIT - IV	Chapter 6:	Sections 6.1, 6.2 [1]
	Chapter 7:	Section 7.1 [1]
	Chapter 8:	Sections 8.1 - 8.2, 8.4 [1]
UNIT - V	Chapter 6:	Sections 6.1, 6.2 [2]

Reference Books

1. Reinhard Diestel (2006).*Graph Theory* ,Springer - Verlag,NewYork.
2. Gary Chartrand, Ping Zhang (2006). *Introduction to Graph Theory*, Tata Mc Graw- Hill Publishing Company Limited, New Delhi.
3. Narsingh Deo (2022). *Graph Theory With Applications To Engineering & Computer Science.* PrenticeHallof India,NewDelhi.

Web References

1. **https://www.youtube.com/results?search_query=graph+theory+definitions+and+examples**
2. **https://www.youtube.com/results?search_query=trees+in+graph+theory**
3. **https://www.whitman.edu/Documents/Academics/Mathematics/stevens.pdf**
4. **https://web.itu.edu.tr/gencata/courses/GT/GTlecture9.pdf**
5. **https://youtu.be/_VzHJXwQCpM**
6. **https://youtu.be/U5f-mxGNTuc**

Pedagogy

Chalk and talk, PPT, Discussion, Assignment, Quiz,Seminar.

Course Designer

Dr.P. Shalini

DISCIPLINE CENTRIC ELECTIVE COURSE-I (DCEC-I)
PROGRAMMING IN C++ AND NUMERICAL METHODS
(2026-2027 ONWARDS)

Semester: I	**Internal Marks: 30**		**External Marks:70**	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/ WEEK**	**CREDITS**
26PMA1DCE1C	**PROGRAMMING IN C++ AND NUMERICAL METHODS**	**DISCIPLINE CENTRIC ELECTIVE-1**	**5**	**3**

Course Objectives

- **Gain** an appreciation of the concept of error in these methods and need to analyze and predict it.
- **Train** the students to develop analytical thinking and the study of stability analysis.
- **Provide** the keen knowledge of C++ language and enable the students to write object oriented, platform independent and interactive program.

Prerequisite

Basic Knowledge of Numerical Methods and C, C+ language.

Course Features

S. No.	**Course Features**	**Relevance Status**
1.	Course emphasis on Employability/Entrepreneurship/Skill Development	Employability, Entrepreneurship, Skill Development
2.	Course integrates cross cutting issues relevant to Professional Ethics/Gender sensitization/ Environment and Sustainability/ Human Values/ Indian Knowledge System	Environment and Sustainability
3.	Course relevant to Local/Regional/National/ Global needs	Global need
4.	Course focus on Sustainable Developmental Goals	SDG 2,12,14

Course Outcomes

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the Successful completion of the course, students will be able to	Cognitive Level
CO1	Recall the fundamental concepts of transcendental and polynomial equations, rate of convergence, interpolation techniques, principles of Object-Oriented Programming and basic structure of C++ programs.	K1, K2
CO2	Explain Descartes' Rule of Signs, Birge–Vieta and Bairstow's methods, Hermite and spline interpolation, core OOP concepts and the structure and compilation process of C++ programs.	K2, K3
CO3	Apply numerical techniques to solve algebraic and transcendental equations, perform interpolation and implement C++ functions including recursion, overloading and parameter passing mechanisms.	K3
CO4	Analyze problems to determine appropriate numerical methods, interpolation strategies and object-oriented programming techniques for computational problem solving.	K3, K4
CO5	Design and develop object-oriented solutions using C++ classes, static members, memory allocation techniques and advanced function concepts to address real-world mathematical and computational problems.	K4, K6

