M.Sc., MATHEMATICS

COURSE STRUCTURE WITH SYLLABUS

PROGRAMME CODE: 2PSMAT

2026-2027

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

(AUTONOMOUS)

(Affiliated to Bharathidasan University, Tiruchirappalli)

Accredited by NAAC

SUNDARAKKOTTAI, MANNARGUDI–614016.

TAMILNADU, INDIA.

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CHOICE BASED CREDIT SYSTEM - LEARNINIG OUTCOMES BASED CURRICULUM FRAMEWORK (CBCS - LOCF)

(For the candidates admitted in the academic year 2026-2027)

CHOICE BASED CREDIT SYSTEM

The credit based semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The choice based credit system provides a "cafeteria" type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning. Our College has moved to CBCS and implemented the grading system.

OUTCOME-BASED EDUCATION (OBE)
LEARNING OUTCOME-BASED CURRICULUM FRAMEWORK (LOCF)

The fundamental premise underlying the learning outcomes-based approach to curriculum planning and development is that higher education qualifications are awarded on the basis of demonstrated achievement of outcomes (expressed in terms of knowledge, understanding, skills, attitudes and values) and academic standards expected of graduates of a programme of study. Learning outcomes specify what graduates completing a particular programme of study are expected to know, understand and be able to do at the end of their programme of study. The expected learning outcomes are used as reference points that would help to formulate graduate attributes, qualification descriptors, programme learning outcomes and course learning outcomes which in turn will help in curriculum planning and development, and in the design, delivery and review of academic programmes. They provide general guidance for articulating the essential learnings associated with programmes of study and courses with in a programme, maintain national standards and international comparability of learning outcomes and academic standards to ensure global competitiveness, and to facilitate student/graduate mobility and provide higher education institutions an

important point of reference for designing teaching-learning strategies, assessing student learning levels, and periodic review of programmes and academic standards.

Some important aspects of the Outcome Based Education

Course: is defined as a theory, practical or theory cum practical subject studied in a semester.

Course Outcomes (COs): are statements that describe significant and essential learning that learners have achieved, and can reliably demonstrate at the end of a course. Generally three or more course outcomes may be specified for each course based on its weightage.

Programme: is defined as the specialization or discipline of a Degree.

Programme Outcomes (POs): Programme outcomes are narrower statements that describe what students are expected to be able to do by the time of graduation. POs are expected to be aligned closely with Graduate Attributes.

Programme Specific Outcomes (PSOs): PSOs are what the students should be able to do at the time of graduation with reference to a specific discipline.

Some important terminologies repeatedly used in LOCF.

Core Courses (CC): A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course. These are the courses which provide basic understanding of their main discipline. In order to maintain a requisite standard certain core courses must be included in an academic program. This helps in providing a universal recognition to the said academic program.

Discipline Centric Elective Courses (DCEC): Elective course may be offered by the main discipline/subject of study is referred to as Discipline Centric Elective Course (DCEC). These courses offer the flexibility of selection of options from a pool of courses. These are considered specialized or advanced to that particular programme and provide extensive exposure in the area chosen; these are also more applied in nature.

Generic Elective Courses: An elective course chosen generally from an **unrelated discipline/subject,** with an intention to seek exposure is called a Generic Elective. Generic Elective courses are designed for the students of other disciplines. Thus, as per the CBCS policy, the students pursuing particular disciplines would have to opt Generic Elective courses offered by other disciplines, as per the basket of courses offered by the college. The scope of the Generic Elective (GE) Courses is positively related to the diversity of disciplines in which programmes are being offered by the college.

Non Major Elective Course (NMEC): A student shall choose at least two Non-major Elective Courses (NMEC) from outside his/her department.

Skill Enhancement Courses (SECs): These courses focus on developing skills or proficiencies in the student, and aim at providing hands-on training. Skill enhancement courses can be opted by the students of any other discipline, but are highly suitable for students pursuing their academic programme. These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge**.**

Field Study/Industrial Visit/Case Study: It has to be completed during the fifth semester of the degree programme. Credit for this course will be entered in the fifth semester's marks statement.

Internship: Students must complete internship during summer holidays after the fourth semester. They have to submit a report of internship training with the necessary documents and have to appear for a viva-voce examination during fifth semester. Credit for internship will be entered in the fifth semester's mark statement.

Extra Credit Courses: In order to facilitate the students, gaining knowledge/skills by attending online courses MOOC, credits are awarded as extra credits, the extra credit are at three semesters after verifying the course completion certificates. According to the guidelines of UGC, the students are encouraged to avail this option of enriching their knowledge by enrolling themselves in the Massive Open Online Courses (MOOC) provided by various portals such as SWAYAM, NPTEL etc.

EXAMINATION
Continuous Internal Assessment (CIA):
PG - Distribution of CIA Marks
Passing Minimum: 50 %
Assignments – 3 = 30%
Tests- 2= 50%
Seminar=10 %
Attendance= 10 %

Question Paper Pattern
Part A: includes two subsections

Part A 1 (10X1=10 marks)
One word question/ Fill in /True or False/ Multiple Choice Questions
Two Questions from Each unit

Part A 2(5X2=10 marks)
ShortAnswers/ Match the following
One question from Each unit
Total Marks - 20

Part B: (5X4=20 marks)
Paragraph Answers
Either/ or type, One Question from each unit

Part C: (3X10=30)
Essay Type Answers
Answer 3 out of 5 Questions
One Question from each unit

Part A: K1 Level
Part B: K2, K3 and K4 Level
Part C: K5 and K6 Level

Knowledge levels for assessment of Outcomes based on Blooms Taxonomy

S.No.	Level	Parameter	Description
1	K1	Knowledge/Remembering	It is the ability to remember the previously Learned
2	K2	Comprehension/ Understanding	The learner explains ideas or concepts
3	K3	Application/Applying	The learner uses information in a new way
4	K4	Analysis/Analysing	The learner distinguishes among different parts
5	K5	Evaluation/Evaluating	The learner justifies a stand or decision
6	K6	Synthesis/Creating	The learner creates a new product or point of view

WEIGHTAGE of K –LEVELS IN QUESTION PAPER

(Cognitive Level) K-LEVELS →	Lower Order Thinking			Higher Order Thinking			Total
	K1	K2	K3	K4	K5	K6	
END SEMESTER EXAMINATIONS (ESE)	20	20			30		**70**
Continuous Internal Assessment (CIA)	20	20			30		**70**

QUESTION PATTERN FOR END SEMESTER EXAMINATION/ Continuous Internal Assessment

SECTION		MARKS
SECTION –A1 (No choice ,One Mark) **TWO** questions from each unit **SECTION –A1** (No choice, Two Mark) **ONE** question from each unit	(10x1=10) (5x2=10)	**20**
SECTION –B (Either/ or type,4-Marks) **ONE** question from each unit	(5x4=20)	**20**
SECTION –C (3 out of 5) (10Marks) **ONE** question from each unit	(3x10=30)	**30**
	Total	**70**

BLUE PRINT OF QUESTION PAPER FOR END SEMESTER EXAMINATION							
DURATION: 3.00 Hours.							**Max Mark :75**
K-LEVELS / **SECTION**	**K1**	**K2**	**K3**	**K4**	**K5**	**K6**	**Total Marks**
SECTION –A1 (One Mark, No choice) (10x1=10)	10						**10**
SECTION –A2 (2-Marks,Nochoice) (5x2=10)	10						**10**
SECTION –B (5-Marks)(Either/or type) (5x4=20)		4	8	8			**20**
SECTION –C (10 Marks)(3 out of 5) (3x10=30) Courses having only **K5,K6** levels, K5 level- 3 Questions, K6 level- 2 Questions **(One K6 level question is compulsory)**					20	10	**30**
Total	**20**	**04**	**08**	**08**	20	10	**70**

EVALUATION

GRADING SYSTEM

Once the marks of the CIA and the end-semester examination for each of the courses are available, they will be added and converted as final mark. The marks thus obtainedwill then be graded as per the scheme provided in Table-1.

Grade Point Average (GPA) will be calculated from the first semester onwards for all semester. From the second semester onwards, the total performance within a semester and the continuous performance starting from the first semester are indicated by semester Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA) , respectively. These two are calculated by the following formulae:

$GPA = \frac{\sum_{i=1}^{N} C_i G_i}{\sum_{I=1}^{n} C_i}$	$WAM(\text{Weighted Average Marks}) = \frac{\sum_{i=1}^{n} C_i M_i}{\sum_{I=1}^{n} C_i}$
Where, C_i is the Credit earned for the Coursei G_i is the Grade Point obtained by the student for the Coursei M_i is the marks obtained for the coursei and n is the number of Courses **Passed** in that semester.	

CGPA: Average GPA of all the Courses starting from the first semester to the current semester.

CLASSIFICATION OF FINAL RESULTS:

i. The classification of final results shall be based on the CGPA, as indicated in Table-2.

ii. For the purpose of Classification of Final Results, the candidates who earn the CGPA 9.00 and above shall be declared to have qualified for the Degree as “Outstanding”. Similarly the candidates who earn the CGPA between 8.00 and 8.99, 7.00 and 7.99, 6.00 and 6.99 and 5.00 and 5.99 shall be declared to have qualified for their Degree in the respective programmes as “Excellent”, “Very Good”, “Good”, and “Above Average” respectively.

iii. Absence from an examination shall not be taken an attempt.

Table- 1: Grading of the Courses

Marks Range	Grade Point	Corresponding Grade
90 and above	**10**	**O**
80 and above and below 90	**9**	A+
70 and above and below 80	**8**	**A**
60 and above and below 70	**7**	**B+**
50 and above and below 60	**6**	**B**
Below50	**NA**	**RA**

NA- Not Applicable, RA- Reappearance

The candidates performance in every current semester is indicated by **Semester Grade Point Average (SGPA)** and from the second semester onwards, the continuous performance including previous semester/s is indicated by **Cumulative Grade Point Average (CGPA)**

Table-2: Final Result

CGPA	Corresponding Grade	Classification of Final Result
9.00 and above	**O**	**Outstanding**
8.00 to 8.99	A+	**Excellent**
7.00 to 7.99	**A**	**Very Good**
6.00 to 6.99	**B+**	**Good**
5.00 to 5.99	**B**	**Above Average**

***** The candidates who have passed in the first appearance and within the prescribed duration of the PG Programme are eligible. If the candidate's Grade is O/A+ with more than one attempt, the performance is fixed as "Very Good"

VISION

Promoting the arithmetic skill in the minds of the women students who hail from the rural and economically weaker section of the society, as Mathematics is the queen of Sciences.

MISSION

- To promote the analytical thinking through logical reasoning.
- To create a mind set for quick arithmetic calculations.

PROGRAMME OUTCOMES FOR M.Sc.,DEGREE PROGRAMMES

PO.No	Programme Outcomes (*Upon completion of the M.Sc.,Degree Programme, the Post graduate will be able to)*
PO-1	**Disciplinary Knowledge**: demonstrate in-depth knowledge and understanding of theories, policies, and practices in one or more disciplines that form a part of a Post Graduate program of study in Master of Science.
PO-2	**Critical Thinking and Problem Solving**: apply analytic thought to a body of knowledge, analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence, identifyrelevant assumptions or implications, formulate coherent arguments, critically evaluate practices, policies and theories by following scientific approach to knowledge development: solve problems and extrapolate the same to real life situation
PO-3	**Information/digital literacy and Communication Skills:** use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources, and use appropriate software for analysis of data: communicate thoughts and ideas analytically and effectively in writing and orally using appropriate media, and present complex information in a clear and concise manner to different groups.
PO-4	**Research-related skills:** conduct independent inquiry in a chosen scientific discipline, demonstrate sense of inquiry and capability for asking relevant/appropriate questions, problematising, synthesizing and articulating; recognize cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; plan, execute and report the results of an experiment or investigation.
PO-5	**Scientific reasoning and Reflective Thinking:** analyse, interpret and draw conclusions from quantitative/qualitative data and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective; critically and sensibly evaluate life experiences, with self awareness and reflexivity of both self and society.
PO-6	**Multidisciplinary Approach, Innovation and Entrepreneurship:** propose novel ideas of interdisciplinary approach in providing better solutions and new ideas for the sustainable developments; identify opportunities, entrepreneurship vision and use of innovative ideas to create value and wealth for the betterment of the individual and society.
PO-7	**Moral and ethical awareness/reasoning:** embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work, demonstrate the ability to identify ethical issues related to one's work, avoid unethical behavior such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights, appreciate environmental and sustainability issues, and adopt objective, unbiased and truthful actions in all aspects of work.
PO-8	**Self directed Learning:** work independently, identify appropriate resources required for a project, and manage a project till completion.
PO-9	**Lifelong Learning:** engage in continuous learning for professional growth and development, acquire knowledge and skills, adapt to changing environment and to changing trades and demands of work place through knowledge/skill development/reskilling.
PO-10	**Multicultural Competence, Social Interaction and Effective Citizenship:** understand the values and beliefs of multiple cultures, global perspectives, engage and interact respectfully with diverse groups and elicit views of others, mediate disagreements and help reach conclusions in group settings, and demonstrate empathetic social concern and equity centered national development

PROGRAMME SPECIFIC OUTCOME (PSO)

PSO No.	Program Specific Outcomes **(M.Sc., Mathematics)**
PSO1	Acquire good knowledge and understanding, to solve specific theoretical & applied problems in different area of mathematics & statistics.
PSO2	Understand, formulate, develop mathematical arguments, logically and use quantitative models to address issues arising in social sciences, business and other context /fields.
PSO3	To prepare the students who will demonstrate respectful engagement with other's ideas, behaviors, beliefs and apply diverse frames of references to decisions and actions. To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations. To encourage practices grounded in research that comply with employment laws, leading the organization towards growth and development.

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M.Sc., MATHEMATICS
CHOICE BASED CREDIT SYSTEM-LEARNINIG OUTCOMES BASED CURRICULUM FRAMEWORK (CBCS - LOCF)
(Applicable to the candidates admitted from the academic year 2026 - 2027)

ELIGIBILITY: A candidate who is a graduate of this University or any recognized University in B.Sc., with Mathematics.

