

Indira Gandhi University, Meerpur

(A State University Established under Haryana Act. No. 29 of 2013)
(Recognized u/s 12(B) & 2(f) of UGC Act, 1956)

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Scheme of Examination

for

Mathematics Subject

in

Under Graduate Programmes

as per NEP 2020

**Curriculum and Credit Framework for Undergraduate Programmes
(Multiple Entry-Exit, Internships and Choice Based Credit System LOCF)**

With effect from the session 2026-27 (in phased manner)

Department of Mathematics
Indira Gandhi University, Meerpur -122502
Rewari, Haryana, India

Details of Approvals

Council/Board	Date	Remark
Staff Council	04.08.26	
Board of Studies	18.08.26	Online
Faculty Board		
Academic Council		
Year of implementation		2026



Chairperson

VISION AND MISSION OF THE UNIVERSITY

VISION

To be a globally renowned university, recognized for excellence in teaching, innovative research, and welfare of the society, imbibing the spirit of “*Vasudhaiv kutumbkam*”.

MISSION

- To introduce and implement innovation in teaching and learning process matching up the global standards to strengthen academic delivery through curriculum design, teaching pedagogy and usage of ICT.
- To develop a mechanism that attracts talented, qualified and experienced faculty from across the globe for pursuing their academic and research careers at the University.
- To offer academic programs at UG, PG, doctoral, Post-Doctoral levels which are learner-centric, industry focused, and adhere to outcome based international models.
- To create an ambiance that is conducive for undertaking sponsored research, innovation and consultancy services to a wide spectrum of societal and industrial requirements while encouraging interdisciplinary approach of learning, team work, and research.
- To establish state of art centres of excellence in frontier areas of research and design innovation through industry collaboration to innovate and incubate the products and services.
- To establish smart campus and promote e-governance activities in the university for the digitally empowered society and knowledge economy.
- To provide a hygienic, modern, environment friendly and vivacious campus attuned to the urgent needs of Green Technology.
- To consider and implement norms, metrics, standards, procedures and benchmarks for assessing and improving the quality in every aspect of University system and achieve quality certifications by National and International bodies.
- To make society self-reliant by organizing various programmes including literacy, gender sensitization, health awareness, and dissemination of information about livelihood generation.



VISION AND MISSION OF THE DEPARTMENT

Vision

To be an internationally recognized center for research and teaching in Mathematics, encouraging excellence, innovation, integrity, and values for society to produce global leaders for academics and industry by imparting multidisciplinary and contemporary mathematical education.

Mission

- To provide quality education and research in Mathematics through an updated curriculum and effective teaching-learning process.
- To impart innovative skills, teamwork, and ethical practices to the students to meet societal and industrial expectations.
- To provide learner-centric, industry-focused, and outcome-based academic programmes at different levels adhering to the international standards.
- To offer integrated M.Sc. (Mathematics) programme and M.Sc. Programme in Big Data Science.

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Indira Gandhi University, Meerpur

Scheme of Examination for the Mathematics Subject in Under Graduate Programmes

as per NEP 2020 Curriculum and Credit Framework for Undergraduate Programmes

(Multiple Entry-Exit, Internships and Choice Based Credit System LOCF) with effect from the session 2026-27 (in a phased manner)

Semester-1

Course Type	Applicable Scheme	Course Code	Nomenclature of the Course	Credits			Contact hours L: Lecture P: Practical T: Tutorial			Internal Assessment Marks		End term Examination Marks		Total Marks	Examination hours	
				Total	Theory (T)	Practical (P)	L	P	Total	T	P	T	P		T	P
CC-1 MCC-1	Scheme A, B & C	26L4.5-MAT-101	Calculus	4	3	1	3	2	5	25	5	50	20	100	3	2
MCC-2	Scheme C	26L4.5-MAT-102	Advanced Calculus	4	3	1	3	2	5	25	5	50	20	100	3	2
*CC-M1	Scheme A,B & D	26L4.5-MAT-103	Basic Calculus	2	1	1	1	2	3	5	5	20	20	50	2	2
CC-M1	Scheme C	From Available CC-1/MCC-1 of 4 credits as per NEP														
MDC 1	A, B & C	From Available pool of Multidisciplinary Courses from a subject of different discipline as per NEP.														
AEC-1	A, B & C	From Available pool of Ability Enhancement Courses as per NEP														
SEC-1	A, B & C	From Available pool of Skill Enhancement Courses as per NEP														
VAC-1	A, B & C	From Available pool of Value Added Courses as per NEP														

*For students who opt Mathematics as a minor subject

Semester-2

Course Type	Applicable Scheme	Course Code	Nomenclature of the Course	Credits			Contact hours L: Lecture P: Practical T: Tutorial			Internal Assessment Marks		End term Examination Marks		Total Marks	Examination hours	
				Total	Theory (T)	Practical (P)	L	P	Total	T	P	T	P		T	P
CC-2 MCC-3	Scheme A, B & C	26L4.5-MAT-201	Algebra and Number Theory	4	3	1	3	2	5	25	5	50	20	100	3	2
DSEC-1	Scheme C	26L4.5-MAT-202	Programming in C	4	3	1	3	2	5	25	5	50	20	100	3	2
*CC-M2	Scheme A, B & D	26L4.5-MAT-203	Basic Algebra	2	1	1	1	2	3	5	5	20	20	50	2	2
CC-M2	Scheme C	From Available CC-2/MCC-3 of 4 credits as per NEP														
MDC-2	A, B & C	From Available pool of Multidisciplinary Courses from a subject of different discipline as per NEP														
AEC-2	A, B & C	From Available pool of Ability Enhancement Courses as per NEP														
SEC-2	A, B & C	From Available pool of Skill Enhancement Courses as per NEP														
VAC-2	A, B & C	From Available pool of Value Added Courses as per NEP														
Internship	A, B & C	26L4.5-UG-INT-200	Internship of 4 Credits of 4-6 weeks duration after 2 nd Semester (Mandatory in case of exit)													

*For students who opt Mathematics as a minor subject



Semester-3

Course Type	Applicable Scheme	Course Code	Nomenclature of the Course	Credits			Contact hours L: Lecture P: Practical T: Tutorial			Internal Assessment Marks		End term Examination Marks		Total Marks	Examination hours	
				Total	Theory (T)	Practical (P)	L	P	Total	T	P	T	P		T	P
CC-3 MCC-4	Scheme A, B & C	26L5.0-MAT-301	Differential Equations-I	4	3	1	3	2	5	25	5	50	20	100	3	2
MCC-5	Scheme B & C	26L5.0-MAT-302	Groups and Rings	4	4	0	4	0	4	30	-	70	-	100	3	-
MCC-2	Scheme B	26L5.0-MAT-303	Advanced Calculus	4	3	1	3	2	5	25	5	50	20	100	3	2
CC-M3	Scheme A & C	From Available CC-3/MCC-4 of 4 credits as per NEP														
CC-M3(V)	Scheme B	From Available pool of Minor (Vocational) Courses VOC-1														
MDC 3	Scheme A, B & C	From Available pool of Multidisciplinary Courses from a subject of different discipline as per NEP														
AEC-3	Scheme A, B & C	From Available pool of Ability Enhancement Courses as per NEP														
SEC-3	Scheme A, B & C	From Available pool of Skill Enhancement Courses as per NEP														
VAC-3	Scheme C only	From Available pool of Value Added Courses as per NEP														

Semester-4

Course Type	Applicable Scheme	Course Code	Nomenclature of the Course	Credits			Contact hours L: Lecture P: Practical T: Tutorial			Internal Assessment Marks		End term Examination Marks		Total Marks	Examination hours	
				Total	Theory (T)	Practical (P)	L	P	Total	T	P	T	P		T	P
CC-4 MCC-6	Scheme A, B & C	26L5.0-MAT-401	Analytical Geometry & Vector Calculus	4	3	1	3	2	5	25	5	50	20	100	3	2
MCC-7	Scheme B & C	265.0-MAT-402	Linear Algebra	4	3	1	3	2	5	25	5	50	20	100	3	2
MCC-8	Scheme B & C	26L5.0-MAT-403	Differential Equations-II	4	3	1	3	2	5	25	5	50	20	100	3	2
DSE-1	Scheme B & C	26L5.0-MAT-404	Probability Theory & Statistics	4	3	1	3	2	5	25	5	50	20	100	3	2
		Or														
		26L5.0-MAT-405	Special Functions	4	3	1	3	2	5	25	5	50	20	100	3	2
CC-M4(V)	B	From Available pool of Minor (Vocational) Courses VOC-2														
	A & C	From Available pool of Minor (Vocational) Courses VOC-1														
AEC-4	A, B & C	From Available pool of Ability Enhancement Courses as per NEP														
VAC-3	A & B	From Available pool of Value Added Courses as per NEP														
VAC-4	C	From Available pool of Value Added Courses as per NEP														
Internship	A,B& C	26L5.0-UG-INT-400	Internship of 4 Credits of 4-6 weeks duration after 4th Semester (Mandatory in case of exit if not done after 2 nd Semester)													