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	1	1	2	2	2	3	2
CO2	3	2	3	1	1	3	3	2	3	2
CO3	3	3	3	2	2	3	3	2	3	3
CO4	3	2	3	2	2	2	2	2	3	3
CO5	3	3	3	2	2	3	3	2	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	**Transcendental and Polynomial Equations:** Rate of convergence – Polynomial equations: Descartes' Rule of Signs - Iterative Methods: Birge-Vieta method - Bairstow's method	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4
II	**Interpolation and Approximation:** Hermite Interpolations, Piecewise and Spline Interpolation - Bivariate Interpolation	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4
III	**Principles of Object-Oriented Programming**: Basic concepts of Object- Oriented Programming- Benefits of OOP- Object- Oriented Languages – Application of OOP. **Beginning with C++:** What is C++ - Applications of C++ - A Simple C++ Program – More C++ Statements – An Example with Class – Structure of C++ Program – Creating the Source File – Compiling and Linking.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4
IV	**Functions in C++:** Introduction – The Main Function–Function prototyping – Call by Reference – Return by Reference – Inline functions– Default Arguments – const Arguments - Recursion - Function overloading.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4
V	**Classes and Objects**: Introduction – C Structures Revisited - Specifying a Class– Defining Member Functions – C++ Program with Class – Making an Outside Function Inline – Nesting of Member Functions – Private Member Functions – Arrays within a Class – Memory allocation for Objects- Static Data Members – Static Member Functions.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4
VI	**Self- Study for Enrichment (Not included for End Semester Examinations)** Direct Method: Graeffe's root squaring method - Lagrange and Newton Interpolation- Friend & Virtual Functions – Math Library Functions –Arrays of Objects – Objects as Function Arguments – Friendly Functions - Returning Objects – const Member Functions	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4

Text Books

1. M.K. Jain, S.R.K. Iyengar and R.K. Jain (2022), Numerical Methods for Scientific and Engineering Computation, New Age International (P) Limited Publishers, New Delhi, 8th Edition.
2. E. Balagurusamy (2018), Object-Oriented Programming with C++, TataMcGrawHill,7thEdition.

Chapters and Sections

UNIT- I	Chapter 2: Section 2.5 & 2.9[1]
UNIT- II	Chapter 4: Section 4.5 – 4.7[1]
UNIT- III	Chapter 1: Section 1.5 – 1.8[2]
	Chapter 2: Section 2.1 – 2.8[2]
UNIT- IV	Chapter 4: Section 4.1 – 4.10[2]
UNIT- V	Chapter 5: Section 5.1 – 5.12[2]

Reference Books

1. M.K. Jain (1983), Numerical Solution of Differential Equations, New Age International Pvt Ltd., 2nd Edition,
2. Robert L afore (2019), Object Oriented Programming in C++, Pearson Education, 4th Edition.
3. Rajesh K. Shukla (2009), Object Oriented Programming in C++, Wilsey India Pvt. Ltd, 1stEdition.

Web References

1. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjii6KIktjyAhUq7HMBHdg7C5EQFnoECAMQAQ&url=https%3A%2F%2Fwww.math.ust.hk%2F~mach as%2Fnumerical-methods.pdf&usg=AOvVaw2XYqzDmJzupEa79S98dhiS
2. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjT8I2RgtjyAhWC7XMBHZknBY8QFnoECAMQAQ&url=https%3A%2F%2Fwww-personal.acfr.usyd.edu.au%2Ftbailey%2Fctext%2Fctext.pdf&usg=AOvVaw1vmjykV3ynWgE- 1Ifz4Th5
3. http://www.nptelvideos.in/2012/11/numerical-methods-and-programing.html
4. http://www.nptelvideos.in/2012/11/numerical-methods-and-computation.html
5. https://nptel.ac.in/courses/122106033/
6. https://nptel.ac.in/courses/122106033/25

Pedagogy

Chalk and Talk, Power Point Presentations, Group discussion, Seminar & Assignment.

Course Designer

Ms. A. Gowri Shankari

GENERIC ELECTIVE COURSE-I (GEC-I)
NUMBER THEORY AND CRYPTOGRAPHY
(2026-2027 ONWARDS)

Semester-I	Internal Marks:30	External Marks:70		
COURSECODE	**COURSE TITLE**	**CATEGORY**	**HOURS/ WEEK**	**CREDITS**
26PMA1GEC1A	**NUMBER THEORY AND CRYPTOGRAPHY**	**GENERIC ELECTIVE COURSE – I**	**4**	**2**

Course Objectives

- **Develop** a strong foundation in number theory, including congruences, quadratic residues, arithmetic functions, and Diophantine equations.
- **Analyse** key results of number theory and **apply** them to mathematical problem-solving.
- **Examine** the number-theoretic foundations of modern cryptography, with emphasis on public-key and elliptic curve cryptosystems.

Prerequisite

- Familiarity in concepts of Theory of Numbers
- Familiarity in concepts of Abstract Algebra.
- Coding, Decoding concepts.