Sem.	Course	Course Code	Course Title	Ins. Hrs.	Credit	Exam Hrs.	Marks		Total
							Int.	Ext.	
I	Core Course - I (CC - I)	P26MA101	Algebra – I	6	4	3	30	70	100
	Core Course - II (CC - II)	P26MA102	Real Analysis –I	6	4	3	30	70	100
	Core Course -III (CC - III)	P26MA103	Ordinary Differential Equations	6	4	3	30	70	100
	Discipline Centric Elective Course - 1 (DCEC-I)	P26MADE11A	Graph Theory	5	4	3	30	70	100
		P26MADE11B	Number Theory						
		P26MADE11C	Cryptography						
	Generic Elective Course - I (GEC – I)	P26MAGE11A	Mathematics for Critical Thinking	5	3	3	30	70	100
		P26MAGE11B	Automata Theory						
		P26MAGE11C	Integral Transforms						
	Skill Enhancement Course – I (Practical - I) - (SEC - I)	P26SEMA11P	Mathematical Documentation Using LaTeX – Practical - I	2	2	3	40	60	100
	Value Added Course - I (VAC - I)*	P26MAVA11	AI Applications in Pure Mathematics	-	2*		30	70	100*
		Total		**30**	**21**	**-**	**-**	**-**	**600**
II	Core Course - IV (CC - IV)	P26MA204	Algebra – II	6	4	3	30	70	100
	Core Course – V (CC - V)	P26MA205	Real Analysis –II	6	4	3	30	70	100
	Core Course - VI (CC - VI)	P26MA206	Partial Differential Equations	6	4	3	30	70	100
	Discipline Centric Elective Course - II (DCEC - II)	P26MADE22A	Fuzzy Mathematics	4	4	3	30	70	100
		P26MADE22B	Discrete Mathematics						
		P26MADE22C	Analytical Number Theory						
	Generic Elective Course - II (GEC - II)	P26MAGE22A	Classical Mechanics	4	3	3	30	70	100
		P26MAGE22B	Neural Networks						
		P26MAGE22C	Difference Equations						
	Skill Enhancement Course – II (Practical - II) - (SEC - II)	P26SEMA22P	Mathematical Computations Using Python – Practical - II	2	2	3	40	60	100
	Non-Major Elective Course - I (NMEC - I)			2	2	3	30	70	100
		Total		**30**	**23**	**-**	**-**	**-**	**700**
	Summer Internship / Industrial Activity during the Summer Vacation after 1st Year								

III	Core Course - VII (CC - VII)		Topology	6	4	3	30	70	100
	Core Course - VIII (CC - VIII)		Complex Analysis	6	4	3	30	70	100
	Core Course - IX (CC - IX)		Measure Theory and Integration	6	4	3	30	70	100
	Discipline Centric Elective Course - III (DCEC - III)		Methods of Applied Mathematics	5	4	3	30	70	100
			Nonlinear Differential Equations						
			Probability Theory						
	Generic Elective Course - III (GEC - III)		Research Methodology	5	3	3	30	70	100
			Optimization Techniques						
			Fluid Dynamics						
	Non-Major Elective Course – II (NMEC - II)			2	2	3	30	70	100
	Internship / Industrial Activity@				2		20	80	100
	Value Added Course - II (VAC - II)*		Data Science Using Python and R –Programming	-	2*	-	30	70	100*
		Total		**30**	**23**	**-**	**-**	**-**	**700**
IV	Core Course - X (CC - X)		Functional Analysis	6	4	3	30	70	100
	Core Course - XI (CC - XI)		Differential Geometry	6	4	3	30	70	100
	Core Course – XII (CC - XII)		Numerical Analysis	6	4	3	30	70	100
	Discipline Centric Elective Course - IV (DCEC - IV)		Stochastic Process	4	4	3	30	70	100
			Mathematical Modelling						
			Mathematical Statistics						
	Entrepreneurship / Industry Based Course		Industrial Mathematics	3	3	3	30	70	100
	Project Work @			5	5	-	20	80	100
	Extra credit course Other than VAC**		MOOC – (NPTEL /SWAYAM)**		2**				
		Total		**30**	**24**	**-**	**-**	**-**	**600**
	Grand Total				**91**				**2600**

LIST OF DISCIPLINE CENTRIC ELECTIVE COURSE

Discipline Centric Elective Course - 1 (DCEC - 1)	
1.	Graph Theory
2.	Number Theory
3.	Cryptography
Discipline Centric Elective Course - 2 (DCEC - 2)	
1.	Fuzzy Mathematics
2.	Discrete Mathematics
3.	Analytical Number Theory
Discipline Centric Elective Course - 3 (DCEC - 3)	
1.	Methods of Applied Mathematics
2.	Nonlinear Differential Equations
3.	Probability Theory
Discipline Centric Elective Course - 4 (DCEC - 4)	
1.	Stochastic Process
2.	Mathematical Modelling
3.	Mathematical Statistics

LIST OF GENERIC ELECTIVE COURSE (GEC)

GENERIC ELECTIVE COURSE - 1 (GEC - 1)	
1.	Mathematics for Critical Thinking
2.	Automata Theory
3.	Integral Transforms
GENERIC ELECTIVE COURSE - 2 (GEC - 2)	
1.	Classical Mechanics
2.	Neural Networks
3.	Difference Equations
GENERIC ELECTIVE COURSE - 3 (GEC - 3)	
1.	Research Methodology
2.	Optimization Techniques
3.	Fluid Dynamics

SUMMARY OF CURRICULUM STRUCTURE OF PG PROGRAMMES: SCIENCE

Sl. No.	**Types of the Course**	**No. of Courses**	**Credits for each Course**	**Total Credits**	**Marks**
1.	Core Course (CC – 12)	12	4	48	1200
2.	Discipline Centric Elective Course (DCEC - 4)	4	4	16	400
3.	Generic Elective Course (GEC – 3)	3	3	9	300
4.	Skill Enhancement Course (SEC – 2)	2	2	4	200
5.	Non-Major Elective Courses (NME – 2)	2	2	4	200
6.	Internship / Industrial Activity @	1	2	2	100
7.	Entrepreneurship / Industry Based Course	1	3	3	100
8.	Project Work @	1	5	5	100
Total		**26**	**-**	**91**	**2600**
Value Added Courses *		2*	2	4*	200
MOOC – (NPTEL / SWAYAM)		1*	2	2*	

*	**The value added courses credit will not be included in the total CGPA . These courses are extra-credit courses. Instruction hours for these courses is 30 hours**
@	Summer Internship will be carried out during the summer vacation after the First year. Viva Voce will be conducted by the college and Marks shall be sent to the University and the same will be included in the 3rd semester Mark Statement. **Summer Internship / Industrial Activity& Project Scheme of Evaluation:** **Description** — **Marks** Report — 80 Viva — 20 Total — 100

NON MAJOR ELECTIVE (NMEC) OFFERED BY THE DEPARTMENT

Semester	Course	Course Code	Title of the Paper
II	NMEC-I	P26NMEMA21	Smart Mathematics for Smart Living
II	NMEC-II		Applied Mathematics

Semester: I -CC- I: **Algebra - I**

Ins. Hrs./Week: 6 **Course Credit**: 4 **Course Code**: P26MA101

COURSE OBJECTIVES:

- Understand the fundamental concepts and structures of groups, subgroups, normal subgroups, and quotient groups.
- Analyze group homomorphisms, permutation groups, and the applications of counting principles and Sylow theorems in finite group theory.
- Develop an understanding of ring homomorphisms, ideals, quotient rings, and Euclidean rings.
- Examine polynomial rings over fields and commutative rings and investigate their algebraic properties.
- Acquire knowledge of vector spaces, dual spaces, inner product spaces, and modules, and apply these concepts in abstract algebra.

UNIT-I : **(20 Hours)**

Group Theory: Groups - Subgroups – A Counting Principle - Normal Subgroups and Quotient Groups.

UNIT-II : **(18 Hours)**

Homomorphisms of Groups: Homomorphisms - Cayley's Theorem- Permutation Groups - Another Counting Principle- Sylow's Theorem

UNIT-III : **(17 Hours)**

Homomorphism of Rings: Homomorphisms- Ideals and Quotient Rings- More ideas and Quotient rings- Euclidean rings.

UNIT-IV : **(17 Hours)**

Polynomial Rings: Polynomial rings - Polynomial rings over the Rational fields- Polynomial rings over Commutative rings.

UNIT-V: **(18 Hours)**

Vector spaces and Modules: Elementary basic concepts of Vector Spaces - Dual spaces - Inner Product Spaces-Modules.

UNIT – VI CURRENT CONTOUR (For Continuous Internal Assessment Only – Self Study):
Future scope of Algebra in AI and Data Science.

Total Lecture Hours- 90

COURSE OUTCOMES:

After the completion of the course, Students will be able to,

1. Understand the fundamental concepts of groups, subgroups, normal subgroups, and quotient groups.
2. Analyze group homomorphisms, permutation groups, and apply Sylow theorems in finite group theory.

3. Understand ring homomorphisms, ideals, quotient rings, and Euclidean rings.
4. Analyze polynomial rings over fields and commutative rings and study their algebraic properties.
5. Understand the basic concepts of vector spaces, dual spaces, inner product spaces, and modules.
6. Explain the applications of algebraic structures such as groups, vector spaces, and modules in Artificial Intelligence, Machine Learning, and modern computational systems.

TEXT BOOKS

1. Herstein. I.N. 2006,(Reprint 2008) Topics in Algebra (II Edition),Wiley Eastern Limited, New Delhi,

   Unit I : Section 2.4, 2.5, 2.6
   Unit II : Section 2.7, 2.9, 2.10, 2.11, 2.12
   Unit III : Section3.3, 3.5, 3.7
   Unit IV : Section 3.9, 3.10, 3.11
   Unit V : Section 4.3, 4.4, 4.5

REFERENCE BOOK(S)

1. M.Artin, Algebra, Prentice Hall of India, 1991.
2. P.B.Bhattacharya, S.K.Jain, and S.R.Nagpaul, Basic Abstract Algebra (II Edition) Cambridge University Press, 1997. (Indian Edition)
3. I.S.Luther and I.B.S.Passi, Algebra, Vol. I –Groups(1996); Vol. II Rings, Narosa Publishing House , New Delhi, 1999
4. D.S.Malik, J.N. Mordeson and M.K.Sen, Fundamental of Abstract Algebra, McGraw Hill (International Edition), New York. 1997.
5. N.Jacobson, Basic Algebra, Vol. I & II W.H.Freeman (1980); also published by Hindustan Publishing Company, New Delhi.

E-RESOURCES

1. http://mathforum.org,
2. http://ocw.mit.edu/ocwweb/Mathematics,
3. http://www.opensource.org,
4. www.algebra.com

Course Learning Outcome (for Mapping with POs and PSOs)

	Pos										PSOs		
	1	2	3	4	5	6	7	8	9	10	1	2	3
CLO1	3	1	3	2	3	3	3	1	2	3	3	2	1
CLO2	2	1	3	1	3	3	2	3	1	1	3	2	1
CLO3	3	2	3	1	3	3	1	2	3	2	3	2	1
CLO4	1	2	3	2	3	3	1	2	3	2	3	2	1
CLO5	3	1	2	3	3	3	1	2	3	1	3	2	1
CLO6	3	3	3	3	3	3	3	3	3	3	3	3	3

Strong: 3 Medium: 2 Low: 1

Semester: I – CC - II: Real Analysis - I

Ins. Hrs./Week: 6 **Course Credit: 4** **Course Code:P26MA102**

COURSE OBJECTIVES:

- To understand functions of bounded variation and their properties
- To study Riemann–Stieltjes integral and its applications
- To analyze convergence of infinite series and products
- To learn power series and sequences of functions
- To develop analytical and proof-writing skills in real analysis

UNIT-I: The Real and Complex Number System (18 Hours)

The Real and Complex Number System – Introduction – Ordered sets – least upper bound property – Fields – The Real filed – Archimedean property - The Complex field – Euclidean spaces.

UNIT –II: Basic Topology (18 Hours)

Basic Topology – Finite – Countable and Uncountable sets - Metric spaces Compact sets - Heine-Borel theorem – Weierstass Theorem - Cantor set – Connected sets.

UNIT–III: Numerical Sequence and Series (18 Hours)

Convergent sequences - subsequences – Cauchy sequences – the upper and lower limits – some special sequences - series – series of nonnegative terms – The number e – Power series – summation by parts – Absolute convergence – Addition and Multiplication of series – rearrangements.

UNIT-IV: Continuity (18 Hours)

Continuity – limit of functions – continuous functions – continuity and compactness – continuity and connectedness – discontinuities – monotone functions.

UNIT-V: Differentiation (18 Hours)

The derivative of a real function – mean value theorem – the continuity of derivatives – L Hospital's rule – Derivatives of higher order – Taylor's theorem – Differentiation of vector valued function**.**

UNIT –VI: Current Contours (For Continuous Internal Assessment Only -self study)

Future scope of Real Analysis in Research Work.

Total Lecture Hours - 90

COURSE OUTCOMES

After the completion of the course, students should be able to,

1. Understand real and complex numbers, Euclidean spaces, and the least upper bound property.
2. Analyze metric spaces, compactness, connectedness, countability, and key topological theorems.
3. Study convergence of sequences, series, Cauchy [1]sequences, and power series.
4. Examine continuity and its relationship with compactness and connectedness.

5. Apply differentiation, the Mean Value Theorem, Taylor's Theorem, and higher-order derivatives.
6. Develop logical reasoning and problem-solving skills in real analysis.

TEXT BOOK

1. Walter Rudin,(1976), Principles of Mathematical Analysis, McGraw Hill, Inc,.
   Unit I: Chapter 1
   Unit II: Chapter 2
   Unit III: Chapter 3
   Unit IV: Chapter 4
   Unit V: Chapter 5

REFERENCE BOOK(S)

1. Tom. M. Apostol (1997.), Mathematical Analysis, Narosa Publishing House, New Delhi,.
2. R. G. Bartle, D. R. Sherbert (1982.), Introduction to Real Analysis, John Wiley and Sons, New York .
3. Kenneth A. Ross (2004.), Elementary Analysis: The Theory of Calculus, Springer New York
4. H. L. Royden (1988.), Real Analysis, Third Edition, Macmillan Publishing Company, New Delhi.
5. Müller-Kirsten, Harald J.W.(1988). Introduction to Real Analysis. World Scientific

E-RESOURCES

1. http://mathforum.org
2. http://ocw.mit.edu/ocwweb/Mathematics
3. http://www.opensource.org
4. www.mathpages.com
5. https://www.geneseo.edu/~aguilar/public/notes/Real-Analysis-HTML/ch8-sequences-of-functions.html

Course Learning Outcome (for Mapping with POs and PSOs)

	POs										PSOs		
	1	2	3	4	5	6	7	8	9	10	1	2	3
CLO1	3	2	1	1	1	1	1	1	1	1	2	2	1
CLO2	3	3	2	2	2	2	1	1	1	1	3	2	2
CLO3	3	3	2	2	2	1	1	1	1	1	3	2	2
CLO4	3	3	3	2	2	2	1	1	1	1	3	3	2
CLO5	3	3	3	3	2	2	1	1	1	1	3	3	2
CLO6	3	3	3	3	2	2	2	2	2	2	3	3	3

Strong: 3 Medium: 2 Low: 1

Semester: I – CC - III: **Ordinary Differential Equations**

Ins. Hrs./Week: 6 **Course Credit**: 4 **Course Code**: P26MA103

COURSE OBJECTIVES:

- To give an in-depth knowledge of differential equations and their applications.
- To provide knowledge of Legendre Polynomials and Bessel functions.
- To study the existence, uniqueness, stability behavior of the solutions of the ODE.
- To enable students to understand the Existence and Uniqueness of Solutions of Initial Value Problem.
- To familiarize students with Eigen values, Eigen functions and types of critical points.