Semester-5

Course Type	Applicable Scheme	Course Code	Nomenclature of the Course	Credits			Contact hours L: Lecture P: Practical T: Tutorial			Internal Assessment Marks		End term Examination Marks		Total Marks	Examination hours	
				Total	Theory (T)	Practical (P)	L	P	Total	T	P	T	P		T	P
CC-5 MCC-9	Scheme A, B & C	26L5.5-MAT-501	Sequences and Series	4	3	1	3	2	5	25	5	50	20	100	3	2
MCC-10	Scheme B & C	26L5.5-MAT-502	Mechanics-I	4	3	1	3	2	5	25	5	50	20	100	3	2
DSE-2	Scheme B & C	26L5.5-MAT-503	Linear Programming	4	3	1	3	2	5	25	5	50	20	100	3	2
		Or														
		26L5.5-MAT-504	Computer Programming	4	3	1	3	2	5	25	5	50	20	100	3	2
DSE-3	Scheme B & C	26L5.5-MAT-505	Number Theory and Cryptography	4	3	1	3	2	5	25	5	50	20	100	3	2
		Or														
		26L5.5-MAT-506	Integral Transforms and Fourier Analysis	4	3	1	3	2	5	25	5	50	20	100	3	2
CC-M5(V)	A & C	From Available pool of Minor (Vocational) Courses VOC-2														
Internship	A, B& C		Internship of 4 Credits of 4-6 weeks duration (if not done after 2 nd Semester or 4 th Semester)													



Semester-6

Course Type	Applicable Scheme	Course Code	Nomenclature of the Course	Credits			Contact hours L: Lecture P: Practical T: Tutorial			Internal Assessment Marks		End term Examination Marks		Total Marks	Examination hours	
				Total	Theory (T)	Practical (P)	L	P	Total	T	P	T	P		T	P
CC-6 MCC-11	Scheme A, B & C	26L5.5-MAT-601	Numerical Analysis	4	3	1	3	2	5	25	05	50	20	100	3	2
MCC-12	Scheme B & C	26L5.5-MAT-602	Real Analysis	4	3	1	3	2	5	25	05	50	20	100	3	2
DSE-4	Scheme B & C	26L5.5-MAT-603	Mechanics-II	4	3	1	3	2	5	25	05	50	20	100	3	2
		Or														
		26L5.5-MAT-604	Classical Mechanics	4	4	0	4	0	4	30	-	70	-	100	3	-
DSE-5	Scheme B & C	26L5.5-MAT-605	Discrete Mathematics	4	3	1	3	2	5	25	05	50	20	100	3	2
		Or														
		26L5.5-MAT-606	Mathematical Modelling	4	3	1	3	2	5	25	05	50	20	100	3	2
CC-M6	A	From Available CC-6/MCC-11 of 4 credits as per NEP														
CC-M5(V)	B	From Available pool of Minor (Vocational) Courses VOC-3														
CC-M6(V)	C															
CC-M7(V)	A															
SEC-4	C	From Available pool of Skill Enhancement Courses as per NEP														

Semester-7 (Honours/Honours with Research)

Course Type	Applicable Scheme	Course Code	Nomenclature of the Course	Credits			Contact hours L: Lecture P: Practical T: Tutorial			Internal Assessment Marks		End term Examination Marks		Total Marks	Examination hours	
				Total	Theory (T)	Practical (P)	L	P	Total	T	P	T	P		T	P
CC-H1	Scheme B & C	26L6.0-MAT-701	Mathematical Analysis	4	4	0	4	0	4	30	-	70	-	100	3	-
CC-H2	Scheme B & C	26L6.0-MAT-702	Complex Analysis	4	4	0	4	0	4	30	-	70	-	100	3	-
CC-H3	Scheme B & C	26L6.0-MAT-703	Theory of Ordinary Differential Equations	4	4	0	4	0	4	30	-	70	-	100	3	-
DSE-6	Scheme B & C	26L6.0-MAT-704	Mechanics of Solids	4	4	0	4	0	4	30	-	70	-	100	3	-
		Or														
		26L6.0-MAT-705	Differential Geometry	4	4	0	4	0	4	30	-	70	-	100	3	-
PC-H1	Scheme B & C	26L6.0-MAT-706	Programming Lab-1	4	2	2	2	4	6	15	15	35	35	100	2	2
CC-HM1	B & C	From Available Core Courses in Minor Subject of 4 credits as per NEP														

Semester-8 (Honours)

Course Type	Applicable Scheme	Course Code	Nomenclature of the Course	Credits			Contact hours L: Lecture P: Practical T: Tutorial			Internal Assessment Marks		End term Examination Marks		Total Marks	Examination hours	
				Total	Theory (T)	Practical (P)	L	P	Total	T	P	T	P		T	P
CC-H4	Scheme B & C	26L6.0-MAT-801	Abstract Algebra	4	4	0	4	0	4	30	-	70	-	100	3	-
CC-H5	Scheme B & C	26L6.0-MAT-802	Topology	4	4	0	4	0	4	30	-	70	-	100	3	-
CC-H6	Scheme B & C	26L6.0-MAT-803	Measure and Integration	4	4	0	4	0	4	30	-	70	-	100	3	-
DSE-7	Scheme B & C	26L6.0-MAT-804	Field Theory	4	4	0	4	0	4	30	-	70	-	100	3	-
		Or														
		26L6.0-MAT-805	Fluid Mechanics	4	4	0	4	0	4	30	-	70	-	100	3	-
PC-H2	Scheme B & C	26L6.0-MAT-806	Programming Lab-2	4	2	2	2	4	6	15	15	35	35	100	2	2
CC-HM2	B & C	From Available Core Courses in Minor Subject of 4 credits as per NEP														

Semester-8 (Honours with Research)

Course Type	Applicable Scheme	Course Code	Nomenclature of the Course	Credits			Contact hours L: Lecture P: Practical T: Tutorial			Internal Assessment Marks		End term Examination Marks		Total Marks	Examination hours	
				Total	Theory (T)	Tutorial (T)	L	T	Total	T	P	T	P		T	P
CC-H4	Scheme B & C	26L6.0-MAT-801	Abstract Algebra	4	4	0	4	0	4	30	-	70	-	100	3	-
CC-H5	Scheme B & C	26L6.0-MAT-802	Topology	4	4	0	4	0	4	30	-	70	-	100	3	-
Research	Scheme B & C	26L6.0-MAT-807	Dissertation	12								300		300		
CC-HM2	B & C	From Available Core Courses in Minor Subject of 4 credits as per NEP														



Scheme of MDC, VAC, SEC and VOC courses

Semester	Course Type	Applicable Scheme	Course Code	Nomenclature of the Course	Credits			Contact hours L: Lecture P: Practical			Internal Assessment Marks		End term Examination Marks		Total Marks	Exam. hours	
					Total	Theory (T)	Practical (P)	L	P	Total	T	P	T	P		T	P
1	MDC-1	Scheme A, B, C & D	26L4.5-MDC-MAT-101	Introductory Mathematics	3	2	1	2	2	4	15	5	35	20	75	2	2
2	MDC-2	Scheme A, B, C & D	26L4.5-MDC-MAT-201	Mathematics for Commerce & Social Sciences	3	2	1	2	2	4	15	5	35	20	75	2	2
3	MDC-3	Scheme A, B, C & D	26L5.0-MDC-MAT-301	Mathematics for all	3	2	1	2	2	4	15	5	35	20	75	2	2
3	VAC-3	Scheme C only	26L5.0-VAC-MAT-301	Mathematics in India: From Vedic Period to Modern Times	2	2	0	2	0	2	15	0	35	-	50	2	-
4	VAC-3	Scheme A, B & D	26L5.0-VAC-MAT-401	Mathematics in Everyday Life	2	2	0	2	0	2	15	0	35	-	50	2	-
4	VAC-4	Scheme C only	26L5.0-VAC-MAT-401	Mathematics in Everyday Life	2	2	0	2	0	2	15	0	35	-	50	2	-