S. No.	Course Features	Relevance Status
1.	Course emphasis on Employability / Entrepreneurship / Skill Development	Employability
2.	Course integrates cross cutting issues relevant to Professional Ethics / Gender Sensitization / Environment and Sustainability / Human Values/ Indian Knowledge System	Professional Ethics
3.	Course relevant to Local / Regional / National / Global needs	Global Need
4.	Course focus on Sustainable Developmental Goals	SDG 4 , SDG 9, SDG 16

Course Outcomes

Course Outcome and Cognitive Level Mapping

CO Number	COStatement On the successful completion of the course, students will be able to	Cognitive Level
CO1	Explain fundamental concepts of number theory and their relevance to cryptography	**K2**
CO2	Apply number-theoretic methods to solve problems involving congruences, residues, functions, and equations.	**K3**
CO3	Analyse number-theoretic structures and relationships in mathematical and cryptographic contexts.	**K4**
CO4	Evaluate number-theoretic techniques used in Diophantine problems and cryptographic systems.	**K5**
CO5	Design public-key and elliptic curve cryptographic solutions using number-theoretic principles.	**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	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	2	3	3
CO5	3	3	3	3	3	3	3	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	**DIVISIBILITY AND CONGRUENCES:** Divisibility – Congruences – Solutions of Congruences - Chinese Remainder Theorem -Primitive Roots and Power Residues.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**QUADRATIC RECIPROCITY AND QUADRATIC FORMS:** Quadratic residues– Quadratic reciprocity– The Jacobi symbol.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**SOME FUNCTIONS OF NUMBER THEORY:** Greatest Integer function-Arithmetic functions–The Mobius Inversion formula.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**SOME DIOPHANTINE EQUATIONS:** The equation ax +by = c – Simultaneous linear equations – Pythagorean triangles.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
V	**Public Key:** The idea of public key cryptography- RSA - Discrete log -Knapsack. **Elliptic Curves:** Basic facts - Elliptic curve cryptosystems	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
VI	**Self-StudyforEnrichment: (Not included for End Semester Examinations)** Primes – Binary quadratic forms – Recurrence functions – Ternary quadratic forms – Elliptic Curve Primality test	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

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
2. Neal Koblitz (1994), *A Course in Number Theory and Cryptography*, Springer-Verlag, Second Edition.

Chapters and Sections

UNIT	CHAPTERS	SECTIONS
UNIT-I	Chapter 1	Sections1.2[1]
	Chapter 2	Sections2.1-2.3,2.8[1]
UNIT-II	Chapter 3	Sections3.1-3.3[1]
UNIT-III	Chapter 4	Sections4.1-4.3[1]
UNIT-IV	Chapter 5	Sections5.1 –5.3[1]
UNIT-V	Chapter IV	Sections1- 4[2]
	Chapter VI	Sections1, 2[2]

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. William Stallings (2009), Cryptography and Network Security - Principles and Practices, (4thedition), Pearson Education Inc.and Dorling Kindersley Publishing Inc

Web References

1. https://www.uobabylon.edu.iq/eprints/publication_10_13825_6154.pdf
2. https://bmsce.ac.in/Content/CS/NV_CNS_UNITIV.pdf
3. https://www.youtube.com/watch?v=ChG_7jeNRHo
4. https://www.youtube.com/watch?v=e8DtzQkjOMQ
5. https://www.youtube.com/watch?v=3W91U-aNclQ
6. https://www.youtube.com/watch?v=bg6CksAkZ-k
7. https://www.youtube.com/watch?v=4dVTlX4bwP0
8. https://www.youtube.com/watch?v=khfIH1H6iUg
9. https://www.youtube.com/watch?v=BC2BdenKsYs
10. https://www.interviewbit.com/blog/0-1-knapsack-problem/

Pedagogy

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

Course Designer

Dr.P.Saranya

GENERIC ELECTIVE COURSE – I(GEC-I)
CLASSICAL DYNAMICS
(2026-2027 and Onwards)

Semester I	Internal Marks: 30		ExternalMarks:70	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**Hrs / Week**	**CREDITS**
26PMA1GEC1B	**CLASSICAL DYNAMICS**	**GENERIC ELECTIVE COURSE**	**4**	**2**

Course Objectives

- **Gain** a strong foundation in mechanical systems, generalized coordinates, constraints, virtual work, and the principles of energy and momentum.
- **Derive** and apply Lagrange's equations to various physical systems and analyze integrals of motion.
- **Understand** Rayleigh's dissipation function, impulsive motion, and velocity-dependent potentials.