UNIT-I : **(20 Hours)**

The General Solution of the Homogeneous Equation– The Use of a Known Solution to Find Another – The Method of Variation of Parameters – 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 – Regular Singular Points (Continued) – Gauss's Hyper geometric Equation – The Point at Infinity - Legendre Polynomials – Properties of Legendre Polynomials – Bessel Functions - The Gamma Function –Properties of Bessel Functions.

UNIT-III : **(17 Hours)**

Linear Systems – Homogeneous Linear Systems with Constant Coefficients – The Method of Solutions of Successive Approximations – Picard's Theorem.

UNIT-IV : **(17 Hours)**

Oscillations and the Sturm Separation Theorem – The Sturm Comparison Theorems –Eigen Values, Eigen Functions and The Vibrating String.

UNIT-V: **(18 Hours)**

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: Current Contours (For Continuous Internal Assessment Only - Self Study)

System of ODE and using AI to solve Canonical forms.

Total Lecture Hours- 90

COURSE OUTCOMES:

After the completion of the course, The students should be able to

1. Solve homogeneous and non-homogeneous differential equations using methods such as variation of parameters and power series techniques.
2. Analyze differential equations with regular singular points and study specialfunctions including Legendre polynomials and Bessel functions.
3. Understand linear systems of differential equations, successive approximationmethods and Picard's existence theorem.

4. Apply Sturm comparison and separation theorems to study oscillatory behavior, eigen values, eigen functions and vibrating string problems.
5. Analyze stability of linear and nonlinear systems using Liapunov's direct method
and critical point theory.
6. Learn the nature of solutions which involves Canonical forms.

TEXT BOOK(S)

1. Simmons G.F., 2017, Differential Equations with Applications and Historical Notes, CRC Press.

UNIT – I - Chapter III: Sec 15, 16, 19 and
Chapter V: Sec 26 to 28
UNIT – II - Chapter V: Sec 29 to 32 and
Chapter VIII: Sec 44 to 47
UNIT – III- Chapter X: Sec 55,56 and
Chapter XIII: Sec 69, 70
UNIT – IV- Chapter IV: Sec 24, 25 and
Chapter VII: Sec 40
UNIT – V - Chapter XI: Sec 59 to 62

REFERENCE BOOK(S)

1. Reid W.T.,1971, Ordinary Differential Equations, JohnWiley&Sons, NewYork.
2. Coddington E.A. and N. Levinson, 1 9 5 5 , Theory of Ordinary Differential Equations, McGraw Hill Publishing Company, New York.
3. William E. Boyce and Richard C. Di Prima, 2020 (12th Edition), Elementary Differential Equations and Boundary Value Problems, Wiley.
4. Henry Edwards C, David E. Penney, and David T. Calvis, 2023 (6th Edition), Differential Equations and Boundary Value Problems: Computing and Modeling, Pearson.
5. Kenneth B. Howell, 2024 (3rd Edition), Ordinary Differential Equations: An Introduction to the Fundamentals, CRC Press (Taylor& Francis).

E-RESOURCES

1. http://www.freebookcentre.net/maths-books-download/gotoweb.php?id=8714
2. https://s3.amazonaws.com/open-bookshelf-content/Open+Textbook+Library/URI/urn%3Auuid%3Ae46a68f9-3e84-4999-b9f6-18c3dfb2faca/Ordinary+Differential+Equations.pdf
3. https://www.ecosia.org/search?q=links+for+ordinary+differential+equatins&addon=opensearch
4. https://users.math.msu.edu/users/gnagy/teaching/ode.pdf
5. http://www.kryakin.site/am2/Pontryagin%201962-ode.pdf

Course Learning Outcome (for Mapping with POs and PSOs)

	POs										PSOs		
	1	2	3	4	5	6	7	8	9	10	1	2	3
CLO1	3	1	3	2	3	1	3	1	3	2	2	3	2
CLO2	2	3	3	1	1	3	1	3	1	3	3	2	1
CLO3	3	2	1	3	3	2	1	2	1	2	3	1	1
CLO4	1	2	3	2	3	3	1	2	3	2	3	2	2
CLO5	3	1	2	3	3	3	1	2	3	1	2	2	3
CLO6	1	1	2	3	3	2	2	3	2	1	2	3	1

Strong: 3 Medium: 2 Low: 1

Semester: I-DCEC-I(A): Graph Theory

Ins. Hrs./Week: 5 **Course Credit: 4** **Course Code: P26MADE11A**

COURSE OBJECTIVES:

- To understand the fundamental concepts of graphs and digraphs and their applications in network modelling.
- To analyze graph connectivity and apply tree structures and spanning tree algorithms to optimization problems.
- To study independent sets, matchings, coverings, and cycle-related properties in graphs.
- To develop proficiency in graph coloring techniques and their applications in scheduling and resource allocation.
- To understand the properties of planar graphs and apply planarity and coloring theorems to graph-theoretic problems.

UNIT I: Graphs and Digraphs (15 Hours)

Basic concepts – subgraphs – degrees of vertices – paths and connectedness – automorphism of a simple graph – line graphs –operations on graphs –applications to social psychology - basic concepts in digraphs – tournaments.

UNIT II: Connectivity and trees (15 Hours)

Vertex cuts and edge cuts – connectivity and edge connectivity – Cyclical edge connectivity of a graph - Definition, Characterization and simple properties of trees – centers and centroids - counting the Number of spanning trees – Cayley‟s formula – Applications: Connector Problem – Kruskal‟s Algorithm.

UNIT III: Independent sets, Matchings and Cycles (15 Hours)

Independents sets and coverings (both vertex & edge) – matchings and factors – matchings in bipartite graphs – Eularian graphs and Hamiltonian graphs – Introduction – Eulerian Graphs – Hamiltonian Graphs – 2-Factorable Graphs.

UNIT IV: Graph colorings (15 Hours)

Vertex colorings – applications of graph coloring - critical graphs – Brooks Theorem – other coloring parameters – b-colorings; Edge colorings – the time table problem – Vizings theorem – Kirkman‟s Schoolgirl Problem – chromatic polynomials.

UNIT V: Planar Graphs (15 Hours)

Planar and non planar graphs – Euler formula and its consequences – K5 and K3,3 are non planar graphs – dual of a plane graph – The four color theorem and the Heawood five color theorem – Hamiltonian plane graphs – Tait coloring.

UNIT – VI: Current Contours (For Continuous Internal Assessment only – Self Study)

Graph algorithms and their complexity – Shortest path problems (Dijkstra's Algorithm) – Network flow problems – Applications of graph theory in computer networks and communication systems – Social network analysis – Graph databases – Introduction to graph theory applications in artificial intelligence, machine learning, and data science.

Total Lecture hours-75

COURSE OUTCOMES:

After the completion of the course, Students will be able to,

1. Understand the basic concepts of graphs and digraphs, including subgraphs, paths, connectedness, automorphisms, and tournaments.
2. Analyze connectivity properties, trees, spanning trees, and apply algorithms such as Kruskal's algorithm in network problems.
3. Study independent sets, coverings, matchings, Eulerian graphs, Hamiltonian graphs, and factorization concepts.
4. Apply graph coloring techniques, edge and vertex colorings, chromatic polynomials, and related theorems in practical problems.
5. Analyze planar and non-planar graphs, Euler's formula, graph duality, and coloring theorems for planar graphs.
6. Apply graph-theoretic concepts and algorithms to analyze and solve real-world problems in networks, computing, and data-driven applications.

TEXT BOOK(S)

1. Balakrishnan R, and Ranganathan K, 2012, "A Textbook of Graph Theory" (2nd edition), Springer, New York.

   Chapter 1: Sections 1.1 to 1.8, 1.11
   Chapter 2: Sections 2.1 to 2.3
   Chapter 3: Sections 3.1 to 3.3, 3.5
   Chapter 4: Sections 4.1 to 4.5, 4.7.1 and 4.7.2
   Chapter 5: Sections 5.1 to 5.5
   Chapter 6: Sections 6.1 to 6.3, 6.6
   Chapter 7: Sections 7.1 to 7.3, 7.6, 7.8, 7.9
   Chapter 8: Sections 8.1 to 8.6, 8.8, 8.9

REFERENCE BOOK(S)

1. Balakrishnan. V.K,2020, Theory and Problems of Graph Theory, McGraw-Hill Education (India) PVT Ltd, New Delhi.
2. Gary Chartrand and Ping Zhang, 2012, Introduction to Graph Theory, Tata McGraw-Hill Edition, India.
3. Gary Chartrand, Linda Lesniak, and Ping Zhang, 2016, Graphs and Diagraphs, CRCPress, United States.
4. Jonathan L., Jay Yellen, and Mark Anderson, 2019, Graph Theory and Its Application, Third Edition, CRC Press, United States.
5. Wilson R. J and Watkins J.J, 1989, Graphs: An Introductory Approach, John Wiley and Sons, New York.

E-RESOURCES

1. http://empresa.bellarica.org
2. http://math.stackexchange.com
3. http://www.nrce.niepa.ac.in
4. http://meskc.ac.in
5. http://www.goodreads.com

Course Learning Outcome (for Mapping with POs and PSOs)

	POs										PSOs		
	1	2	3	4	5	6	7	8	9	10	1	2	3
CLO1	3	2	2	1	1	1	1	1	1	1	2	2	1
CLO2	3	3	2	2	2	2	1	1	1	1	3	2	2
CLO3	3	3	2	2	2	1	1	1	1	1	3	2	2
CLO4	3	3	3	2	2	2	1	1	1	1	3	3	2
CLO5	3	2	2	2	2	1	1	1	1	1	2	2	2
CLO6	3	3	3	3	2	2	2	2	2	2	3	3	3

Strong: 3 Medium: 2 Low: 1

Semester: I-DCEC-I(B): Number Theory

Ins. Hrs./Week: 5 **Course Credit: 4** **Course Code:** P26MADE11B

COURSE OBJECTIVES:

- To introduce the fundamental concepts of elementary number theory, including divisibility, the Euclidean algorithm, and arithmetic computations.
- To develop an understanding of congruences, modular arithmetic, and their applications in factorization problems.
- To provide knowledge of finite fields, quadratic residues, and the law of quadratic reciprocity.
- To familiarize students with the principles of classical cryptography and matrix-based encryption techniques.
- To impart the theoretical foundations and practical applications of public key cryptography, particularly the RSA cryptosystem, in secure communication.

UNIT- I: Elementary Number theory **(15 Hours)**
Time estimates for doing arithmetic – divisibility and the Euclidean algorithm

UNIT-II: Elementary Number theory **(15 Hours)**
Congruences – Some applications to factoring.

UNIT -III: Finite Fields and Quadratic Residues **(15 Hours)**
Finite Fields - Quadratic residues and reciprocity.

UNIT-IV: Cryptography **(15 Hours)**
Some simple cryptosystems – Enciphering matrices

UNIT-V: Public Key Cryptography **(15 Hours)**
Public key cryptography – RSA

UNIT-VI: Current Contours (Continuous Internal Assessment Only- Self Study)
Digital signatures and hash functions – Blockchain technology and cryptocurrencies.
Introduction to elliptic curve cryptography (ECC) and post-quantum cryptography.

Total Lecture hours-75

COURSE OUTCOMES:

After the completion of the course, Students will be able to,

1. Explain the fundamental concepts of elementary number theory, including divisibility, the Euclidean algorithm, and computational aspects of arithmetic operations.
2. Apply congruence relations and modular arithmetic to solve number-theoretic problems and perform integer factorization techniques.

3. Analyze the structure and properties of finite fields, quadratic residues, and the law of quadratic reciprocity.
4. Demonstrate the principles of classical cryptography and implement simple cryptographic systems using enciphering matrices.
5. Apply public key cryptographic techniques, particularly the RSA algorithm, for secure communication and data protection.
6. Evaluate and solve real-world security problems using number-theoretic concepts and modern cryptographic methods.

TEXT BOOK(S):

1. Neal Koblit, 2002, A Course in Number Theory and Cryptography, Second Edition, Springer – Verlag, New York.

Chapter I: Sections 1, 2
Chapter I: Sections 3, 4
Chapter II: Sections 1, 2
Chapter III: Sections 1, 2
Chapter IV: Sections 1,2

REFERENCE BOOK(S)

1. Thomas Koshy, 2007, Elementary Number Theory with Applications, Academic Press.
2. David M. Burton, 2023, Elementary Number Theory, 7th Edition, Tata McGraw Hill Education Private Limited, Noida.
3. Hardy G.H and Wright E.M, 2008, Introduction to the theory of numbers, sixth edition, Oxford University press, Oxford, London.
4. Gareth A. Jones & Mary Jones J, 2012, Elementary Number Theory, 7th Edition, Springer – Verlag, London.
5. Telang S.G, Number Theory, 1996, Tata McGraw Hill Education Private Limited, New Delhi.

E-RESOURCES

1. https://www.geeksforgeeks.org/number-theory-used-in-cryptography/
2. https://www.math.wustl.edu/~matkerr/NTCbook.pdf
3. http://www.numbertheory.org/ntw/N12.html
4. https://aud.delhi.gov.in/number-theory-and-cryptography
5. https://www.amrita.edu/course/number-theory-and-information-security/

Course Learning Outcome (for Mapping with POs and PSOs)

	POs										PSOs		
	1	2	3	4	5	6	7	8	9	10	1	2	3
CLO1	3	2	2	1	1	1	1	1	1	1	2	2	1
CLO2	3	3	2	2	2	1	1	1	1	1	3	2	2
CLO3	3	3	2	2	2	1	1	1	1	1	3	3	2
CLO4	3	3	3	2	3	2	1	1	1	1	3	3	2
CLO5	3	3	3	3	3	2	1	1	1	1	3	3	3
CLO6	3	3	3	3	3	3	2	2	2	2	3	3	3

Strong: 3 Medium: 2 Low: 1

Semester: I- DCEC-I(C): Cryptography

Ins. Hrs./Week: **5** **Course Credit**: **4** **Course Code**: P26MADE11C

COURSE OBJECTIVES:

- To understand the fundamental concepts, goals, and historical development of cryptography.
- To analyze symmetric key encryption techniques for secure communication.
- To examine cryptographic principles used to ensure authentication of data.
- To understand public key cryptography concepts and apply asymmetric encryption algorithms for secure key exchange.
- To explore primality testing and integer factorization methods that form the mathematical Foundation of modern cryptographic systems.