Sem ester	Course Type	Applicable Scheme	Course Code	Nomenclature of the Course	Credits			Contact hours L: Lecture P: Practical			Internal Assessment Marks		End term Examination Marks		Total Marks	Exam. hours	
					Total	Theory (T)	Practical (P)	L	P	Total	T	P	T	P			
2	SEC-2	Scheme A, B, C & D	26L4.5- SEC-MAT- 201	Calculation Skills with Vedic Mathematics-I	3	2	1	2	2	4	15	5	35	20	75	2	2
2	SEC-2	Scheme A, B, C & D	26L4.5- SEC-MAT- 202	Numerical Ability Enhancement Skills	3	2	1	2	2	4	15	5	35	20	75	2	2
3	SEC-3	Scheme A, B, C & D	26L5.0- SEC-MAT- 301	Calculation Skills with Vedic Mathematics-II	3	2	1	2	2	4	15	5	35	20	75	2	2
3	SEC-3	Scheme A, B, C & D	26L5.0- SEC-MAT- 302	Learning MATLAB Skills	3	2	1	2	2	4	15	5	35	20	75	2	2
3	SEC-3	Scheme A, B, C & D	26L5.0- SEC-MAT- 303	Quantitative Aptitude	3	2	1	2	2	4	15	5	35	20	75	2	2
6	SEC-4	Scheme C only	26L5.5- SEC-MAT- 601	Basic Mathematical Techniques	2	1	1	1	2	3	5	5	20	20	50	2	2

CC-1/MCC-1

Part A – Introduction

Name of the Subject	Mathematics		
Semester	I		
Nature of Course/Course Composition	Theory + Practical		
Name of the Course	Calculus		
Course Code	26L4.5-MAT-101		
Course Type	CC/MCC		
Course Level	100-199		
Pre-requisite for the course	Mathematics as a subject at 4.0 Level (Class-XII)		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁ :	Gain knowledge of the concepts and theory of limit, continuity and differentiability of functions. Attain skills of calculating the limit of functions and examining the continuity and differentiability of different types of functions, and perform successive differentiation of functions. To apply the procedural knowledge to obtain the series expansions of functions which find multidisciplinary applications.	
	CLO ₂ :	Understand concepts of asymptotes and curvature, the geometrical meaning of these terms and to have procedural knowledge to solve related problems.	
	CLO ₃ :	Determine singular points of a curve and classify them. Understand the concept of rectification of curves and derive the reduction formulae. Have theoretical knowledge and practical skills to evaluate the area bounded by the curves, and volume and surface area of solids formed by revolution of curves.	
	CLO ₄ :	Attain cognitive and technical skills required for solving different problems of calculus associated with tracing of curves, determination of curvature, and rectification of curves, volume and surface area of solids of revolution. Have technical and practical skills of solving calculus problems related to differentiation and integration of functions by using MAXIMA/Scilab software.	
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	5	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	

Part B- Contents of the Course

Instructions for Theory Paper-Setter

The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.

Instructions for Practical Examiner

Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes. The maximum marks for the write-up and execution of the practical will be 10.

	Topics	CLO's Attempt	Contact Hours
Unit-I	ϵ - δ definition of limit and continuity of a real valued function, Basic properties of limits, Types of discontinuities, Differentiability of functions, Application of L'Hospital rule to indeterminate forms, Successive differentiation, Leibnitz theorem, Taylor's and Maclaurin's series expansion with different forms of remainder.	CLO_1	15
Unit-II	Asymptotes: Horizontal, vertical and oblique asymptotes for algebraic curves, Asymptotes for polar curves, Intersection of a curve and its asymptotes, Curvature and radius of curvature of curves (cartesian, parametric, polar & intrinsic forms), Newton's method, Centre of curvature and circle of curvature.	CLO_2	15
Unit-III	Multiple points, Node, Cusp, Conjugate point, Tests for concavity and convexity, Points of inflexion, Tracing of curves, Reduction formulae. Rectification, intrinsic equation of a curve, Quadrature, Area bounded by closed curves, Volumes and surfaces of solids of revolution.	CLO_3	15
Practical	The practical component of the course has two parts, Problem Solving and Practical's using MAXIMA/SCILAB software. The examiner will set 4 questions at the time of practical examination asking two questions from the part (A) and two questions from the part (B) by taking course learning outcomes (CLO) into consideration. The examinee will be required to solve one problem from the part (A) and to execute one problem successfully from the part (B). Equal weightage will be given to both the parts. The evaluation will be done on the basis of practical record, viva-voce, write up and execution of the program. (A) Problem Solving- Questions related to the following problems will be solved and their record will be maintained in the Practical Notebook: 1. Problems of curve tracing when equation is given in Cartesian coordinates. 2. Problems of curve tracing when equation is given in Parametric form. 3. Problems of curve tracing when equation is given in Polar coordinates. 4. Problem of determination of length of a curve expressed in Cartesian coordinates.	CLO_4	30

	5. Problem of determination of length of a curve expressed in Polar coordinates. 6. Problem of determination of radius of curvature expressed in Cartesian coordinates. 7. Problem of determination of radius of curvature expressed in Polar coordinates. 8. Problem of determination of radius of curvature expressed in Parametric form. 9. Problem of determination of volumes and surfaces of solids of revolution for Cartesian curve. 10. Problem of determination of volumes and surfaces of solids of revolution for Parametric curve. 11. Problem of determination of volumes and surfaces of solids of revolution for Polar curve.				
	(B)The following practicals will be done using MAXIMA/SCILAB software and their record will be maintained in the practical note book: 1. Learn to use basic operators and functions in MAXIMA/SCILAB software. 2. Simplify algebraic expressions and expressions containing radicals, logarithms, exponentials and trigonometric functions. 3. Expand algebraic, rational, trigonometric and logarithmic expressions. 4. Find derivatives of algebraic, trigonometric, exponential and logarithmic functions. 5. Find derivatives of functions involving above mentioned functions. 6. Problems of successive differentiation. 7. Find indefinite integrals of different functions. 8. Find definite integrals of different functions. 9. To plot curves involving Cartesian, parametric and polar forms. 10. To demonstrate singular points.				
	Contact Hours				75
	Evaluation Methods				
Internal Assessment	TH-25	PR-05	End Term Examination: 70	TH-50	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	05	Written Examination	50	NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Anton, H., Bivens, I., & Davis, S. (2021). *Calculus* (12th ed.). John Wiley & Sons.
2. Klambauer, G. (1986). *Aspects of calculus* (4th ed.). Springer.
3. Krawcewicz, W., & Rai, B. (2003). *Calculus with Maple labs*. Alpha Science International Ltd.
4. Prasad, G. (2016). *Differential calculus* (19th ed.). Pothishala Pvt. Ltd.
5. Thomas, G. B., Jr., Hass, J., Heil, C., & Weir, M. D. (2018). *Thomas' calculus* (14th ed.). Pearson Education.
6. Strauss, M. J., Bradley, G. L., & Smith, K. J. (2002). *Calculus* (3rd ed.). Dorling Kindersley (India) Pvt. Ltd.

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	75
Skill Enhancement	75
Communication Development	45



MCC-2

Part A – Introduction

Name of the Subject	Mathematics		
Semester	I(For Scheme C) /III(For Scheme B)		
Nature of Course/Course Composition	Theory + Practical		
Name of the Course	Advanced Calculus		
Course Code	26L4.5-MAT-102 (Sem. I)/26L5.0-MAT-303 (Sem. III)		
Course Type	MCC		
Course Level	100-199		
Pre-requisite for the course	Mathematics as a subject at 4.0 Level (Class-XII)		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁ :	Have theoretical knowledge about various mean value theorems and their geometrical interpretations. Learn conceptual variations while advancing from dealing with functions of one variable to several variables in calculus and discuss limit and continuity of such functions.	
	CLO ₂ :	Have deeper understanding of Euler's theorem and Taylor's theorem and practice to attain skill in multidisciplinary contexts. Know about differentiability of real valued functions of two variables and understand Young's, theorem Schwarz's theorem and implicit function theorem.	
	CLO ₃ :	Determine maxima and minima of functions of two variables, learn Lagrange's method of undetermined multipliers and exploit this procedural knowledge for various realistic optimization problems. Understand and acquire theoretical knowledge about Jacobians, Beta and Gamma functions, with acquisition of skill to analyse various methods of integration and evaluate double and triple integrals which find application in the determination of areas and volumes.	
	CLO ₄ :	Attain cognitive skills required for solving problems associated with continuity, differentiability of functions of several variables and applications of double and triple integrals. Have technical and practical skills of solving problems related to plotting of curves in two and three dimensions and evaluating double and triple integrals by using built in functions of MAXIMA/SCILAB software.	
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	5	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	

Part B- Contents of the Course

Instructions for Theory Paper-Setter

The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.