Prerequisite

UG level Statics and Dynamics.

S. No.	Course Features	Relevance Status
1.	Course emphasis on Employability/Entrepreneurship/Skill Development	Employability, Skill Development
2.	Course integrates cross cutting issues relevant to Professional Ethics/Gender sensitization/ Environment and Sustainability/ Human Values/ Indian Knowledge System	Professional Ethics, Human Values
3.	Course relevant to Local/Regional/National/ Global needs	National and Global Need
4.	Course focus on Sustainable Developmental Goals	SDG 4,9,11

Course Outcomes

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the course, students will be able to	Cognitive Level
CO1	Recall fundamental principles of mechanical systems, generalized coordinates, constraints, virtual work, energy, and momentum, as well as key formulations in Lagrangian and Hamiltonian mechanics.	K1
CO2	Explain the derivation of Lagrange's and Hamilton's equations, integrals of motion, Rayleigh's dissipation function, impulsive motion, velocity-dependent potentials, and Hamilton-Jacobi theory.	K2
CO3	Apply Lagrange's equations, Hamilton's principles, and the Hamilton-Jacobi equation to solve complex mechanical problems involving constrained and unconstrained motion.	K3
CO4	Analyze various mechanical systems using Lagrangian and Hamiltonian formulations, compare different Variational principles, and evaluate the role of energy conservation in dynamic systems.	K4
CO5	Critically evaluate different approaches in classical mechanics, such as Newtonian, Lagrangian, and Hamiltonian formulations, to determine their effectiveness in solving specific physical problems.	K5

Mapping of CO with PO and PSO

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	2	3	2	3	2	2	2
CO2	2	2	2	3	2	2	2	3	2	3
CO3	2	3	2	2	3	3	2	2	3	2
CO4	3	3	2	2	3	3	2	3	2	2
CO5	2	3	2	3	3	3	2	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	**Introductory Concepts:** Generalised Coordinates - Constraints - Virtual work - Energy and Momentum.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
II	**Lagrange's Equation:** Derivation of Lagrange's Equation - Examples - Integrals of the Motion	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
III	**Special Applications of Lagrange's Equations:** Rayleigh's Dissipation Function - Impulsive Motion - Gyroscopic Systems – Velocity-Dependent Potentials.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
IV	**Hamilton's Equations:** Hamilton's Principle - Hamilton's Equations - Other Variational Principles.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	**Hamilton - Jacobi Theory:** Hamilton's Principal Function – The Hamilton - Jacobi Equation - Separability.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
VI	**Self-Study for Enrichment: (Not included for End Semester Examinations)** The Mechanical System - Small Oscillations – Phase Space.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

Text Books

Donald T. Greenwood (1985), *Classical Dynamics*, PHI Pvt. Ltd., New Delhi.

Chapters and Sections

UNIT-I Chapter 1: Sections 1.2 to 1.5
UNIT-II Chapter 2: Sections 2.1 to 2.3
UNIT-III Chapter 3: Sections 3.1 to 3.4
UNIT- IV Chapter 4: Sections 4.1 to 4.3
UNIT- V Chapter 5: Sections 5.1 to 5.3

Reference Books

1. Goldstein, H. (1998). *Classical mechanics* (2nd ed.). Narosa Publishing House.
2. Synge, J. L., & Griffith, B. A. (2017). *Principles of mechanics* (3rd ed.). McGraw-Hill.
3. Narayan Chandra Rana & Promod Sharad Chandra Joag,(1991). *Classical Mechanics,* Tata McGraw Hill, 1991.

Web References

1. https://www.youtube.com/watch?v=2clf7jPxuJY&list=PLyqSpQzTE6M_d9f-9fKxUQYR1qI5YEnSz
2. https://www.youtube.com/watch?v=sERzHGJn7lM&list=PLyqSpQzTE6M_d9f-9fKxUQYR1qI5YEnSz&index=5
3. https://youtu.be/Kjfzve6lNWI?si=XTxeaAhneAz8C2Of
4. https://en.wikipedia.org/wiki/Hamilton%E2%80%93Jacobi_equation
5. https://mathworld.wolfram.com/HamiltonsEquations.html
6. https://galileoandeinstein.phys.virginia.edu/7010/CM_06_HamiltonsEqns.html

Pedagogy

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

Course Designer

Dr. E. Litta.