UNIT I: Introduction to cryptography **(15 Hours)**

Encryption and secrecy – The objectives of cryptography - Attacks – Cryptographic protocols – Provable security.

UNIT II: Symmetric Key Encryption **(15 Hours)**

Introduction – Stream ciphers – Block ciphers – DES – Modes of operation.

UNIT III: Cryptography **(15 Hours)**

Some simple Cryptosystems – Basic notions - Diagraph transformations - Enciphering matrices- Review of linear algebra – Linear algebra modulo – Affine enciphering transformation.

UNIT IV: Public Key **(15 Hours)**

The idea of public key Cryptography – classical versus public key – Authentication – Hash functions – key exchange – Probabilistic Encryption- RSA cryptosystem – Discrete log – The Diffie – Hellmam key exchange system – Diffie – Hellmam assumption- The Massey – Omura Cryptosystem for message transmission – The Digital signature standard – Algorithms for finding discrete logs in finite fields – The index-calculus algorithm for discrete logs.

UNIT V: Primality and Factoring **(15 Hours)**

Pseudoprimes – Solovay – Strassen primality test – Strong pseudo primes – Miller-Rabin primality test – The rho method – Fermat factorization and factor bases- Factor base algorithm – Heuristic time estimate- Implications for RSA.

UNIT-VI: Current Contours (Continuous Internal Assessment Only-Self Study)

Introduction to digital signatures – Block chain technology – Cryptography in cyber security – Applications of cryptography in e-commerce, banking, and secure communication systems.

Total Lecture Hours - 75

COURSE OUTCOMES:

After the completion of the course, Students will be able to,

1. Understand the fundamental concepts, goals, and applications of cryptography.
2. Apply symmetric key encryption techniques of cryptography.
3. Develop a deeper conceptual understanding of the theoretical basis of number theory.
4. Identify how number theory is related to and used in cryptography.
5. Understand the concept of Primality and Factoring.

6.Explain the role of digital signatures, block chain technology, and cryptographic techniques in Cyber security and secure applications such as e-commerce, banking, and communication systems.

TEXT BOOK(S)

1. Hans Delfs, Helmut knebl, 2015, Introduction to cryptography Principles and Applications, Third Edition, Springer, Berlin, Heidelberg.
2. Chowdhury K.C, 2018, Fundamentals of Theory of numbers, Fourth Revised edition, Kalyani Publishers, New Delhi.

UNIT I Chapter 1: Sec. 1.1 to 1.5 [1]
UNIT II Chapter 2: Sec. 2.1, 2.2, 2.2.1, 2.2.2 [1]
UNIT III Chapter III: Sec. 1, 2 [2]
UNIT IV Chapter IV: Sec. 1, 2, 3 [2]
UNIT V Chapter V: Sec. 1, 2, 3 [2]

REFERENCE BOOK(S)

1. Williams Stallings, 2004, Cryptography & Network Security, Pearson Education 3rd edition, New Delhi.
2. Atul Kahate, 2005, Cryptography & Network Security, Tata McGraw Hill, New Delhi.
3. Christof Paar, Jan Pelzl, 2010, Understanding Cryptography, 1ST edition, Springer, New York.
4. Sahadeo Padhye, Rajeev A. Sahu, Vishal Saraswat, 2021, Introduction to Cryptography, 1ST edition, CRC Press, New Delhi.
5. Serge Vaudenay, 2008, A classical Introduction to Cryptography, Springer (SIE), New Delhi, India.

E-RESOURCES

1. https://www.geeksforgeeks.org/number-theory-used-in-cryptography/
2. https://www.math.wustl.edu/~matkerr/NTCbook.pdf
3. https://www.cryptography101.org/mathematics/number-theory.html
4. https://aud.delhi.gov.in/number-theory-and-cryptography
5. https://www.amrita.edu/course/number-theory-and-information-security/

Course Learning Outcome (for Mapping with POs and PSOs)

	POs										PSOs		
	1	2	3	4	5	6	7	8	9	10	1	2	3
CLO1	3	2	1	1	2	1	1	1	1	1	2	2	1
CLO2	3	3	2	2	3	2	1	1	1	1	3	3	2
CLO3	3	3	2	2	2	1	1	1	1	1	3	2	2
CLO4	3	3	3	2	3	2	1	1	1	1	3	3	2
CLO5	3	3	2	2	2	1	1	1	1	1	3	2	2
CLO6	3	3	3	3	3	3	2	2	2	2	3	3	3

Strong: 3 Medium: 2 Low: 1

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

(AUTONOMOUS)

SUNDARAKKOTTAI, MANNARGUDI- 614016

(For the Candidates admitted in the academic year 2026– 2027)

DEPARTMENT OF MATHEMATICS

M.Sc., MATHEMATICS

Semester: I - GEC- I (A): Mathematics for Critical Thinking

Ins.hrs / Week : 5 **Course Credit : 3** **Course code:P26MAGE11A**

COURSE OBJECTIVES:

- To introduce the role of mathematical logic in computer science and artificial intelligence.
- To develop analytical and critical thinking skills through real-life mathematical applications.
- To understand the use of sets, relations, and functions in data organization and information systems.
- To explore the significance of counting techniques and cardinality in data analysis.
- To familiarize students with mathematical structures used in digital technologies and decision-making.

UNIT-I **(15 hours)**

Statements and Logic: Statements - Statements with quantifiers - Compound statements - Implications - Proofs in Mathematics – Sets: Basic terminologies - Operations on sets - Family of sets - Power sets - Cartesian product of sets.

UNIT-II **(15 hours)**

Functions: Basic definitions - One-one, onto functions and bijections - Composition of functions - Inverse of a function - Image of subsets under functions - Inverse image of subsets under functions. Relation: Relations on sets - Types of relations - Equivalence relations - Equivalence classes and partitions of a set.

UNIT-III **(15 hours)**

Induction Principles - The Induction Principle - The Strong Induction Principle - The Well-ordering Principle - Equivalence of the three principles.

UNIT-IV **(15 hours)**

Countability of Sets: Sets with same cardinality - Finite sets - Countable sets - Comparing cardinality.

UNIT-V **(15 hours)**

Order Relations: Partial and Total Orders - Chains, bounds and maximal elements - Axiom of Choice and its Equivalents.

UNIT-VI: CURRENT CONTOUR(For Continuous Internal Assessment Only)

Applications of Mathematical Logic and Discrete Structures in Modern Technology

Total Lecture Hours -75

COURSE OUTCOMES:

After the completion of the course, students should be able to,

1. Understand statements, logical operations, mathematical proofs, and fundamental concepts of set theory.

2. Analyze functions and relations including equivalence relations, partitions, and properties of mappings between sets.
3. Apply induction principles and well-ordering concepts in proving mathematical statements.
4. Study finite, countable, and uncountable sets and compare cardinalities of sets.
5. Understand partial and total order relations, chains, maximal elements, and the Axiom of Choice with its equivalents.
6. Analyze and interpret modern technological applications using the foundational principles of mathematics.

TEXT BOOK(S)

1. Ajit. Kumar, S. Kumaresan, Bhaba Kumar Sarma, A Foundation Course in Mathematics, Alpha Science International Ltd., 2018.

Unit – I: Chapter 1 & 2
Unit – II: Chapter 3 & 4
Unit – III: Chapter 5
Unit – IV: Chapter 6
Unit – V: Chapter 7

REFERENCE BOOK(S)

1. B.S.Grewal, Higher Engineering Mathematics, 42ndEdition, KhannaPublishers, 2012.
2. Seymour Lipschutz, Marc Lipson. Discrete Mathematics, 3rd Edition, Schaum's outline,2007.
3. Thomas Koshy, Elementary Number Theory with Applications, 2nd Edition, Academic Press, 2007.

E_RESOURCES :

1. http://mathforum.org,
2. http://ocw.mit.edu/ocwweb/Mathematics,
3. http://www.opensource.org,
4. http://www.nptel

Course Learning Outcome (for Mapping with POs and PSOs)

	POs										PSOs		
	1	2	3	4	5	6	7	8	9	10	1	2	3
CLO1	3	2	1	1	1	1	1	1	1	1	2	2	1
CLO2	3	3	2	2	2	1	1	1	1	1	3	2	2
CLO3	3	3	3	2	2	2	1	1	1	1	3	3	2
CLO4	3	3	3	2	2	2	1	1	1	1	3	3	2
CLO5	3	3	3	3	2	2	1	1	1	1	3	3	3
CLO6	3	3	3	3	3	2	2	2	2	2	3	3	3

Strong: 3 Medium: 2 Low: 1

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

(AUTONOMOUS)

SUNDARAKKOTTAI, MANNARGUDI- 614016

(For the Candidates admitted in the academic year 2026– 2027)

DEPARTMENT OF MATHEMATICS

M.Sc., MATHEMATICS

Semester: I - GEC- I (B): Automata Theory

Ins.hrs / Week : 5 **Course Credit : 3** **Course code:P26MAGE11B**

COURSE OBJECTIVES:

- To understand the role of automata theory in modern computing systems.
- To explore applications of finite automata in text processing, pattern matching, and compiler design.
- To study the significance of formal languages and grammars in programming language development.
- To analyze the use of automata models in artificial intelligence and natural language processing.
- To develop problem-solving skills using formal computational models.

UNIT-I : Lattices and Boolean Algebra **(15 hours)**

Lattices as partially ordered sets – Boolean algebra –Boolean Functions –Representations and Minimization of Boolean Function.

UNIT-II : Grammars and Languages **(15 hours)**

Discussion of Grammars – Formal Definition of a Language – Notation of Syntax Analysis.

UNIT-III :Finite Automata, Regular Expressions and Languages **(15 hours)**

An Informal picture of Finite Automata – Deterministic Finite Automata – Nondeterministic Finite Automata – An Application: Text Search – Finite Automata with Epsilon Transitions – Regular Expressions – Finite Automata and Regular Expressions – Applications of Regular Expressions – Algebraic Laws for Regular Expressions.

UNIT-IV : Properties of Regular Languages **(15 hours)**

Proving languages not to be regular – Closure properties of Regular Languages – Decision properties of Regular Languages – Equivalence and Minimization of Automata.

Context-Free Grammars and Languages Context-Free Grammars – Parse Trees – Applications of Context-Free Grammars – Ambiguity in Grammars and Languages.

UNIT-V : Pushdown Automata **(15 hours)**

Definition of the Pushdown Automaton – The languages of a PDA – Equivalence of PDA‟s and CFG‟s – Deterministic Pushdown Automata-Properties of Context - Free Languages Normal Forms for Context – Free Grammars – The Pumping Lemma for CFL‟s – Closure properties of CFL‟s – Decision properties of CFL‟s.

UNIT-VI: CURRENT CONTOUR(For Continuous Internal Assessment Only-Self Study)

Applications of Automata Theory in Computing and Artificial Intelligence

Total Lecture Hours -75

COURSE OUTCOME:

After the completion of the course, students should be able to,

1. Understand lattices, Boolean algebra, Boolean functions, and minimization techniques for Boolean expressions.
2. Analyze grammars, formal languages, and syntax analysis used in language theory.
3. Apply deterministic and nondeterministic finite automata, regular expressions, and regular languages in computational problems.
4. Study properties of regular and context-free languages, parse trees, ambiguity, and minimization of automata.
5. Analyze pushdown automata, equivalence between PDA and CFG, normal forms, pumping lemma, and closure properties of context-free languages.
6. Explain the applications of finite automata, pushdown automata, and formal language theory in computer science and related fields.

TEXT BOOK(S)

1. J.P Tremblay and R.P. Manohar, "Discrete mathematical Structures with Applications to Computer Science" McGraw Hill Publishing company, reprint 2016.
2. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, "Introduction to Automata Theory, languages and Computation" Pearson Education, 2nd Edition, reprint 2005.

UNIT I : Chapter 4: Sec 4.1.1to 4.4.2(1)
UNIT II: Chapter 3: Sections 3.3.1 – 3.3.3(1)
UNIT III: Chapters 2 & 3
UNIT IV: Chapters 4 and 5
UNIT V : Chapters 6 and 7

REFERENCE BOOK(S)

1. P. Linz, Introduction to formal Language & Automata, Jones &Bartilett Learning, Fifth Edition,2012.
2. T. Santha and P. Radha, Discrete Mathematics for Computer Science and Applications, Kalaikathir Publications, 2003.
3. J. Truss, Discrete Mathematics for Computer Scientists, Pearson Education Ltd, 2nd Edition,2001.
4. T. Veerarajan, Discrete Mathematics with Graph Theory and Combinatorics, Tata Mcgraw-Hill Publishing company Ltd, 2008.
5. M.K. Venkatraman, Dr. N. Sridharan and N. Chandrasekaran, Discrete Mathematics, First Edition Reprint, The National Publishing Company, Chennai, 2003.

E_RESOURCES :

1. http://mathforum.org,
2. http://ocw.mit.edu/ocwweb/Mathematics,
3. http://www.opensource.org,
4. http://www.nptel

Course Learning Outcome (for Mapping with POs and PSOs)

	Pos										PSOs		
	1	2	3	4	5	6	7	8	9	10	1	2	3
CLO1	3	2	2	1	1	1	1	1	1	1	2	2	1
CLO2	3	3	2	2	2	2	1	1	1	1	3	2	2
CLO3	3	3	3	2	3	2	1	1	1	1	3	3	2
CLO4	3	3	3	3	2	2	1	1	1	1	3	3	2
CLO5	3	3	3	3	2	2	1	1	1	2	3	3	3
CLO6	3	3	3	3	3	2	2	2	2	2	3	3	3

Strong: 3 Medium: 2 Low: 1

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

(AUTONOMOUS)

SUNDARAKKOTTAI, MANNARGUDI- 614016

(For the Candidates admitted in the academic year 2026– 2027)

DEPARTMENT OF MATHEMATICS

M.Sc., MATHEMATICS

Semester: I - GEC- I (C): Integral Transforms

Ins.hrs / Week : 5 **Course Credit : 3** **Course code:P26MAGE11C**

COURSE OBJECTIVES:

- To understand the contemporary applications of integral transforms in science and engineering.
- To explore the role of Laplace and Fourier transforms in signal processing and communication systems.
- To study the applications of Hankel transforms in physics, engineering, and image analysis.
- To develop problem-solving skills using transform techniques for real-world mathematical models.
- To familiarize students with the use of integral transforms in computational and data-driven methods.

UNIT-I : **(15 hours)**

Introduction Integral Transform-Laplace Transform-Linearity Property of Laplace Transform-Initial value theorem-Final value theorem.