Instructions for Practical Examiner

Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes. The maximum marks for the write-up and execution of the practical will be 10.

	Topics	CLO's Attempt	Contact Hours
Unit-I	Continuous functions, Sequential criterion for continuity, Properties of continuous functions, Uniform continuity, Chain rule of differentiability, Mean value theorems: Rolle's Theorem, Lagrange's mean value theorem and their geometrical interpretations, Cauchy mean value theorem. Taylor's theorem with various forms of remainders. Limit and continuity of real valued functions of two variables, Partial differentiation. Total Differentials;	<i>CLO₁</i>	15
Unit-II	Composite functions & implicit functions. Change of variables. Homogenous functions & Euler's theorem on homogeneous functions. Taylor's theorem for functions of two variables. Differentiability of real valued functions of two variables. Young's theorem, Schwarz's theorem, Implicit function theorem.	<i>CLO₂</i>	15
Unit-III	Extrema of functions of two and more variables: Maxima, minima and saddle points. Lagrange's method of undetermined multipliers. Jacobians. Beta and Gamma functions, Relation between Beta and Gamma functions, Legendre's duplication formula. Double integration over rectangular and non rectangular regions, Double integrals in polar co-ordinates. Change of order of integration. Volume by triple integrals, Triple integration in cylindrical and spherical co-ordinates. Dirichlet integrals, Liouville's extension of Dirichlet's integral.	<i>CLO₃</i>	15
Practical	This course has two components, Problem Solving and Practical's using MAXIMA/SCILAB software. The examiner will set 4 questions at the time of practical examination asking two questions from the part (A) and two questions from the part (B) by taking course learning outcomes (COs) into consideration. The examinee will be required to solve one problem from the part (A) and to execute one problem successfully from the part (B). Equal weightage will be given to both the parts. The evaluation will be done on the basis of practical record, viva-voce, write up and execution of the program.	<i>CLO₄</i>	30

	(A) Problem Solving- Questions related to the following problems will be solved and record of those will be maintained in the Practical Notebook: 1. Problems to check continuity of functions of several variables. 2. Problems of checking differentiability of functions of several variables. 3. Problems of finding maxima /minima of functions of two variables. 4. Problems of determination of surface area through application of double integrals in Cartesian and Polar coordinates. 5. Problems of determination of volume using triple integrals. 6. Problem to demonstrate uniform continuity of a function of single variable. 7. Problem to demonstrate the existence of a continuous function which is not uniformly continuous. 8. Problem to demonstrate that for a function f of two variables f_{xy} need not be equal to f_{yx}. (B)The following practicals will be done using MAXIMA/SCILAB software and record of those will be maintained in the practical note book: 1. To find partial derivatives of a function. 2. To find total differential of a function of several variables. 3. To plot a curve for a function of two variables. 4. To plot a curve for a function of three variables. 5. To solve practical problems using method of Lagranges multipliers. 6. To evaluate double integrals. 7. To evaluate triple integrals. 8. To demonstrate Young's theorem.		
	Contact Hours	75	
Evaluation Methods			
Internal Assessment	TH-25	PR-05	End Term Examination: 70 TH-50 PR-20
Class Participation:	5	0	Lab record NA 05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce NA 05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	05	Written Examination 50 NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical NA 10

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Anton, H., Bivens, I., & Davis, S. (2021). *Calculus* (12th ed.). Wiley India.
2. Klambauer, G. (1986). *Aspects of calculus*. Springer-Verlag.
3. Krawcewicz, W., & Rai, B. (2003). *Calculus with Maple labs*. Narosa Publishing House.
4. Prasad, G. (2016). *Differential calculus* (19th ed.). Pothishala Pvt. Ltd.
5. Thomas, G. B., Jr., Hass, J., Heil, C., & Weir, M. D. (2018). *Thomas' calculus* (14th ed.). Pearson Education.
6. Strauss, M. J., Bradley, G. L., & Smith, K. J. (2011). *Calculus* (3rd ed.). Pearson Education.
7. Marsden, J. E., Tromba, A. J., & Weinstein, A. (2009). *Basic multivariable calculus*. Springer India Pvt. Ltd.
8. Stewart, J. (2012). *Multivariable calculus* (7th ed.). Brooks/Cole, Cengage Learning.
9. Spiegel, M. R., & Wrede, R. (2011). *Schaum's outline of advanced calculus* (3rd ed.). McGraw-Hill Education.

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	75
Skill Enhancement	75
Communication Development	45



CC-M1

Part A – Introduction			
Name of the Subject	Mathematics		
Semester	I		
Nature of Course/Course Composition	Theory + Practical		
Name of the Course	Basic Calculus		
Course Code	26L4.5-MAT-103		
Course Type	CC-M		
Course Level	100-199		
Pre-requisite for the course	Mathematics as a subject at 4.0 Level (Class-XII)		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁ :	Gain knowledge of the concepts of limit, continuity and differentiability of functions. Apply Taylor and Maclaurin's series expansion in multidisciplinary applications within the chosen field of learning. Understand and acquire procedural skills required for accomplishing assigned tasks of determining asymptotes and analyze them geometrically. Comprehend the process of deriving reduction formulae and use this skill to solve typical integrals easily and quickly.	
	CLO ₂ :	Attain cognitive and theoretical skills to find successive derivatives of a function, higher derivative of the product of two functions using Leibnitz's rule and apply this skill for expansion of functions. Have technical and practical skills of solving problems related to differentiation and integration of functions by using built in functions of MAXIMA/SCILAB software.	
	Theory	Practical	Total
Credits	1	1	2
Teaching hours per week	1	2	3
Internal Assessment Marks	05	05	10
End Term Exam Marks	20	20	40
Max. Marks	25	25	50
Examination Duration (in Hours)	02	02	
Part B- Contents of the Course			
<u>Instructions for Theory Paper-Setter</u> The paper setter shall prepare 4 questions from unit 01 with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 6 short answer type questions carrying one mark each (total 06 marks). The remaining questions will be carrying 07 marks each. Examinees will be required to attempt three questions: the compulsory question no. 1 and 02 questions from other 03 questions. <u>Instructions for Practical Examiner</u> Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes. The maximum marks for the write-up and execution of the practical will be 5.			

Topics		CLO's Attempt	Contact Hours
Unit-I	Limit and continuity of a real valued function, basic properties of limits, types of discontinuities, Differentiability of functions. Application of L'Hospital rule to Indeterminate forms. Successive differentiation, Leibnitz theorem (statement only), Taylor's and Maclaurin's series expansions with different forms of remainder. Asymptotes: Horizontal, vertical and oblique asymptotes for algebraic curves, Asymptotes for polar curves, Intersection of a curve and its asymptotes. Reduction formulae.	CLO ₁	15
Practical	This course has two components, Problem Solving and Practical's using MAXIMA/SCILAB software. The examiner will set 4 questions at the time of practical examination asking two questions from the part (A) and two questions from the part (B) by taking course learning outcomes (CLOs) into consideration. The examinee will be required to solve one problem from the part (A) and to execute one problem successfully from the part (B). Equal weightage will be given to both the parts. The evaluation will be done on the basis of practical record, viva-voce, write up and execution of the program. (A) Problem Solving- Questions related to the following problems will be solved and their record will be maintained in the Practical Notebook: 1. Practical problems to check the limit and continuity of a function. 2. Practical problems to check the differentiability of a function. 3. Practical problems of finding derivatives of algebraic, trigonometric, exponential and logarithmic functions. 4. Practical problems of finding n^{th} derivatives using Leibnitz theorem. 5. Practical problems related to application of Taylor's theorem. 6. Practical problems to find the asymptotes of a given algebraic curve. 7. Practical application of L'Hospital rule to evaluate indeterminate forms. 8. Practical problems to find the asymptotes of a polar curve. 9. Practical problems to find Maclaurin's series expansion of various functions. 10. Practical problems based on reduction formulae	CLO ₂	30