NON-MAJOR ELECTIVE COURSE -I (NMEC-I)
FOUNDATION FOR LOGICAL THINKING
(2026 – 2027 and onwards)

Semester I	Internal Marks: 30			External Marks:70
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**Hrs / Week**	**CREDITS**
26PMA1NME1	**FOUNDATION FOR LOGICAL THINKING**	**NON-MAJOR ELECTIVE**	**3**	**2**

Course Objectives

- **Explain** many short tricks to solve mathematical problems easily.
- **Apply** the knowledge to **interpret** and **solve** the problems.
- **Predict** elite knowledge in verbal reasoning.

Prerequisite

Knowledge of basic mathematics

S. No.	Course Features	Relevance Status
1.	Course emphasis on Employability/Entrepreneurship/Skill Development	Employability, Entrepreneurship, Skill Development
2.	Course integrates cross cutting issues relevant to Professional Ethics/Gender sensitization/ Environment and Sustainability/ Human Values/ Indian Knowledge System	Professional Ethics, Sustainability
3.	Course relevant to Local/Regional/National/ Global needs	Global need
4.	Course focus on Sustainable Developmental Goals	SDG 4,8,9,12

Course Outcomes

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the course, students will be able to	Cognitive Level
CO1	Explain the knowledge of the various techniques of quantitative aptitude and reasoning.	K1, K2
CO2	Apply the concepts in solving mathematical problems to succeed in various competitive examinations.	K3
CO3	Examine various types of Problems using arithmetic and reasoning test.	K3
CO4	Apply the concept obtained in the course to solve the problems.	K3
CO5	Analyse real-life problems and find solutions.	K4

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	3	3	3	2	2	3
CO2	3	2	3	3	3	3	3	3	2	3
CO3	3	3	2	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	**Arithmetical Ability:** Probability – Heights and Distances – Odd Man Out and Series	9	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4
II	**Data Interpretation:** Bar Graphs - Pie Chart - Line Graphs.	9	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4
III	**Reasoning Test:** Relationship or Analogy Test–Direction Sense Test - Problems based on Alphabet.	9	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4
IV	**Reasoning Test:** Time Sequence Test – Mathematical Ability Test – Situation Reaction Test – Assigning Artificial Values to Artificial Digits and Signs.	9	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4
V	**Logical Reasoning:** Validity Test of Syllogism	9	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4
VI	**Self-Study for Enrichment: (Not included for End Semester Examinations)** Arithmetical Ability: Permutation and Combination- Clocks – Calendar. Verbal Reasoning: Analogy- Classification.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4

Text Books

1. Aggarwal,R. S. (Reprint 2017), *Quantitative Aptitude for Competitive Examinations (Fully Solved)*, S.Chand and Company Ltd., New Delhi.
2. Dr..Lal, Jain and Dr.K.C.Vashisthu (2018), *UGC NET/JRF/ SET Teaching & Research Aptitude*, Upkar Prakashan, Agra.

Chapters and Sections

UNIT-I Section I (31, 34, 35) **[1]**

UNIT-II Section II (37, 38, 39) **[1]**

UNIT-III Section I (1, 5, 7) **[2]**

UNIT- IV Section I (8, 9, 10, 14) **[2]**

UNIT- V Section II **[2]**

Reference Books

1. Dinesh Khattar (2016), *Pearson Guide to Quantitative Aptitude for Competitive Examinations*, Pearson Publication, 3rd Edition.
2. Gautam Puri,(2017), *Reasoning for competitive Examinations*, G K Publications(P) ltd
3. Abhijit Guha (2014), *Quantitative Aptitude for Competitive Examinations*, Mcgraw Hill Education Private Limited, New Delhi, 5th Edition.

Web References

1. https://www.indiabix.com/aptitude/questions-and-answers/
2. https://www.youtube.com/watch?v=lFHjNbSmsCE
3. https://www.sawaal.com/aptitude-reasoning/quantitative-aptitude-arithmetic-ability-questions-and-answers.html
4. https://www.youtube.com/watch?v=xRLNYich5Ls
5. https://www.youtube.com/watch?v=qwHJtfEUCgE
6. https://www.youtube.com/watch?v=g0_1ZhueCcE
7. https://www.indiabix.com/logical-reasoning/questions-and-answers/
8. https://byjus.com/govt-exams/logical-reasoning/

Pedagogy

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

Course Designer

Dr.R.Radha