UNIT-II : **(15 hours)**

Inverse Laplace transform-Null Function-Lerch's Theorem-Linearity Property with Examles

UNIT-III : **(15 hours)**

Fourier Transforms: Fourier Sine and Cosine transforms – Properties of Fourier Transform – Multiple Fourier Transforms – Convolution – Solving Integral Equations.

UNIT-IV : **(15 hours)**

Finite Fourier Transforms: Finite Fourier Sine and Cosine Transforms – Multiple Finite Fourier Transforms – Properties of Finite Fourier Sine and Cosine Transforms – Convolution.

UNIT-V : **(15 hours)**

Hankel Transforms: Definition – Inverse Formula for the Hankel Tranform – Some important results for Bessel Function – Linearity Property – Hankel Transform of the Derivatives of the function – Hankel Transform of differential operators – Parseval's Theorem.

UNIT-VI: CURRENT CONTOUR(For Continuous Internal Assessment Only-Self Study)

Applications of Integral Transforms in Science, Engineering and Data Analysis

Total Lecture Hours -75

COURSE OUTCOME:

After the completion of the course, students should be able to,

1. Understand the different types of Integral Equations and their properties have learned.
2. Study the concept of Fourier Integral Theorem and Complex form of the Fourier Integral.
3. Solve the Cosine & Sine Transform and Parseval's Identity.
4. Learn about the properties of Hankel Transform.
5. Learn about the properties of Fourier Transforms and Convolution.
6. Explain the applications of Laplace, Fourier, and Hankel transforms in modern technological and research domains.

TEXT BOOK(S)

1. A.R.Vasishtha,R.K.Gupta, Integral Transforms, Krishna Prakashan Media Pvt.Ltd., India,2002.
   UNIT–I : Chapter 1 : Sec. 1.1 to 1.3,1.14,1.15
   UNIT–II: Chapter 2: Sec 2.1 to 2.4
   UNIT–III: Chapter 6 : Sec. 6.1 to 6.22
   UNIT–IV:Chapter 7 : Sec. 7.1 to 7.9
   UNIT–V:Chapter 9 : Sec. 9.1 to 9.7

REFERENCE BOOKS

1. Dr. Raisinghania, Integral Equations and Boundary Value Problems, S.Chand,2014.
2. U.P.Singh, R.Y.Denis, S.K.D.Dubey&K.N.Singh, Differential Equations &Integral Transforms, Dominant Publishers, NewDelhi.

E_RESOURCES :

1. http://mathforum.org,
2. http://ocw.mit.edu/ocwweb/Mathematics,
3. http://www.opensource.org,
4. http://www.nptel

Course Learning Outcome (for Mapping with POs and PSOs)

	POs										PSOs		
	1	2	3	4	5	6	7	8	9	10	1	2	3
CLO1	3	2	2	1	2	1	1	1	1	1	3	2	2
CLO2	3	3	2	2	3	1	1	1	1	1	3	3	2
CLO3	3	3	3	2	3	2	1	1	1	1	3	3	3
CLO4	3	3	2	3	3	2	1	1	1	2	3	3	3
CLO5	3	3	3	3	3	2	2	1	2	2	3	3	3
CLO6	3	3	3	3	3	2	2	2	2	2	3	3	3

Strong: 3 Medium: 2 Low: 1

Semester: I -SEC-I : Mathematical Documentation Using LaTeX – Practical - I

Ins. Hrs./Week: 2 **Course Credit**: 2 **Course Code**: **P26SEMA11P**

COURSE OBJECTIVES:

- To understand LaTeX document structure
- To apply formatting commands in LaTeX
- To typeset mathematical expressions
- To include figures and tables
- To prepare bibliography and Beamer presentations

UNIT-I: Introduction to LaTeX **(6 Hours)**

Basic Structure of a Latex 2e -Input file structure - Layout- Editors-Forward Search -Inverse Search - Compiling - Conversion to various formats.

UNIT-II: Formatting and Basic Commands **(6 Hours)**

Typesetting simple documents -Sectioning -Titles -page layout-listing-enumerating - quote -letter formats.

UNIT–III: Mathematical Typesetting **(6 Hours)**

Using package amsmath typing equations labelling and referring.

UNIT-IV: Figure inclusion and Table inclusion **(6 Hours)**

Figure inclusion -Table inclusion.

UNIT–V: Bibliography Writing using LaTeX **(6 Hours)**

Bibliography -Index typing -Beamer presentation Styles

UNIT–VI Current Contours (For Continuous Internal Assessment Only)

LaTeX Documentation preparation.

Total Lecture Hours– 30

COURSE OUTCOMES:

After the completion of the course, The students should able to

1. Use LaTeX for mathematical documentation
2. Format equations and mathematical expressions
3. Create professional reports and assignments
4. Design tables, figures, and references
5. Prepare project/thesis documents
6. Best Practices in LaTeX Documentation

TEXT BOOKS

1. Lesile Lamport. LATEX(1994) Document Preparation System Reading Massachusetts Second Edition

REFERENCE BOOK(S)

1. Leslie Lamport (1994). *LaTeX: A Document Preparation System*, Addison-Wesley, Reading, Massachusetts.
2. Leslie Lamport (1994). *LaTeX: A Document Preparation System*, Addison-Wesley,reading.
3. Leslie Lamport (2002). *LaTeX: A Document Preparation System*, Addison- Wesley,reading, Massachusetts, 2nd Edition.
4. Tobias Oetiker (2003), Hubert Partl, Irene Hyna & Elisabeth Schlegl. *The (Not So) Short Introduction to LaTeX2e*, Samurai Media Limited.
5. H. J. Greenberg. *A Simplified Introduction to LaTeX*.
6. Indian LaTeX Users Group. *LaTeX Tutorials – A Prim*

E-RESOURCES

1. http://mirrors.ctan.org/info/lshort /english/lshort.pdf).
2. https://www.tug.org/twg/mactex/tutorials/ltxprimer
3. https://www.ctan.org/tex-archive/info/simplified.
4. https://www.deo.org/tpqe-art/info/doc.
5. https://www.bht.org/twg/bilo/tutorials/ltxgyt

Course Learning Outcome (for Mapping with POs and PSOs)

	POs										PSOs		
	1	2	3	4	5	6	7	8	9	10	1	2	3
CLO1	2	1	1	1	3	1	1	1	1	2	2	3	2
CLO2	3	1	1	1	3	1	1	1	1	2	2	3	2
CLO3	2	2	2	1	3	2	1	2	2	3	2	3	2
CLO4	2	2	2	2	3	2	1	1	2	3	2	3	3
CLO5	2	2	3	2	3	2	1	2	2	3	3	3	3
CLO6	2	2	3	2	3	2	1	2	3	3	3	3	3

Strong: 3 Medium: 2 Low: 1

Semester: I - VAC - 1: AI Applications in Pure Mathematics

Ins. Hrs./Week: 2 **Course Credit**: 2 **Course Code**: **P26MAVA11**

COURSE OBJECTIVES:

- Introduce advanced AI concepts and applications in mathematical sciences
- Familiarize students with AI-assisted computational and analytical tools
- Demonstrate AI applications in advanced mathematical modeling and computation
- Develop AI-assisted analytical, visualization, and problem-solving skills
- Enable students to understand ethical and practical implications of AI-assisted mathematical analytics

UNIT-I : Foundations of AI in Advanced Mathematics (6 Hours)

Introduction to Artificial Intelligence in Mathematical sciences - AI, Machine Learning, and computational mathematics - AI-assisted symbolic computation - AI in mathematical research and analytics - AI in scientific computation and modeling - Opportunities and challenges of AI in Mathematics - Emerging trends in computational analytics - AI-assisted mathematical communication

UNIT-II : AI-Assisted Algebra, Calculus, and Differential Equations (6 Hours)

AI-assisted advanced algebraic computation - Matrix operations and eigenvalue analysis - AI-assisted multivariable calculus - AI in vector calculus visualization - Differential equations and computational interpretation - AI-assisted symbolic differentiation and integration - Partial differential equation visualization concepts - Applications in mathematical computation

UNIT-III : AI in Statistics, Numerical Methods, and Computational Analytics (6 Hours)

AI-assisted statistical computation - Probability modeling using AI tools - AI-assisted regression interpretation - Numerical approximation methods - Root-finding and interpolation concepts - AI-assisted optimization techniques - Data analytics and computational interpretation - Mathematical analytics using AI platforms

UNIT-IV : AI-Assisted Mathematical Modeling and Optimization (6 Hours)

Mathematical modeling concepts - AI-assisted optimization models - Linear programming concepts - AI in operations research - AI-assisted simulation concepts - Computational modeling techniques - AI in predictive mathematical systems - Applications in engineering and analytics

UNIT-V : AI Tools for Visualization, Computational Platforms, and Research Analytics (6 Hours)

AI-assisted mathematical visualization - Advanced graph plotting using GeoGebra - MATLAB demonstrations for advanced mathematics - Python/Jupyter demonstrations - Wolfram tools for computational analytics - AI-assisted research documentation - Ethical considerations in AI-assisted mathematics - Future of AI in mathematical sciences

UNIT – VI : CURRENT CONTOUR (For Continuous Internal Assessment Only– Self Study):
Ethical issues and future prospects of AI in mathematical research

Total Lecture Hours- 30

COURSE OUTCOMES:

After the completion of the course, Students will be able to,

1. Explain advanced AI concepts and applications in mathematical computation and analytics.
2. Identify suitable AI-assisted computational tools for advanced mathematical analysis.
3. Apply AI-assisted platforms for symbolic computation, visualization, and numerical analysis
4. Analyze mathematical models and computational datasets using AI-assisted tools
5. Evaluate the capabilities and limitations of AI in mathematical research and analytics
6. Develop AI-assisted mathematical reports, computational models, and analytical presentations

TEXT BOOKS

1. Stuart Russell.Peter Norving, 2010, Artificial Intelligence - A Modern Approach (III Edition), Prentice – Hall of India Private Limited.

REFERENCE BOOK(S)

1. David L. Poole and Alan K. Mackworth, 2017, *Artificial Intelligence: Foundations of Computational Agents*(II Edition), Cambridge University Press.
2. Elaine Rich and Kevin Knight, 2009, *Artificial Intelligence* (III Edition), Tata McGraw – Hill Publishing Company Limited.
3. Ian Goodfellow, Yoshua Bengio and Aaron Courville, 2016, *Deep Learning* (I Edition), MIT Press.
4. Kevin P. Murphy, 2012, *Machine Learning: A Probabilistic Perspective* (I Edition), MIT Press.
5. Marc Peter Deisenroth, A. Aldo Faisal and Cheng Soon Ong, 2020, *Mathematics for Machine Learning* (I Edition), Cambridge University Press.

E-RESOURCES

1. NPTEL – Artificial Intelligence Course
2. MIT OpenCourseWare – Artificial Intelligence
3. Stanford University AI Resources
4. Coursera – AI Courses
5. Khan Academy – Linear Algebra and Probability

Course Learning Outcome (for Mapping with POs and PSOs)

	POs										PSOs		
	1	2	3	4	5	6	7	8	9	10	1	2	3
CLO1	3	1	3	2	3	3	3	1	2	3	3	2	1
CLO2	2	1	3	1	3	3	2	3	1	1	3	2	1
CLO3	3	2	3	1	3	3	1	2	3	2	3	2	1
CLO4	1	2	3	2	3	3	1	2	3	2	3	2	1
CLO5	3	1	2	3	3	3	1	2	3	1	3	2	1
CLO6	3	3	3	3	3	3	3	3	3	3	3	3	3

Strong: 3 Medium: 2 Low: 1

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

(AUTONOMOUS)

SUNDARAKKOTTAI, MANNARGUDI- 614016

(For the Candidates admitted in the academic year 2026 – 2027)

DEPARTMENT OF MATHEMATICS

M.Sc., MATHEMATICS

Semester: II -CC- IV: Algebra - II

Ins. Hrs./Week: 6 **Course Credit**: 4 **Course Code**: P26MA204

COURSE OBJECTIVES:

- Understand the theory of fields, field extensions, and the roots of polynomial equations.
- Analyze algebraic extensions and apply the fundamental concepts of Galois theory to polynomial solvability.
- Develop proficiency in the study of linear transformations, characteristic roots, and matrix representations of linear operators.
- Examine canonical forms, nilpotent transformations, trace, and transpose, and their significance in linear algebra.
- Apply determinant theory and investigate Hermitian, unitary, and normal transformations in finite-dimensional vector spaces.

UNIT-I : **(20 Hours)**

Fields : Extension fields - Roots of Polynomials.

UNIT-II : **(18 Hours)**

Fields Continued: More about Roots - The Elements of Galois Theory.

UNIT-III : **(18 Hours)**

Linear Transformations: Algebra of Linear transformations -Characteristic roots- Matrices of linear transformations.

UNIT-IV : **(19 Hours)**

Canonical forms: Triangular forms- Nilpotent transformations -Trace and transpose.

UNIT-V : **(15 Hours)**

Determinants and Transformations: Determinants – Hermitian, Unitary and Normal transformations.

UNIT – VI CURRENT CONTOUR (For Continuous Internal Assessment Only – Self Study):

Applications of Field Extensions in Secure Communication.

Total Lecture Hours- 90

COURSE OUTCOMES

After the completion of the course, Students will be able to,

1. Understand extension fields, roots of polynomials, and algebraic properties of fields.
2. Analyze polynomial roots and apply the fundamental concepts of Galois theory in algebraic structures.
3. Study linear transformations, characteristic roots, and matrix representations of linear operators.
4. Examine canonical forms, nilpotent transformations, trace, and transpose of linear transformations.

5. Apply determinant theory and analyze Hermitian, unitary andnormal transformations in vector spaces.
6. Explain the applications of field theory, Galois theory, and linear transformations in cryptography, coding theory, and modern information security systems.

TEXT BOOKS

1. Herstein. I.N, 2006,(Reprint 2008) Topics in Algebra (II Edition) Wiley Eastern Limited, New Delhi.
   Unit I : Chapter 5 : Section 5.1 and 5.3
   Unit II : Chapter 5 : Sections 5.5 and 5.6
   Unit III : Chapter 6 : Section 6.1, 6.2 and 6.3
   Unit IV : Chapter 6 : Section 6.4, 6.5 and 6.8
   Unit V : Chapter 6 : Sections 6.9 and 6.10

REFERENCE BOOK(S)

1. M.Artin, Algebra, Prentice Hall of India, 1991.
2. P.B.Bhattacharya, S.K.Jain, and S.R.Nagpaul, Basic Abstract Algebra (II Edition) Cambridge University Press, 1997. (Indian Edition)
3. I.S.Luther and I.B.S.Passi, Algebra, Vol. I –Groups(1996); Vol. II Rings,Narosa Publishing House , New Delhi, 1999
4. D.S.Malik, J.N. Mordeson and M.K.Sen, Fundamental of Abstract Algebra, McGraw Hill (International Edition), New York. 1997.
5. N.Jacobson, Basic Algebra, Vol. I & II Hindustan Publishing Company, New Delhi.