	(B)The following practicals will be done using MAXIMA/SCILAB software and record of those will be maintained in the practical note book: 1. Introduce basic operators and functions in MAXIMA/SCILAB software. 2. Simplify algebraic expressions and expressions containing radicals, logarithms, exponentials and trigonometric functions. 3. Expand algebraic, rational, trigonometric and logarithmic expressions. 4. Find derivatives of algebraic, trigonometric, exponential and logarithmic functions. 5. Find derivatives of functions involving above mentioned functions. 6. Find indefinite integrals of different functions. 7. Find definite integrals of different functions.				
	Contact Hours			45	
Suggested Evaluation Methods					
Internal Assessment	TH-5	PR-5	End Term Examination: 40	TH-20	PR-20
Class Participation:	0	0	Lab record	NA	5
Seminar/presentation/assignment/quiz/class test etc.:	0	NA	Viva-Voce	NA	5
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	20	NA
Mid-Term Exam:	5	NA	Write-up and execution of the practical	NA	10
Part C-Learning Resources					
Recommended Books/e-resources/LMS:					
1. Anton, H., Bivens, I., & Davis, S. (2021). <i>Calculus</i> (12th ed.). Wiley India. 2. Klambauer, G. (1986). <i>Aspects of calculus</i> . Springer-Verlag. 3. Krawcewicz, W., & Rai, B. (2003). <i>Calculus with Maple labs</i> . Narosa Publishing House. 4. Prasad, G. (2016). <i>Differential calculus</i> (19th ed.). Pothishala Pvt. Ltd. 5. Thomas, G. B., Jr., Hass, J., Heil, C., & Weir, M. D. (2018). <i>Thomas' calculus</i> (14th ed.). Pearson Education. 6. Strauss, M. J., Bradley, G. L., & Smith, K. J. (2011). <i>Calculus</i> (3rd ed.). Pearson Education. 7. Marsden, J. E., Tromba, A. J., & Weinstein, A. (2009). <i>Basic multivariable calculus</i> . Springer India Pvt. Ltd. 8. Stewart, J. (2012). <i>Multivariable calculus</i> (7th ed.). Brooks/Cole, Cengage Learning. 9. Spiegel, M. R., & Wrede, R. (2011). <i>Schaum's outline of advanced calculus</i> (3rd ed.). McGraw-Hill Education.					

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	45
Skill Enhancement	45
Communication Development	15



CC-2/MCC-3

Part A – Introduction

Name of the Subject	Mathematics	
Semester	II	
Nature of Course/Course Composition	Theory + Practical	
Name of the Course	Algebra and Number Theory	
Course Code	26L4.5-MAT-201	
Course Type	CC/MCC	
Course Level	100-199	
Pre-requisite for the course	Mathematics as a subject at 4.0 Level (Class-XII)	
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	<i>CLO₁:</i>	Gain knowledge of the type of matrices, Linear dependence and independence of rows and columns of a matrix. Have knowledge of procedure and cognitive skills used in calculating rank of a matrix, eigen values, characteristic equation, minimal polynomial of a matrix and technical skills used in solving problems based on Cayley- Hamilton theorem.
	<i>CLO₂:</i>	Have knowledge of the concepts used in solving problems based on polynomial equation. Analyze and solve polynomial equations by applying Descartes' Rule of Signs and appropriate algebraic methods for cubic and biquadratic equations, demonstrating conceptual understanding, procedural proficiency, and analytical reasoning.
	<i>CLO₃:</i>	Explain the fundamental concepts of Number Theory and apply the principles of linear congruences, linear Diophantine equations, Fermat's Theorem, Euler's Theorem, Wilson's Theorem and its converse, and the Chinese Remainder Theorem to analyze and solve mathematical problems effectively.
	<i>CLO₄:</i>	Attain cognitive and technical skills required to formulate and solve practical problems involving rank of a matrix, inverse of a matrix, Cardon's method, Ferrari's method, Descarte's method, Cayley-Hamilton theorem, Euler's theorem and Chinese Remainder theorem.

	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	5	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	

Part B- Contents of the Course

Instructions for Theory Paper-Setter

The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.

Instructions for Practical Examiner

Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes. The maximum marks for the write-up and execution of the practical will be 10.

	Topics	CLO's Attempt	Contact Hours
Unit-I	Symmetric, Skew symmetric, Hermitian and skew Hermitian matrices, Elementary operations on matrices, Rank of a matrix, Inverse of a matrix, Linear dependence and independence of rows and columns of matrix, Row rank and column rank of a matrix, Eigen values, Eigen vectors and characteristic equation of a matrix, Minimal polynomial of a matrix, Cayley-Hamilton theorem and its use in finding the inverse of a matrix, Unitary and orthogonal matrices.	CLO ₁	15
Unit-II	Relations between the roots and coefficients of general polynomial equation in one variable, Solutions of polynomial equations having conditions on roots, Common roots and multiple roots, Transformation of equations, Nature of the roots of an equation, Descarte's rule of signs. Solutions of cubic equations (Cardon's method), Biquadratic equations and their solutions.	CLO ₂	15
Unit-III	Divisibility, Greatest common divisor (gcd), Least common multiple (lcm), Prime numbers, Fundamental theorem of arithmetic. Linear congruences, Fermat's theorem, Euler's theorem, Wilson's theorem and its converse, Chinese Remainder theorem, Linear Diophantine equations in two variables.	CLO ₃	15
Practical	The practical component of the course has two parts, Problem Solving and Practical's using MAXIMA/SCILAB software. The examiner will set 4 questions at the time of practical examination asking two questions from the part (A) and two questions from the part (B) by taking course learning outcomes (CLOs) into consideration.	CLO ₄	30

	The examinee will be required to solve one problem from the part (A) and to execute one problem successfully from the part (B). Equal weightage will be given to both the parts. The evaluation will be done on the basis of practical record, viva-voce, write up and execution of the program. A) Problem Solving: Questions related to the following problems will be worked out and record of those will be maintained in the Practical Notebook: 1. Problems to find the row rank and column rank of a matrix. 2. Problems to find the eigen values and eigen vectors of a matrix. 3. Problems to find the minimal polynomial of a matrix. 4. Problems of finding inverse of a matrix using Cayley- Hamilton theorem. 5. Problems of solving cubic equations by Cardon's method. 6. Problems of solving biquadratic equations by Descarte's method. 7. Problems of solving biquadratic equations by Ferrari's method. 8. Problems to find gcd and lcm of two integers. 9. Problems to find solution of linear congruence using Euler's theorem. 10. Problems to find common solution of congruences using Chinese remainder theorem. B) The following practicals will be done using MAXIMA/SCILAB Software and their record will be maintained in the practical note Book: 1. To find roots of algebraic equations using MAXIMA/SCILAB. 2. To find multiple roots of algebraic equations using MAXIMA/SCILAB 3. To find the value of a determinant using MAXIMA/SCILAB. 4. To compute inverse of a square matrix using MAXIMA/SCILAB.		
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	5. To find Eigen values of a square matrix using MAXIMA/SCILAB.				
	6. To find Eigen vectors of a square matrix using MAXIMA/SCILAB.				
	7. To solve system of linear equations using MAXIMA/SCILAB.				
	8. Problems to find gcd and lcm of two or more integers using MAXIMA/SCILAB.				
	9. Problems of solving biquadratic equations by Ferrari's method using MAXIMA/SCILAB.				
	Contact Hours		75		
Evaluation Methods					
Internal Assessment	TH-25	PR-05	End Term Examination: 70	TH-50	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/ assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva- voce/Lab records etc.:	NA	05	Written Examination	50	NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10
Part C-Learning Resources					
Recommended Books/e-resources/LMS:					
1. Friedberg, S. H., Insel, A. J., & Spence, L. E. (2022). <i>Linear algebra</i> (5th ed.). Pearson.					
2. Lipschutz, S., & Lipson, M. L. (2013). <i>Linear algebra</i> (4th ed.). McGraw-Hill Education.					
3. Dutta, K. B. (2004). <i>Matrix and linear algebra</i> . Prentice Hall of India Pvt. Ltd.					
4. Sahai, V., & Bist, V. (2013). <i>Linear algebra</i> (2nd ed.). Narosa Publishing House.					
5. Niven, I. (1991). <i>An introduction to the theory of numbers</i> (5th ed.). John Wiley & Sons.					
6. Hall, H. S., & Knight, S. R. (2023). <i>Higher algebra</i> (7th ed.). Arihant Publications.					
7. Dickson, L. E. (2009). <i>First course in the theory of equations</i> . Project Gutenberg.					
https://www.gutenberg.org/ebooks/29785					