E-RESOURCES

1. http://mathforum.org,
2. http://ocw.mit.edu/ocwweb/Mathematics,
3. http://www.opensource.org,
4. www.algebra.com

Course Learning Outcome (for Mapping with POs and PSOs)

	POs										PSOs		
	1	2	3	4	5	6	7	8	9	10	1	2	3
CLO1	3	1	3	2	3	3	3	1	2	3	3	2	1
CLO2	2	1	3	1	3	3	2	3	1	1	3	2	1
CLO3	3	2	3	1	3	3	1	2	3	2	3	2	1
CLO4	1	2	3	2	3	3	1	2	3	2	3	2	1
CLO5	3	1	2	3	3	3	1	2	3	1	3	2	1
CLO6	3	3	3	3	3	3	3	3	3	3	3	3	3

Strong: 3 Medium: 2 Low: 1

Semester: II - CC- V: Real Analysis -II

Ins. Hrs./Week:6 **Course Credit:4** **Course Code:P26MA205**

COURSE OBJECTIVES:

- To understand the Riemann–Stieltjes integral and its applications.
- To analyze sequences and series of functions, including uniform convergence and equicontinuity.
- To study Fourier series, Fourier integrals, and special functions.
- To apply concepts of multivariable calculus and linear transformations.
- To use implicit function theory, rank theorem, determinants, and higher-order derivatives to solve extremum problems.

UNIT-I: The Riemann Stieltjes Integral (17 Hours)

The Riemann Stieltjes Integral – Definition and Existence of integral – Properties of Integral – Integration and Differentiation – Integration of Vector-valued functions – Rectifiable curves.

UNIT –II: Sequences and Series of Functions (17 Hours)

Sequences and Series of Functions – Definition and Examples – Uniform convergence – Uniform convergence and continuity - Uniform convergence and Integration – Uniform convergence and Differentiation – Equi continuous of functions – The StoneWeierstrass theorem

UNIT–III: Fourier Series and Fourier Integrals (19 Hours)

Some Special Functions – Power Series – The exponential and logarithmic functions – The trigonometric functions – Algebraic completeness of complex filed – Fourier series - The Gamma function

UNIT-IV: Functions of Several Variables (19 Hours)

Linear Transformation – Differentiation – The contraction principle – The inverse function theorem

UNIT-V: Implicit Functions and Extremum Problems (18 Hours)

Functions of Several Variables Continued – The implicit function theorem – The Rank theorem - Determinants – Derivatives of higher order

UNIT-VI: Current Contours (For Continuous Internal Assessment Only – self study)

Riemann integration (simple problems) - Directional derivative basics

Total Lecture Hours - 90

COURSE OUTCOME

After the completion of the course, students should be able to

1. Explain the concepts, properties, and applications of the Riemann–Stieltjes integral.
2. Analyze the convergence properties of sequences and series of functions.

3. Apply Fourier series, Fourier integrals, and special functions to mathematical problems.
4. Solve problems involving functions of several variables, linear transformations, and differentiation.
5. Utilize implicit function theorem, rank theorem, and determinants in multivariable analysis.
6. Demonstrate the ability to solve advanced problems involving higher-order derivatives and extremum conditions.

TEXT BOOKS

1. Walter Rudin, Principles of Mathematical Analysis, McGraw Hill, Inc, 1976.
   Unit I: Chapter 6
   Unit II: Chapter 7
   Unit III: Chapter 8
   Unit IV: Chapter 9 Sections 1-4
   Unit V: Chapter 9 Sections 5-8

REFERENCE BOOK(S)

1. Tom. M. Apostol(1997), Mathematical Analysis, Narosa Publishing House, New Delhi,.
2. R. G. Bartle, D. R. Sherbert,(1982) Introduction to Real Analysis, John Wiley and Sons, New York,.
3. Kenneth A. Ross(2004), Elementary Analysis: The Theory of Calculus, Springer
4. Müller-Kirsten, Harald J.W.(2007). Introduction to Real Analysis. World Scientific.
5. H.L Royden ,(1998) Real Analysis ,Third Edition MacMillian Publishing Company

E-RESOURCES

1. http://mathforum.org
2. http://ocw.mit.edu/ocwweb/Mathematics
3. http://www.opensource.org
4. www.mathpages.com
5. https://dodl.klyuniv.ac.in/download/SLM2023/Mathematics/2_COR3.2.pdf

Course Learning Outcome (for Mapping with POs and PSOs)

	POs										PSOs		
	1	2	3	4	5	6	7	8	9	10	1	2	3
CLO1	3	2	2	1	1	1	1	1	1	1	2	2	1
CLO2	3	3	2	2	2	2	1	1	1	1	3	2	2
CLO3	3	3	2	2	2	1	1	1	1	1	3	2	2
CLO4	3	3	3	2	2	2	1	1	1	1	3	3	2
CLO5	3	2	2	2	2	1	1	1	1	1	2	2	2
CLO6	3	3	3	3	2	2	2	2	2	2	3	3	3

Strong: 3 Medium: 2 Low: 1

Semester: II – CC - VI: Partial Differential Equations

Ins. Hrs./Week: 6 **Course Credit**: 4 **Course Code**: P26MA206

COURSE OBJECTIVES:

- To introduce the theory and solution techniques of partial differential equation (PDE) arising in mathematical physics and engineering.
- To develop analytical skills in solving first and second order PDEs.
- To solve boundary value problems and classical equations such as wave equation.
- To understand the Dirichlet Interior and Exterior Problems for a Circle.
- To familiarize students with Heat Conduction Equation.

First Order P.D.E.:

UNIT–I **(20 Hours)**

Curves and Surfaces- Genesis of First Order P.D.E.- Classification of Integrals-Linear Equations of the First Order- Pfaffian Differential Equations Compatible Systems- Charpit's Method- Jacobi's Method.

UNIT–II **(18 Hours)**

Integral Surfaces through a Given Curve- Quasi-Linear Equations- Non-linear First Order P.D.E.

Second Order PDE:

UNIT–III **(17 Hours)**

Genesis of Second Order P.D.E.- Classification of Second Order P.D.E. One-Dimensional Wave Equation- Vibrations of an Infinite String- Vibrations of a Semi-infinite String-Vibrations of a String of Finite Length (Method of separation of variables).

UNIT–IV **(17 Hours)**

Laplace's Equation: Boundary Value Problems- Maximum and Minimum Principles-The Cauchy Problem- The Dirichlet Problem for the Upper Half Plane- The Neumann Problem for the Upper Half Plane- The Dirichlet Interior Problem for a Circle- The Dirichlet Exterior Problem for a Circle- The Neumann Problem for a Circle- The Dirichlet Problem for a Rectangle- Harnack's Theorem.

UNIT–V **(18 Hours)**

Heat Conduction Problem- Heat Conduction- Infinite Rod Case- Heat Conduction Finite Rod Case- Duhamel's Principle-Wave Equation-Heat Conduction Equation.

UNIT – VI: Current Contours (For Continuous Internal Assessment Only - Self Study)

Green's function – AI applications in theory of distributions.

Total Lecture Hours- 90

COURSE OUTCOMES:

After the completion of the course,The students should be able to

1. Understand the formation and classification of first order partial differential equations and apply methods such as Charpit's and Jacobi's methods for solving them.
2. Analyze integral surfaces, quasi-linear equations and non linear first order partial differential equations.
3. Classify and solve second order partial differential equations, including wave equations and vibration problems using separation of variables.
4. Apply boundary value techniques to solve Laplace equations, Dirichlet and Neumann problems, and analyze harmonic functions using maximum and minimum principles.
5. Solve heat conduction and wave propagation problems using classical methods and apply Duhamel's principle in heat equations.
6. Learn the nature of Green's function and Theory of distributions..

TEXT BOOK(S)

1. Amarnath T, 2010, An Elementary Course in Partial Differential Equations, 2nd edn., Narosa Publishing Company.

Unit-I : Chapter 1: Sections 1.1 to 1.8

Unit-II : Chapter 1: Sections 1.9 to 1.11

Unit-III : Chapter 2: Sections 2.1 to 2.3.5 except 2.3.4

Unit-IV : Chapter 2: Sections 2.4.1 to 2.4.10

Unit-V : Chapter 2: Sections 2.4.11 to 2.6.2

REFERENCE BOOK(S)

1. Raisighania, 2015, Advanced Differential Equations, S.Chand & Company Pvt. Ltd..
2. Tyn Myint U, Lokenath Debnath, 2007, Linear Partial Differential equations for scientists and engineers, 3rd edn., Birkhauser.
3. Snedden I.N., 2006, Elements of Partial Differential Equations, Dover.
4. Sankara Rao K, 2023, Introduction to Partial Differential Equations, PHI Learning Pvt. Ltd., 3rd Edition.
5. Fritz John, 1982, Partial Differential Equations, Springer Nature, 4th Edition.

E-RESOURCES

1. https://ocw.mit.edu/courses/18-152-introduction-to-partial-differential-equations-fall-2011/□
2. https://nptel.ac.in/courses/111106100□
3. https://tutorial.math.lamar.edu/classes/de/de.aspx□
4. https://mathworld.wolfram.com/PartialDifferentialEquation.html□
5. https://encyclopediaofmath.org/wiki/Partial_differential_equation

Course Learning Outcome (for Mapping with POs and PSOs)

	POs										PSOs		
	1	2	3	4	5	6	7	8	9	10	1	2	3
CLO1	3	1	3	2	2	1	3	1	3	2	2	3	2
CLO2	2	1	3	1	1	3	1	3	1	3	3	2	1
CLO3	3	2	1	3	3	2	1	2	2	2	3	1	1
CLO4	1	2	3	2	3	3	1	2	3	2	3	2	2
CLO5	3	1	2	3	3	3	1	2	3	1	2	2	1
CLO6	1	1	3	2	3	1	1	3	2	1	3	2	1

Strong: 3 Medium: 2 Low: 1

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE
(AUTONOMOUS)
SUNDARAKKOTTAI, MANNARGUDI- 614016
(For the Candidates admitted in the academic year 2026 – 2027)
DEPARTMENT OF MATHEMATICS
M.Sc., MATHEMATICS

Semester: II- DCEC –II(A): Fuzzy Mathematics

Ins. Hrs./Week: 4 **Course Credit**: 4 **Course Code**: **P26MADE22A**

COURSE OBJECTIVES:

- To understand the fundamental concepts of fuzzy sets, fuzzy set operations, and their properties.
- To learn various operations on fuzzy sets, including fuzzy complements, intersections, and unions.
- To study fuzzy numbers, linguistic variables, and arithmetic operations on fuzzy quantities.
- To understand fuzzy relations and their applications in modeling uncertain and imprecise information.
- To learn fuzzy decision-making techniques and fuzzy linear programming for solving real-world problems.

UNIT I **(12 Hours)**

From Classical Sets To Fuzzy Sets, Fuzzy Sets Verses Crisp Sets: Fuzzy sets: Basic types – Fuzzy sets: Basic Concepts –Additional Properties of α – cuts- Extension Principle for fuzzy sets.

UNIT II **(12 Hours)**

Operations On Fuzzy Sets: Types of operations– Fuzzy complements- Fuzzy Intersections: t-Norms – Fuzzy Unions: t-Conorms - Combinations of Operations.

UNIT III **(12 Hours)**

Fuzzy Arithmetic: Fuzzy numbers - Linguistic variables - Arithmetic operations on intervals – Arithmetic operations on Fuzzy numbers.

UNIT IV **(12 Hours)**

Fuzzy Relations: Binary Fuzzy Relations – Binary Relations on a Single Set – Fuzzy Equivalence Relations – Fuzzy Compatibility Relations –Fuzzy Ordering Relations – Fuzzy Morphisms.

UNIT V **(12 Hours)**

Fuzzy Decision Making: Individual decision making – Multiperson Decision Making-Ranking methods – Fuzzy Linear programming.

UNIT–VI: Current Contour (For Continuous Internal Assessment Only– self study)

Applications of Fuzzy Sets, Fuzzy Relations, Fuzzy Arithmetic, Fuzzy Decision Making, Fuzzy Control Systems and Fuzzy Clustering in engineering, artificial intelligence, pattern recognition and data analysis.

Total Lecture Hours – 60

COURSE OUTCOMES:

After the completion of the course, students should be able to,

1. Explain the concepts of fuzzy sets, membership functions, α-cuts, and the extension principle.
2. Analyze fuzzy set operations, including fuzzy complements, intersections, unions, and their properties.
3. Apply arithmetic operations on fuzzy numbers and linguistic variables to solve fuzzy mathematical problems.
4. Analyze fuzzy relations, equivalence relations, compatibility relations, ordering relations, and fuzzy morphisms.
5. Apply fuzzy decision-making techniques, ranking methods, and fuzzy linear programming in practical situations.
6. Use fuzzy mathematics in artificial intelligence, control systems, pattern recognition, data analysis, and real-world decision-making applications.

TEXT BOOK(S) :

1. Klir, G.J. and Yuan, B., 2005. *Fuzzy Sets and Fuzzy Logic: Theory and Applications*, Prentice Hall of India, New Delhi.

UNIT I - Chapter 1	Sec1.3, 1.4, Chapter :2 Sec 2.1, 2.3
UNIT II - Chapter 3	Sec 3.1, 3.2, 3.3, 3.4, 3.5.
UNIT III - Chapter 4	Sec4.1,4.2, 4.3, 4.4.
UNIT IV- Chapter 5	Sec 5.3 ,5.4, 5.5, 5.6, 5.7, 5.8.
UNIT V - Chapter 15	Sec 15.2,15.3, 15.6, 15.7

REFERENCE BOOK(S)

1. Zimmermann, H.J., 1991. *Fuzzy Set Theory and Its Applications*, Allied Publishers Limited.
2. Ganesh, M., 2006. *Introduction to Fuzzy Sets and Fuzzy Logic*, Prentice Hall of India, New Delhi.
3. S.N. Sivanandam and S.N. Deepa, 2018, *Principles of Soft Computing*, Wiley India.
4. Lotfi A. Zadeh, *Fuzzy Sets and Information Control*.
5. John Yen and Reza Langari, 2019, *Fuzzy Logic: Intelligence, Control and Information*, Pearson.

E_RESOURCES

1. https://pzs.dstu.dp.ua/logic/bibl/math.pdf
2. https://freecomputerbooks.com/Fuzzy-Mathematics.html
3. http://www.springer.com
4. www.openlibrary.org

Course Learning Outcome (for Mapping with POs and PSOs)

	POs										PSOs		
	1	2	3	4	5	6	7	8	9	10	1	2	3
CLO1	3	2	1	1	1	1	1	1	1	1	2	2	1
CLO2	3	3	2	2	1	1	1	1	1	1	3	2	2
CLO3	3	3	3	2	2	1	1	1	1	1	3	3	2
CLO4	3	3	3	2	2	2	1	1	1	1	3	3	2
CLO5	3	3	3	3	2	2	1	1	1	1	3	3	3
CLO6	3	3	3	3	3	2	2	2	2	2	3	3	3

Strong: 3 Medium: 2 Low: 1

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE
(AUTONOMOUS)
SUNDARAKKOTTAI, MANNARGUDI- 614016
(For the Candidates admitted in the academic year 2026 – 2027)
DEPARTMENT OF MATHEMATICS
M.Sc., MATHEMATICS

Semester: II- DCEC –II(B) : Discrete Mathematics

Ins. Hrs./Week: 4 **Course Credit**: 4 **Course Code: P26MADE22B**

COURSE OBJECTIVES :

- To understand the fundamentals of mathematical logic, propositional equivalence, predicates, quantifiers, and proof techniques.
- To learn the basic principles of counting, including the pigeonhole principle, permutations, and combinations.
- To study recurrence relations, generating functions, and their applications in advanced counting techniques.
- To understand Boolean algebra, Boolean functions, logic gates, and circuit minimization methods.
- To learn the concepts of finite state machines and Turing machines for modeling computational systems.

UNIT- I : The Foundation of Logic **(12 Hours)**
Logic – Propositional equivalence – Predicates and quantifiers – Proof Methods and Strategy – The growth of function.

UNIT - II : Counting **(12 Hours)**
Basics of counting – The pigeonhole principle – permutations and combinations – Generalized permutations and combinations – Generating permutations and combinations.

UNIT - III : Advanced counting techniques **(12 Hours)**
Recurrence relation – Solving recurrence relations – Generating functions.

UNIT- IV : Boolean Algebra **(12 Hours)**
Boolean functions – Representing Boolean functions – Logic Gates –Minimization of circuits.

UNIT - V : Modeling Computations **(12 Hours)**
Finite – state machines with output, finite – State machines with no output – Turing machines

UNIT – VI: Current Contours (For Continuous Internal Assessment Only – self study)
Applications of Logic, Counting, Boolean Algebra and Turing Machines in Computer Science. Introduction to Artificial Intelligence, Cryptography, Digital Circuits and Automata Theory.

Total Lecture Hours - 60

COURSE OUTCOMES:

After the completion of the course, students should be able to,

1. Explain the fundamental concepts of logic, propositional equivalence, predicates, quantifiers, and proof techniques.
2. Apply counting principles, the pigeonhole principle, permutations, and combinations to solve discrete mathematical problems.
3. Solve recurrence relations and use generating functions in counting and combinatorial applications.
4. Analyze Boolean functions, logic gates, and simplify digital circuits using Boolean algebra.
5. Describe finite state machines and Turing machines and their role in modeling computations.
6. Apply discrete mathematical concepts in computer science, digital systems, and computational problem-solving.

TEXT BOOK(S)

1. Rosen, K.H., 2011. *Discrete Mathematics and Its Applications*, 7th Edition, McGraw-Hill Education, New Delhi.

   Chapter 1 & 3 – Sections 1.1–1.3 &1.8, 3.2

   Chapter 5: Sections 5.1–5.6

   Chapter 6: Sections 6.1, 6.2, 6.4

   Chapter 10: Sections 10.1–10.4

   Chapter 12: Sections 12.2, 12.3,12.5

REFERENCE BOOK(S)

1. Bender, E.A. and Williamson, S.G., 2006. *A Short Course in Discrete Mathematics*, Dover Publications.
2. Albertson, M.O. and Hutchinson, J.P., 2008. *Discrete Mathematics with Algorithms*, John Wiley & Sons.
3. Akerkar, R. and Akerkar, R., 2004. *Discrete Mathematics*, Pearson Education Pvt. Ltd., Singapore.
4. Trembley, J.P. and Manohar, R., 1997. *Discrete Mathematical Structures*, Tata McGraw-Hill, New Delhi.
5. Aigner, M., 2007. *A Course in Enumeration*, Springer-Verlag, Heidelberg.
6. Van Lint, J.H. and Wilson, R.M., 2001. *A Course in Combinatorics*, 2nd Edition, Cambridge University Press, Cambridge.

E_RESOURCES

1. https://www.freebookcentre.net/Mathematics/Discrete Mathematics-Books-Download.html
2. https://www.cs.yale.edu/homes/aspnes/classes/202/notes
3. http://www.coursera.org
4. www.mathworld.wolfram.com

Course Learning Outcome (for Mapping with POs and PSOs)

	Pos										PSOs		
	1	2	3	4	5	6	7	8	9	10	1	2	3
CLO1	3	2	1	1	1	1	1	1	1	1	2	2	1
CLO2	3	3	2	2	2	1	1	1	1	1	3	2	2
CLO3	3	3	3	2	2	1	1	1	1	1	3	3	2
CLO4	3	3	3	3	2	2	1	1	1	1	3	3	2
CLO5	3	3	3	3	2	2	2	1	1	1	3	3	3
CLO6	3	3	3	3	3	2	2	2	2	2	3	3	3

Strong: 3 Medium: 2 Low: 1

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE
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(For the Candidates admitted in the academic year 2026 – 2027)
DEPARTMENT OF MATHEMATICS
M.Sc., MATHEMATICS

Semester: II- DCEC –II(C) : Analytical Number Theory

Ins. Hrs./Week: 4 **Course Credit: 4** **Course Code: P26MADE22C**

COURSE OBJECTIVES :

- To understand the basic concepts of arithmetical functions and Dirichlet multiplication.
- To study the average order and asymptotic behavior of arithmetic functions.
- To learn the distribution of prime numbers and related theorems.
- To understand congruences, residue systems, and the Chinese remainder theorem.
- To study finite abelian groups and character theory with applications in number theory.

UNIT–I: Arithmetical Functions and Dirichlet Multiplication (12 Hours)

Introduction – The Mobius function μ(n) – The Euler totient function φ(n) – A relation connecting φ and μ - A product formula for φ(n) – The Dirichlet product of arithmetical functions – Dirichlet inverses and Mobius inversion formula – The Mangoldt function ∧(n) – Multiplicative functions – Multiplicative functions and Dirichlet multiplication.

UNIT – II: Averages of Arithmetical Functions (12 Hours)

Asymptotic equality of functions – Euler's summation formula – some elementary asymptotic formulas –The average order of d(n) - The average order of the divisor functions σ_α(n) -The average order of (n).

UNIT – III: Some Elementary Theorems on the Distribution of Prime Numbers (12 Hours)

Chebyshev's functions Ψ(x) and π(x) – Relations connecting ϑ(x) and π(x) – Some equivalent forms of the prime number theorem – Inequalities for π(n) and p_n – Shapiro's Tauberian theorem – Applications of Shapiro's theorem.

UNIT – IV: Congruences (12 Hours)

Definition and basic properties of congruences – Residue classes and complete residue systems – Linear congruences – Reduced residue systems and the Euler – Fermat theorem – Polynomial congruences modulo p. Lagrange's theorem - Applications of Lagrange's theorem – Simultaneous linear congruences .The Chinese remainder theorem - Applications of the Chinese remainder theorem.

UNIT – V:Finite Abelian Groups and Their Characters (12 Hours)

Definitions – Examples of groups and subgroups – Elementary properties of groups – Construction of subgroups – Characters of finite abelian groups – The Character group – The orthogonality relations for Characters.

UNIT – VI: CURRENT CONTOUR (For Continuous Internal Assessment Only – self study)
Applications of Number Theory, Arithmetic Functions, Prime Numbers, Remainder Theorem, Finite Abelian Groups and their Applications.

Total Lecture Hours- 60

COURSE OUTCOMES:

After the completion of the course, students should be able to,

1. Explain arithmetical functions, Möbius inversion, and Dirichlet multiplication.
2. Analyze asymptotic formulas and average orders of arithmetic functions.
3. Apply theorems related to prime numbers and their distribution.
4. Solve problems involving congruences, residue classes, and Chinese remainder theorem.
5. Describe finite abelian groups and properties of group characters.
6. Apply concepts of number theory in cryptography, algebra, and computational mathematics.

TEXT BOOKS

1. Tom M.Apostol. 2010. Introduction to Analytic Number Theory , Springer .
   - UNIT - I Chapter 2 : Sec. 2.1 to 2.10
   - UNIT -II Chapter 3 : Sec. 3.2 to 3.7
   - UNIT -III Chapter 4 : Sec. 4.2 to 4.7
   - UNIT -IV Chapter 5 : Sec. 5.1 to 5.8
   - UNIT -V Chapter 6 : Sec. 6.1 to 6.7

REFERENCE BOOK(S)

1. K.Chandrasekharan, 2012, Introduction to Analytic Number Theory, Springer Berlin,Heidelberg.
2. Michael Th.Rassias, and Carl Pomerance 2016, Analytic Number Theory, Springer International Publishing AG , New Delhi.
3. Paul T Bateman and Harold G Diamond 2009, Analytic Number Theory ,World Scientific Publishing, Co. Pte. Ltd.,
4. Y.Motohashi 2010, Analytic Number Theory, Cambridge University Press.
5. K. Chandrasekharan, 2012 , Introduction to Analytic Number Theory, published by Springer.

E-RESOURCES

1. https://dl.icdst.org/pdfs/files1/ebc2974176a03ab93756026a97b6d370.pdf
2. https://dl.icdst.org/pdfs/files1/8dc80d73b142455012b6c7d87a2e3a0b.pdf
3. https://people.math.harvard.edu/~elkies/M229.22/intro.pdf
4. www.ucl.ac.uk/~ucahpet/IANTnotes2018.pdf

Course Learning Outcome (for Mapping with POs and PSOs)

	Pos										PSOs		
	1	2	3	4	5	6	7	8	9	10	1	2	3
CLO1	3	2	1	1	1	1	1	1	1	1	2	2	1
CLO2	3	3	2	2	1	1	1	1	1	1	3	2	2
CLO3	3	3	3	2	2	1	1	1	1	1	3	3	2
CLO4	3	3	3	3	2	2	1	1	1	1	3	3	2
CLO5	3	3	2	3	2	2	1	1	1	1	3	3	3
CLO6	3	3	3	3	3	2	2	2	2	2	3	3	3

Strong: 3 Medium: 2 Low: 1

Semester: II-GEC-II (A): Classical Mechanics

Ins. Hrs./Week:4 **Course Credit**:3 **Course Code**: **P26MAGE22A**

COURSE OBJECTIVES:

- To understand the Lagrangian principles
- To apply variational principles and derive equations of motion.
- To analyze systems using Hamiltonian mechanics.
- To study canonical transformations in advanced classical mechanics.
- To explore special relativity and its formulation through Lagrangian and Hamiltonian mechanics.

UNIT -I: Survey of the Elementary principles (12 Hours)

Mechanics of a Particle-Mechanics of a System of Particles-Constraints-D'Alembert's Principle and Lagrange's Equations-Velocity Dependent Potentials and the Dissipation Function.

UNIT –II: Variational Principles and Lagrange's Equations (12 Hours)

Hamilton's Principle-Some Techniques of the Calculus of Variations-Derivation of Lagrange's equations from Hamilton's Principle

UNIT–III: The Hamilton Equations of Motion (12 Hours)

Legendre's Transformations and the Hamiltonian Equations of Motion-Cyclic Coordinates and Conservation theorem-Routh's Procedure.

UNIT-IV: Canonical Transformations (12 Hours)

The Equations of Canonical Transformation-Examples of Canonical Transformations-The Harmonic Oscillator.

UNIT-V: The Classical Mechanics of the Special Theory of Relativity (12 Hours)

Basic Postulates of the Special Theory-Lorentz Transformations-Velocity Addition and Thomas Procession-Vectors and the Metric Tensor.

UNIT-VI: Current Contours (For Continuous Internal Assessment Only – self study)

Legendre's Transformations and the Hamiltonian Equations and motions problems.

Total Lecture Hours – 60

COURSE OUTCOMES:

After the completion of the course, students should be able to,

1. Illustrate the concept of elementary principles of a particle.
2. Understand Hamilton's equation and energy function.

3. Analyze and apply the legendre transformation
4. Ability to determine the newtons law of motion
5. Understand the principle of least action.
6. Implement optimized applications.

TEXT BOOKS

1. Herbert Goldstein, Charles P. Poole and John Safko,2011,Classical Mechanics, Third Edition
   UNIT- I Chapter 1: Sec.1.1 to 1.5
   UNIT -II Chapter 2: Sec.2.1 to 2.3
   UNIT-III Chapter 8: Sec.8.1 to 8.3
   UNIT -IV Chapter 9: Sec 9.1 to 93
   UNIT -V Chapter 7: Sec. 7.1 to 7.4.

REFERENCE BOOK(S)

1. SLKakani, Chemrajani, Shubrakakani , Mechanics Vivabooks Private Limited.
2. Marion, Jerry; Thornton, Stephen (2003). Classical Dynamics of Particles and Systems(5thed.). Brooks Cole.
3. Morin, David (2005).Introduction to Classical Mechanics: Cambridge University Press.
4. Müller-Kirsten, Harald J.W. (2008). Classical Mechanics and Relativity. World Scientific.
5. Taylor, John (2005). Classical Mechanics. University Science Books.

E-RESOURCES

1. https://www.amazon.in/Fundamental-Laws-Mechanics-I-Irodov/dp/9351448185.
2. https:-principle/#:~:text=D'Alembert'sprinciple.
3. https://edu.itp.phys.ethz.ch/hs15/cm/ex11.pdf.
4. https://www.tandfonline.com/doi/abs/10.2753/MIS0742-1222240302
5. https://www.tandfonline.com/doi/abs/10.2753/MIS0742-1222240302

Course Learning Outcome (for Mapping with POs and PSOs)

	POs										PSOs		
	1	2	3	4	5	6	7	8	9	10	1	2	3
CLO1	3	2	1	1	1	1	1	1	1	1	2	2	1
CLO2	3	3	2	2	2	1	1	1	1	1	3	2	2
CLO3	3	3	3	2	2	2	1	1	1	1	3	3	2
CLO4	3	3	3	2	2	2	1	1	1	1	3	3	2
CLO5	3	3	3	3	2	2	1	1	1	1	3	3	3
CLO6	3	3	3	3	3	2	2	2	2	2	3	3	3

Strong: 3 Medium: 2 Low: 1

Semester: II-GEC-II (B): Neural Networks

Ins. Hrs./Week:4 **Course Credit**:3 **Course Code**: P26MAGE22B

COURSE OBJECTIVES:

- To understand the fundamentals of neural networks
- To learn neural network architectures and learning methods
- To develop neural network models for problem-solving
- To apply neural networks to real-world applications
- To evaluate and improve neural network performance

UNIT-I: Evolution of Neural Networks (12Hours)

Mathematical Neuron Model – Network Architectures – Perceptron –Hamming Network- Hopfield Network-Learning Rules.