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	75
Skill Enhancement	75
Communication Development	45

DSEC-1

Part A – Introduction			
Name of the Subject	Mathematics		
Semester	II		
Nature of Course/Course Composition	Theory + Practical		
Name of the Course	Programming in C		
Course Code	26L4.5-MAT-202		
Course Type	DSEC		
Course Level	100-199		
Pre-requisite for the course	Mathematics as a subject at 4.0 Level (Class-XII)		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁ :	Gain the knowledge and understanding of the concepts of C programming language. Learn elements of C, data types, constants and variables, operations and operators, statements and expressions. Attain the skills to write C programs.	
	CLO ₂ :	Apply the concepts of input/output functions, decision-making statements, loops, and arrays to design, develop, and debug C programs for solving practical problems, demonstrating computational thinking and programming proficiency.	
	CLO ₃ :	Learn strings of characters, their declaration, input/output, operations on strings and functions which handle strings. Acquire knowledge of the concepts of user defined functions in C. Attain the skills to write codes in C using functions.	
	CLO ₄ :	Attain cognitive and technical skills for solving problems with the C programming language. Have hands-on experience to run and debug programs in C for different mathematical and other practical problems of daily or scientific use.	
	Theory		Total
Credits	3		4
Teaching hours per week	3		5
Internal Assessment Marks	25		30
End Term Exam Marks	50		70
Max. Marks	75		100
Examination Duration (in Hours)	3		2

Part B- Contents of the Course

Instructions for Theory Paper-Setter

The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.

Instructions for Practical Examiner

Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes. The maximum marks for the write-up and execution of the practical will be 10.

	Topics	CLO's Attempt	Contact Hours
Unit-I	Introduction to algorithms and flowcharts, Overview of C: Introduction and importance of C, Basic structure of a C program, Executing a C program. Elements of C: C character set, C tokens, Identifiers and keywords, Constants and variables, Data types, Assignment statement, Symbolic constants. Operators and expressions: Arithmetic, relational, logical, bitwise, unary, assignment, conditional and special operators. Arithmetic expressions, Evaluation of arithmetic expression, Type casting and conversion, Operators hierarchy.	<i>CLO₁</i>	15
Unit-II	Input/output: Unformatted and formatted I/O functions, Input functions viz. scanf(), getch(), getche(), getchar(), gets(), Output functions viz. printf(), putchar(), puts(). Decision making and branching: Decision making with IF statement, if-else statement, Nested IF statement, else-if ladder, switch statement, goto statement. Looping: For, while and do-while loops, Jumps in loops, break, continue statement.	<i>CLO₂</i>	15
Unit-III	Character Strings: Declaration and initialization, Reading and writing, Arithmetic operations on characters, Putting strings together, Comparison of strings, String handling functions. User defined functions: Need for user defined functions, Form of C functions, Return values and their types, Calling a function, Category of functions, Nesting of functions, Recursion, Functions with arrays, Scope of variables in functions, ANSI C functions.	<i>CLO₃</i>	15



Practical	The practical component will involve coding based on Programming in C for mathematical and scientific problems. The examiner will set 4 programs at the time of practical examination by taking course learning outcomes (CLOs) into consideration. The examinee will be required to execute two programs. The evaluation will be done on the basis of practical record, viva-voce, write-up and execution of the program. Practical: The following practicals will be done using the programming language C and record of those will be maintained in the practical Note Book: 1. To find greatest and smallest of three numbers. 2. To find the roots of a quadratic equation. 3. To check whether a given year is leap year or not. 4. To prepare electricity bill. 5. To calculate the Letter grades and Grade points of a student according to marks obtained in 4 subjects on the basis of following table: <table><tr><th>Marks</th><th>Grade Point</th><th>Letter Grade</th></tr><tr><td>>85</td><td>10</td><td>O (Outstanding)</td></tr><tr><td>>75</td><td>9</td><td>A+ (Excellent)</td></tr><tr><td>>65</td><td>8</td><td>A (Very Good)</td></tr><tr><td>>55</td><td>7</td><td>B+ (Good)</td></tr><tr><td>>50</td><td>6</td><td>B (Above Average)</td></tr><tr><td>>40</td><td>5</td><td>C (Average)</td></tr><tr><td>40</td><td>4</td><td>P (Pass)</td></tr><tr><td><40</td><td>0</td><td>F (Fail)</td></tr></table> 6. To check a given number for being palindrome or Armstrong. 7. To generate Fibonacci sequence. 8. Write a function to check a given number for being prime number. Use the same to generate the prime numbers less than or equal to a given number m. 9. To find area of circle, triangle and rectangle depending on choice using switch statement. 10. To find sum of cosine series and sine series up to n terms. 11. To find sum of any n numbers. 12. To find transpose of a matrix.	Marks	Grade Point	Letter Grade	>85	10	O (Outstanding)	>75	9	A+ (Excellent)	>65	8	A (Very Good)	>55	7	B+ (Good)	>50	6	B (Above Average)	>40	5	C (Average)	40	4	P (Pass)	<40	0	F (Fail)	CLO ₄	30
Marks	Grade Point	Letter Grade																												
>85	10	O (Outstanding)																												
>75	9	A+ (Excellent)																												
>65	8	A (Very Good)																												
>55	7	B+ (Good)																												
>50	6	B (Above Average)																												
>40	5	C (Average)																												
40	4	P (Pass)																												
<40	0	F (Fail)																												

	13. To find sum and product of two matrices. 14. To find factorial of a number using (a) iteration (b) function. 15. To sort given numbers in ascending/descending order using (a) selection sort (b) bubble sort		
	Contact Hours	75	
Evaluation Methods			
Internal Assessment	TH-25	PR-05	End Term Examination: 70 TH-50 PR-20
Class Participation:	5	0	Lab record NA 05
Seminar/presentation/ assignment/quiz/class test etc.:	5	NA	Viva-Voce NA 05
Seminar/Demonstration/Viva- voce/Lab records etc.:	NA	05	Written Examination 50 NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical NA 10
Part C-Learning Resources			
Recommended Books/e-resources/LMS:			
1. Balagurusamy, E. (2019). <i>Programming in ANSI C</i> (8th ed.). McGraw Hill Education. 2. Thareja, R. (2016). <i>Computer fundamentals and programming in C</i> (2nd ed.). Oxford University Press. 3. Gottfried, B. S. (1998). <i>Schaum's outline of theory and problems of programming with C</i> . McGraw Hill Education. 4. Rajaraman, V. (1994). <i>Computer programming in C</i> . Prentice Hall of India. 5. Kernighan, B. W., & Ritchie, D. M. (1988). <i>The C programming language</i> (2nd ed.). Prentice Hall.			

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	75
Skill Enhancement	75
Communication Development	45

CC-M2

Part A – Introduction			
Name of the Subject	Mathematics		
Semester	II		
Nature of Course/Course Composition	Theory + Practical		
Name of the Course	Basic Algebra		
Course Code	26L4.5-MAT-203		
Course Type	CC-M		
Course Level	100-199		
Pre-requisite for the course	Mathematics as a subject at 4.0 Level (Class-XII)		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Analyze and solve problems involving matrix algebra, eigenvalues, eigenvectors, characteristic and minimal polynomials, the Cayley–Hamilton theorem, orthogonal and unitary matrices, systems of linear equations, and polynomial equations using appropriate algebraic techniques and logical reasoning.	
	CLO ₂	Attain cognitive and technical skills required for using relevant methods and procedures to solve algebraic equations, finding inverse and eigen values of matrices. Have technical and practical skills of solving algebraic equations, finding inverse and eigen values of matrices by using built in functions of MAXIMA/SCILAB software.	
	Theory	Practical	Total
Credits	1	1	2
Teaching hours per week	1	2	3
Internal Assessment Marks	05	05	10
End Term Exam Marks	20	20	40
Max. Marks	25	25	50
Examination Duration (in Hours)	02	02	
Part B- Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 4 questions from unit 01 with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 6 short answer type questions carrying one mark each (total 06 marks). The remaining questions will be carrying 07 marks each. Examinees will be required to attempt three questions: the compulsory question no. 1 and 02 questions from other 03 questions.			
<u>Instructions for Practical Examiner</u>			
Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes. The maximum marks for the write-up and execution of the practical will be 5.			