UNIT-II: Perceptron Learning Rules (12Hours)

Perceptron Architectures and Learning Rule with Proof of Convergence. Supervised Hebbian Learning-Linear Associator.

UNIT-III: Multi-Layer Perceptrons (12Hours)

The Hebb Rule-Pseudo inverse Rule – Variations of Hebbian Learning – Back Propagation – Multilayer Perceptions.

UNIT-IV: Back Propagation (12Hours)

Back propagation Algorithm - Convergence and Generalization – Performances Surfaces and Optimum Points – Taylor series.

UNIT-V: Optimization in Neural Network **(12Hours)**

Directional Derivatives – Minima-Necessary Conditions for Optimality – Quadratic Functions-Performance Optimizations – Steepest Descent

UNIT-VI: Current Contours (For Continuous Internal Assessment Only – self study)

Directional Derivatives – Newton's Method – Conjugate Gradient and Problems.

Total Lecture Hours – 60

COURSE OUTCOMES:

After the completion of the course, students should be able to,

1. Use fundamental concepts of neural networks.
2. Apply neural network learning algorithms.
3. Develop neural network models for classification and prediction.
4. Analyze the performance of neural network systems.
5. Design solutions using neural network techniques.
6. Implement optimized neural network applications.

TEXT BOOK

1. Martin T Hagan., Howard B Demuth., and Mark Beale., (2014). Neural Network Design, Vikas, Publishing House, New Delhi,
2. James A Freeman., and David M Skapura., (2011). Neural Networks Algorithms, Applications and Programming Techniques, Pearson Education.
3. Robert J Schalkoff.,(2000) Artificial Neural Network, McGraw-Hill International Edition.

REFERENCE BOOK(S)

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, (2016). Deep Learning, MIT Press.
2. Martin T. Hagan, Howard B. Demuth, and Mark H. Beale, (2014). Neural Network Design, Vikas Publishing House, New Delhi.
3. Simon Haykin, (2008). Neural Networks and Learning Machines, Pearson Education.
4. Simon Haykin, (1999). Neural Networks: A Comprehensive Foundation, Prentice Hall.
5. Laurene Fausett, (1994). Fundamentals of Neural Networks: Architectures, Algorithms and Applications, Prentice Hall.

E-RESOURCES

1. https://www.coursera.org/specializations/deep-learning
2. https://ocw.mit.edu
3. https://www.tensorflow.org
4. https://pytorch.org
5. https://developers.google.com/machine-learning/crash-course

Course Learning Outcome (for Mapping with POs and PSOs)

	POs										PSOs		
	1	2	3	4	5	6	7	8	9	10	1	2	3
CLO1	3	2	2	1	2	1	1	1	1	1	3	2	2
CLO2	3	3	2	2	3	1	1	1	1	1	3	3	2
CLO3	3	3	3	2	3	2	1	1	1	1	3	3	3
CLO4	3	3	2	3	3	2	1	1	1	2	3	3	3
CLO5	3	3	3	3	3	2	2	1	2	2	3	3	3
CLO6	3	3	3	3	3	2	2	2	2	2	3	3	3

Strong: 3 Medium: 2 Low: 1

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

(AUTONOMOUS)

SUNDARAKKOTTAI, MANNARGUDI- 614016

(For the Candidates admitted in the academic year 2026 – 2027)

DEPARTMENT OF MATHEMATICS

M.Sc., MATHEMATICS

Semester: II-GEC-II (C): Difference Equations

Ins. Hrs./Week:4 **Course Credit**:3 **Course Code**: **P26MAGE22C**

COURSE OBJECTIVES:

- To understand the fundamental concepts of difference calculus and summation techniques.
- To apply methods for solving first-order and linear difference equations.
- To utilize z-transforms in the analysis of difference equations.
- To analyze the stability and behavior of linear dynamical systems.
- To evaluate asymptotic methods for solving mathematical problems and equations.

UNIT – I: Difference Calculus **(12 Hours)**

The Difference operator - Summation – Generating functions and approximate Summation.

UNIT – II: Linear Difference Equations **(12 Hours)**

First order equations - General results for linear equations - Solving linear equations.

UNIT III: Linear Difference **(12 Hours)**

Equations with variable coefficients – The z -transform.

UNIT IV: Stability Theory **(12 Hours)**

Initial value problems for linear systems – Stability of linear systems.

UNIT V: Asymptotic Methods **(12 Hours)**

Introduction – Asymptotic analysis of sums – Linear equations.

UNIT-VI: Current Contours (For Continuous Internal Assessment Only – self study)

First order equations - Equations with variable coefficients and some problems.

Total Lecture Hours – 60

COURSE OUTCOMES:

After the completion of the course, students should be able to,

1. Explain the concepts of difference calculus, summation, and generating functions.
2. Solve first-order and linear difference equations using appropriate methods.
3. Apply z-transform techniques to analyze and solve difference equations.

4. Analyze the stability of linear systems and initial value problems.
5. Evaluate asymptotic methods for approximating sums and solving equations.
6. Demonstrate problem-solving skills in difference equations and related mathematical models.

TEXT BOOK

1. W.G. Kelley and A.C. Peterson (2001), "Difference Equations", 2nd Edition, Academic Press, New York.

   UNIT:I : Chapter 2: Sections 2.1 – 2.3

   UNIT:II : Chapter 3: Sections 3.1 – 3.3

   UNIT:III : Chapter 3: Sections 3.5& 3.7

   UNIT:IV : Chapter 4: Sections 4.1& 4.2

   UNIT:V : Chapter 5: Sections 5.1 – 5.3.

REFERENCE BOOK(S)

1. R. E. Mickens (2015.), "Difference Equations", 3rd Edition, CRC Press.
2. S.N. Elaydi(2008), "An Introduction to Difference Equations", 3rd Edition, Springer, India.
3. R.P. Agarwal (2001),"Difference Equations and Inequalities",2nd Edition, Marcel Dekker, New York.
4. R. E. Mickens(2001), "Difference Equations", 3rd Edition, CRC Press.
5. B.S.Grewal (2000), Higher Engineering Mathematics, 42ndEdition, Khanna Publishers,

E-RESOURCES

1. https://www.sdefrorg/gelll/deep-study
2. https://ocw.nit.edu .in
3. https://wwwpoyreflow.org
4. https://iythr.org
5. https://defrty..google.com/machine-learning/crash-course

Course Learning Outcome (for Mapping with POs and PSOs)

	Pos										PSOs		
	1	2	3	4	5	6	7	8	9	10	1	2	3
CLO1	3	2	2	1	1	1	1	1	1	1	2	2	1
CLO2	3	3	2	2	2	2	1	1	1	1	3	2	2
CLO3	3	3	3	2	3	2	1	1	1	1	3	3	2
CLO4	3	3	3	3	2	2	1	1	1	1	3	3	2
CLO5	3	3	3	3	2	2	1	1	1	2	3	3	3
CLO6	3	3	3	3	3	2	2	2	2	2	3	3	3

Strong: 3 Medium: 2 Low: 1

Semester: II – SEC- II: Mathematical Computations Using Python – Practical - II

Ins. Hrs./Week: 2 **Course Credit**: 2 **Course Code**: P26SEMA22P

COURSE OBJECTIVES:

- To introduce Python programming and computational techniques for solving mathematical problems
- To develop programming skills, computational thinking.
- To get the ability to use Python libraries for mathematical analysis, data handling and scientific computations.
- To familiarize students the Output formatting using Format specifiers to align, sign, width, precision, type, etc.
- To understand to find the mean median, mode, standard deviation etc., of a given data.

UNIT–I **(6 Hours)**

Review of commands – File management and permissions – Using VI editor – Introducing a programming language, syntax, basic tools, simple programmes, etc.

UNIT–II **(6 Hours)**

Basic Tools – First Program file – Handling complex numbers –Functions and loops – Standard math functions; Conditionals; Python key words and function names; Defining Names.

UNIT–III **(6 Hours)**

Lists in Python– Defining and accessing lists – Loops with lists – Range function– for loop with lists for sorting–Built-in sort functions–else class in loops–slicing lists–lists as stacks–using lists as queues–new lists from old.

UNIT–IV **(6 Hours)**

Data types–Numeric Types–Tuples–Accepting tuple inputs–sorting iterables–the lambda function – Sets – Dictionaries – Input and output – Output formatting – Format specifiers – align, sign, width, precision, type – File operations – Functions from Numpy and Scipy libraries.

UNIT–V **(6 Hours)**

Math problems for practice which includes the following: (a) Finding GCD of two or more integers; (b) Primality checking; Finding primes up to a given integer; (c) Plotting curves;(d) Area of a triangle;(e) Angle between vectors;(f)Convert a number in decimal to a given base n. (g) Transpose of a matrix; Product of two matrices;(h) Finding the mean; median; mode; standard deviation etc.,of a given data.

UNIT – VI: Current Contours (For Continuous Internal Assessment Only - Self Study)

Using AI to analyze Data types–Numeric Types–Tuples.

Total Lecture Hours- 30

COURSE OUTCOMES:

After the completion of the course, The students should be able to

1. Understand Linux commands, file management, VI editor operations, and the basic syntax and structure of Python programming.
2. Apply Python programming concepts including functions, loops, conditionals, complex numbers, and standard mathematical operations.
3. Use lists, loops, sorting techniques, slicing, stacks, queues and list manipulations effectively in Python programs.
4. Analyze and implement Python data structures such as tuples, sets, dictionaries, and perform formatted input-output and file operations using NumPy and SciPy libraries.
5. Develop Python programs to solve mathematical and statistical problems including matrix operations, primality testing, plotting graphs, vector operations, and statistical computations.
6. Learn to analyze Data types and Numeric types using AI.

TEXT BOOK(S)

1. Real Python, A Practical introduction to Python,https://static.realpython.com/python-basics-sample-chapters.pdf

REFERENCE BOOK(S)

1. Qingkai Kon et all, Python Programming and Numerical Methods - A Guide for Engineers and Scientists, https://pythonnumericalmethods.berkeley.edu/notebooks/Index.htBrian Heinold,
2. A Practical Introduction to Python Programming https://www.brianheinold.net/python/A_Practical_Introduction_to_Python_Programming_Heinold.pdf

E-RESOURCES

1. http://greenteapress.com/thinkpython2/thinkpython2.pdf
2. http://www.math.ubc.ca/~pwalls/math-python/
3. http://anh.cs.luc.edu/python/hands-on/3.1/handsonHtml/
4. http://www.python.org
5. http://www.scipy.org

Course Learning Outcome (for Mapping with POs and PSOs)

	POs										PSOs		
	1	2	3	4	5	6	7	8	9	10	1	2	3
CLO1	3	1	3	2	2	3	3	1	3	2	2	2	2
CLO2	2	1	3	1	1	3	1	3	1	3	3	2	1
CLO3	3	2	3	1	3	2	1	2	3	2	3	1	1
CLO4	1	2	3	2	3	3	1	2	3	2	3	2	2
CLO5	3	1	2	3	3	3	1	2	3	1	3	2	1
CLO6	2	1	2	1	3	2	2	3	2	1	1	2	3

Strong: 3 Medium: 2 Low: 1

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

(AUTONOMOUS)

SUNDARAKKOTTAI, MANNARGUDI- 614016

(For the Candidates admitted in the academic year 2026 – 2027)

DEPARTMENT OF MATHEMATICS

Semester: II- NMEC - I : Smart Mathematics for Smart Living

Ins. Hrs./Week: 2 **Course Credit**: 2 **Course Code**: **P26NMEMA21**

COURSE OBJECTIVES:

- To develop mathematical thinking and problem-solving skills for everyday life situations.
- To apply arithmetic, algebraic, and geometric concepts to practical problems.
- To enhance financial literacy through the study of percentages, interest, budgeting, and investments.
- To interpret and analyze data for informed decision-making in personal and professional contexts.
- To explore the role of mathematics in technology, artificial intelligence, and smart living practices.

UNIT-I: Mathematics in Daily Life **(6 hours)**

Numbers and logical reasoning in daily activities- Percentages, discounts, profit and loss.

UNIT – II: **Smart Financial Mathematics** **(6 hours)**

Banking concepts and simple interest- Investment planning and savings.

UNIT – III: **Data Handling and Smart Technology** **(6 hours)**

Basic statistics for daily life- Smart technology and numerical analysis.

UNIT – IV: Problem Solving and Logical Thinking **(6 hours)**

Puzzles and reasoning- Mathematical modelling in real life.

UNIT – V: Mathematics for Healthy and Smart Living **(6 hours)**

Mathematics in diet planning- Environmental mathematics.

UNIT –VI: CURRENT CONTOUR (For Continuous Internal Assessment Only- Self Study)

Problems on Percentages, discounts, profit and loss**.**

Total Lecture Hours- 30

COURSE OUTCOMES

After the completion of the course, The students should be able to

1. Apply mathematical concepts to solve day-to-day life problems.
2. Use financial mathematics for budgeting, savings, investments, and personal finance management.
3. Analyze and interpret data using tables, graphs, and basic statistical techniques.
4. Develop logical reasoning and critical thinking skills for effective decision-making.
5. Utilize mathematical tools and digital technologies for smart and sustainable living.
6. Apply mathematical principles in health management, environmental awareness, and resource optimization.

TEXT BOOK(S) :

1. Dr. R.S. Aggarwal, 2024, Quantitative Aptitude for Competitive Examinations, S. Chand Publishing .

UNIT I: Chapter 1 & 3
UNIT II: Chapter 5 & 7
UNIT III: Chapter 11 & 12
UNIT IV: Chapter 13,14 & 16
UNIT V: Chapter 17 & 19

REFERENCE BOOKS:

1. Jordan Ellenberg, 2015 How Not to Be Wrong: The Power of Mathematical Thinking , Penguin Books..
2. John A. Adam, 2025, A Mathematical Nature Walk, Princeton University Press.
3. Brian Bolt, 2024, The Mathematics of Everyday Life, Cambridge University.
4. Lynn Arthur Steen, 2024, Mathematics and Life, Dover Publications.

E_RESOURCES :

1. https://www.ndl.iitkgp.ac.in
2. https://www.ocw.mit.edu
3. https://epgp.inflibnet.ac.in
4. https://www.swayam.gov.in

Course Learning Outcome (for Mapping with POs and PSOs)

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CLO4	3	3	2	3	3	2	1	1	1	2	3	3	3
CLO5	3	3	3	3	3	2	2	1	2	2	3	3	3
CLO6	3	3	3	3	3	2	2	2	2	2	3	3	3

Strong: 3 Medium: 2 Low: 1