Topics		CLO's Attempt	Contact Hours
Unit-I	Rank of a matrix, Row rank and column rank of a matrix, Eigen values, Eigen vectors and the characteristic equation of a matrix, Minimal polynomial of a matrix. Cayley-Hamilton theorem and its use in finding the inverse of a matrix, Unitary and orthogonal matrices. Applications of matrices to a system of linear (both homogeneous and non-homogeneous) equations, Theorems on consistency of a system of linear equations. Relations between the roots and coefficients of general polynomial equation in one variable, Solutions of polynomial equations having conditions on roots.	<i>CLO₁</i>	15
Practical	The practical component of the course has two parts, Problem Solving and Practical's using MAXIMA/SCILAB software. The examiner will set 4 questions at the time of practical examination asking two questions from the part (A) and two questions from the part (B) by taking course learning outcomes (CLOs) into consideration. The examinee will be required to solve one problem from the part (A) and to execute one problem successfully from the part (B). Equal weightage will be given to both the parts. The evaluation will be done on the basis of practical record, viva-voce, write up and execution of the program. A) Problem Solving- Questions related to the practical applications based on following problems will be worked out and record of those will be maintained in the Practical Note Book: Problems to find the row rank and column rank of a matrix. 1. Problems to find the eigen values and eigen vectors of a matrix. 2. Problems of finding inverse of a matrix using Cayley-Hamilton theorem. 3. Problems to find the minimal polynomial of a matrix. 4. Problems to check the consistency of a system of linear equations.	<i>CLO₂</i>	30

	B) The following practicals will be worked out using MAXIMA/SCILAB Software and their record will be maintained in the Practical Notebook: 1. To find roots of algebraic equations using MAXIMA/SCILAB. 2. To find the value of determinant using MAXIMA/SCILAB. 3. To compute inverse of a square matrix using MAXIMA/SCILAB. 4. To find Eigen values and Eigen vectors of a square matrix using MAXIMA/SCILAB. 5. To solve system of linear equations using MAXIMA/SCILAB.				
	Contact Hours			45	
Suggested Evaluation Methods					
Internal Assessment	TH-5	PR-5	End Term Examination: 40	TH-20	PR-20
Class Participation:	0	0	Lab record	NA	5
Seminar/presentation/assignment/quiz/class test etc.:	0	NA	Viva-Voce	NA	5
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	20	NA
Mid-Term Exam:	5	NA	Write-up and execution of the practical	NA	10
Part C-Learning Resources					
Recommended Books/e-resources/LMS: 1. Friedberg, S. H., Insel, A. J., & Spence, L. E. (2022). <i>Linear algebra</i> (5th ed.). Pearson. 2. Lipschutz, S., & Lipson, M. L. (2013). <i>Linear algebra</i> (4th ed.). McGraw-Hill Education. 3. Dutta, K. B. (2004). <i>Matrix and linear algebra</i> . Prentice Hall of India Pvt. Ltd. 4. Hall, H. S., & Knight, S. R. (2023). <i>Higher algebra</i> (7th ed.). Arihant Publications. 5. Dickson, L. E. (2009). <i>First course in the theory of equations</i> . Project Gutenberg. https://www.gutenberg.org/ebooks/29785					

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	45
Skill Enhancement	45
Communication Development	15
Current Issues and Social Awareness	05
Public policies	03

CC-3/MCC-4

Part A – Introduction		
Name of the Subject	Mathematics	
Semester	III	
Nature of Course/Course Composition	Theory + Practical	
Name of the Course	Differential Equations-1	
Course Code	26L5.0-MAT-301	
Course Type	CC/MCC	
Course Level	200-299	
Pre-requisite for the course	Mathematics as a subject at 4.0 Level (Class-XII)	
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁ :	Gain knowledge of the basic concepts of ordinary differential equations and learn various techniques of finding exact solutions of certain solvable first order differential equations.
	CLO ₂ :	Analyze and solve homogeneous and non-homogeneous second-order linear ordinary differential equations with constant and variable coefficients, and demonstrate an understanding of total differential equations and the basic concepts of partial differential equations for solving mathematical problems.
	CLO ₃ :	Apply analytical methods to formulate and solve linear partial differential equations and evaluate appropriate solution techniques for different types of PDEs. Determine integral and orthogonal surfaces, analyze compatible systems, and apply PDE concepts to solve mathematical problems arising in multidisciplinary contexts.



	<i>CLO₄</i> :	To attain cognitive and technical skills required for selecting and using relevant methods and techniques to assess the appropriateness of approaches to solving problems associated with the differential equations. To attain technical skill of solving differential equations by using built in functions of MAXIMA/SCILAB software.		
		Theory	Practical	Total
Credits		3	1	4
Teaching hours per week		3	2	5
Internal Assessment Marks		25	5	30
End Term Exam Marks		50	20	70
Max. Marks		75	25	100
Examination Duration (in Hours)		3	2	

Part B- Contents of the Course

Instructions for Theory Paper-Setter

The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.

Instructions for Practical Examiner

Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes. The maximum marks for the write-up and execution of the practical will be 10.

	Topics	CLO's Attempt	Contact Hours
Unit-I	Basic concepts and genesis of ordinary differential equations, Order and degree of a differential equation, Solutions of differential equations of first order and first degree, Exact differential equations, Integrating factor, First order higher degree equations solvable for x , y and p , Lagrange's equations, Clairaut's form and singular solutions. Orthogonal trajectories of one-parameter families of curves in a plane.	<i>CLO₁</i>	15
Unit-II	Solutions of linear ordinary differential equations with constant coefficients, linear non-homogeneous differential equations. Linear differential equation of second order with variable coefficients. Method of reduction of order, method of undetermined coefficients, method of variation of parameters. Cauchy-Euler equation. Solution of simultaneous differential equations, total differential equations. Genesis of Partial differential equations (PDE), Concept of linear and non- linear PDEs. Complete solution, general solution and singular solution of a PDE.	<i>CLO₂</i>	15

Unit-III	Linear PDE of first order. Lagrange's method for PDEs of the form: $P(x, y, z) p + Q(x, y, z) q = R(x, y, z),$ where $p = \partial z / \partial x$ and $q = \partial z / \partial y$. Integral surfaces passing through a given curve. Surfaces orthogonal to a given system of surfaces. Compatible systems of first order equations. Charpit's method, Special types of first order PDEs, Jacobi's method. Second Order Partial Differential Equations with Constant Coefficients.	<i>CLO₃</i>	15
Practical	The practical component of the course has two parts, Problem Solving and Practical's using MAXIMA/SCILAB software. The examiner will set 4 questions at the time of practical examination asking two questions from the part (A) and two questions from the part (B) by taking course learning outcomes (COs) into consideration. The examinee will be required to solve one problem from the part (A) and to execute one problem successfully from the part (B). Equal weightage will be given to both the parts. The evaluation will be done on the basis of practical record, viva-voce, write up and execution of the program. (A) Problem Solving- Questions related to the following problems will be solved and record of those will be maintained in the Practical Notebook: 1. Problems solving for differential equations which are reducible to homogeneous. 2. Problems solving for differential equations which are Exact differential equations. 3. Problems solving for linear differential equations with constant coefficient. 4. Problems solving for linear differential equations with variable coefficient. 5. Problems solving for differential equations by method of variation of parameters. 6. Problems solving for differential equations by method of undetermined coefficients. 7. Problems solving for simultaneous differential equations. 8. Problems solving for different PDEs using Lagrange's method. 9. Problems solving for PDEs with Charpit's method and Jacobi's method.	<i>CLO₄</i>	30

	(B)The following practicals will be done using MAXIMA/SCILAB software and record of those will be maintained in the practical note book: 1. Solutions of first and second order differential equations. 2. Plotting of family of solutions of differential equations of first, second and third order. 3. Solution of differential equations using method of variation of parameters. 4. Growth and decay model (exponential case only). 5. Lake pollution model (with constant/seasonal flow and pollution concentration). 6. Density-dependent growth model. 7. Predatory-prey model (basic Volterra model, with density dependence, effect of DDT, two prey one predator). 8. To find the solutions Linear differential equations of second order using built in functions of MAXIMA/SCILAB software. 9. To find numerical solution of a first order ODE using plotdf built in function of MAXIMA/SCILAB. 10. To find exact solutions of first and second order ODEs using ode2 and ic1/ic2 built in functions of MAXIMA/SCILAB. 11. To find exact solutions of first and second order ODEs using desolve and atvalue built in functions of MAXIMA/SCILAB.		
	Contact Hours	75	
Evaluation Methods			
Internal Assessment	TH-25	PR-5	End Term Examination: 70 TH-50 PR-20
Class Participation:	5	0	Lab record NA 05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce NA 05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination 50 NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical NA 10
Part C-Learning Resources			
Recommended Books/e-resources/LMS: 1. Kreyszig, E. (2011). <i>Advanced engineering mathematics</i> (10th ed.). John Wiley & Sons. 2. Rai, B., & Choudhury, D. P. (2006). <i>Ordinary differential equations: An introduction</i>. Narosa Publishing House Pvt. Ltd. 3. Ross, S. L. (2014). <i>Differential equations</i> (3rd ed.). Wiley India Pvt. Ltd. 4. Simmons, G. F. (2017). <i>Differential equations with applications and historical notes</i> (3rd ed.). CRC Press. 5. Sneddon, I. N. (2006). <i>Elements of partial differential equations</i>. Dover Publications.			

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	75
Skill Enhancement	75
Communication Development	45



MCC-5

Part A - Introduction			
Name of Subject	Mathematics		
Semester	III		
Nature of Course	Theory		
Nomenclature of the Course	Groups and Rings		
Course Code	26L5.0-MAT-302		
Course Type	MCC		
Course Level	200-299		
Pre-requisite for the course	Basic Algebra of 100-199 Level		
Course Learning Outcomes (CLOs ₁) After completing this course, the learner will be able to:	CLO ₁	Gain theoretical knowledge of the concept of a group, subgroup, abelian group, cyclic group, normal group, quotient group and have understanding of the results based on these concepts.	
	CLO ₂	Have knowledge and understanding of the theory of group homomorphisms, group isomorphisms and group automorphisms. Learn about the permutation groups, permutations, centre of a group and theorems based on these concepts.	
	CLO ₃	Gain the deeper knowledge of the concepts of a ring, subring, ideal, integral domain, field of quotient and understanding of the results based on these concepts	
	CLO ₄	Know about Euclidean rings, Polynomial rings and Unique factorization domain.	
	Theory	Tutorial	Total
Credits	4	0	4
Teaching Hours per week	4	0	4
Internal Assessment Marks	30	0	30
End Term Exam Marks	70	0	70
Max. Marks	100	0	100
Examination Duration (in Hours)	3		
Part B- Contents of the Course			
<u>Instructions for Paper- Setter:</u>			
The paper setter shall prepare 9 questions selecting two questions from each unit with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory, comprising 7 short answer type questions carrying two marks each (total 14 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt five questions: the compulsory question no. 1 and 1 question from the each of the four units.			

Unit	Topics	CLO's Attempt	Contact Hours
I	Definition of a group, Elementary properties of groups, Subgroups and subgroup criteria, Cosets, Index of a sub-group, Coset decomposition, Lagrange's theorem and its consequences, Cyclic groups, Normal subgroups, Quotient groups.	CLO_1	15
II	Homomorphisms, Isomorphisms, Automorphisms and inner Automorphisms of groups, Automorphisms of cyclic groups, Permutation groups, Even and odd permutations, Alternating groups, Cayley's theorem, Centre of a group.	CLO_2	15
III	Introduction to rings, Subrings, Integral domains and fields, Characteristic of a ring, Ring homomorphism. Ideals: principal, prime and maximal ideals, Quotient ring, Field of quotients of an integral domain.	CLO_3	15
IV	Euclidean rings, Polynomial rings, Polynomials over the rational field, The Eisenstein's criterion, Polynomial rings over commutative rings, Unique factorization domain.	CLO_4	15
	Contact hours		60
Evaluation Methods			
Internal Assessment: 30 Marks		End Term Examination: 70 Marks	
• Class Participation:	5	Written Examination: 70	
• Seminar/presentation/assignment/quiz/ class test etc.:	10		
• Mid-Term Exam:	15		
Part C-Learning Resources			
Recommended Books/Journals/ e-resources/ Learning Management Systems (LMS):			
Instructions			
1. Artin, M. (2011). <i>Abstract algebra</i> (2nd ed.). Pearson.			
2. Sahai, V., & Bist, V. (2010). <i>Algebra</i> (3rd ed.). Narosa Publishing House.			
3. Herstein, I. N. (2008). <i>Topics in algebra</i> (2nd ed.). Wiley India Pvt. Ltd.			
4. Singh, S., & Zameeruddin, Q. (2006). <i>Modern algebra</i> (8th ed.). Vikas Publishing House Pvt. Ltd.			
5. Fraleigh, J. B. (2002). <i>A first course in abstract algebra</i> (7th ed.). Pearson.			
6. Wallace, D. A. R. (1998). <i>Groups, rings and fields</i> . Springer.			
7. Rotman, J. J. (1995). <i>An introduction to the theory of groups</i> (4th ed.). Springer-Verlag.			

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	60
Skill Enhancement	60
Communication Development	30
Current Issues and Social Awareness	2

CC-4/MCC-6

Part A – Introduction		
Name of the Subject	Mathematics	
Semester	IV	
Nature of Course/Course Composition	Theory + Practical	
Name of the Course	Analytical Geometry & Vector Calculus	
Course Code	26L5.0-MAT-401	
Course Type	CC/MCC	
Course Level	200-299	
Pre-requisite for the course	Mathematics as a subject at level 4.0 (Class XII)	
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	<i>CLO₁</i>	Gain knowledge of the concept of different conic sections, their classification and properties. Understand various terms related to conic sections and gain skills to use them in problem solving.
	<i>CLO₂</i>	Apply the concepts of three-dimensional analytical geometry to analyze and solve problems involving spheres, cones, cylinders, and conicoids. Determine tangent planes, normals, orthogonality, intersections, coaxial systems, director spheres, envelopes, and related geometric properties using appropriate analytical techniques.
	<i>CLO₃</i>	Analyze and solve problems in vector algebra and vector calculus by applying vector differential operators, evaluating line, surface, and volume integrals, and using Green's, Gauss' Divergence, and Stokes' theorems to model and interpret physical and engineering applications.
	<i>CLO₄</i>	Attain cognitive and technical skills required for solving practical problems related to assessing nature of conicoid, their characteristics. Learn skills to formulate and solve real life practical problems on sphere, cone and cylinder; to generate solutions of practical problems involving complex line, surface and volume integral using Gauss Divergence theorem, Stoke's theorem, Green's theorem in a very easy manner.

	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	5	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	

Part B- Contents of the Course

Instructions for Theory Paper-Setter

The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.

Instructions for Practical Examiner

Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes. The maximum marks for the write-up and execution of the practical will be 10.

	Topics	CLO's Attempt	Contact Hours
Unit-I	General equation of second degree: Classification of conic sections; centre, asymptotes, axes, eccentricity, foci and directrices of conics. Tangent at any point to a conic, chord of contact, pole of line to a conic, director circle of a conic. Polar equation of a conic, tangent and normal to a conic, confocal conics. Definition of a group, Elementary properties of groups, Subgroups and subgroup criteria, Cosets, Index of a sub-group, Coset decomposition, Lagrange's theorem and its consequences, Cyclic groups, Normal subgroups, Quotient groups. Cone: Equation of a cone, right circular cone, quadric cone, enveloping cone. Tangent plane and condition of tangency.	CLO ₁	15
Unit-II	Sphere: General form, Plane section of a sphere. Sphere through a given circle. Intersection of two spheres, tangent plane and line, polar plane and line, orthogonal spheres, radical plane of two spheres and co-axial system of spheres. Cylinder: Right circular cylinder and enveloping cylinder. Central Conicoids: Equation of tangent plane. Director sphere. Normal to the conicoids. Polar plane of a point. Enveloping cone of a conicoid, Enveloping cylinder of a conicoid, confocal conicoid, reduction of second degree equations.	CLO ₂	15
Unit-III	Scalar and Vector product of three vectors, four vectors, reciprocal vectors, vector differentiation and derivative along a curve, directional derivatives; Gradient of a scalar point function, divergence and curl of vector point functions, their geometrical meanings and vector identities. Vector integration: line integral, surface integral and volume integral. Theorem of Gauss, Green, Stoke and problems based on these.	CLO ₃	15

Practical	The examiner will set 4 questions at the time of practical examination asking two questions by taking course learning outcomes (CLOs) into consideration. The examinee will be required to solve two problems. The evaluation will be done on the basis of practical record, viva-voce, write up and execution of the program. Problem Solving: Questions related to the following problems will be worked out and record of those will be maintained in the Practical Notebook: 1. Practical problems to find nature of the curve, center and the equation of the conic referred to center as the origin. 2. Practical problems to demonstrate the length of axes, eccentricity and the equations of the conic. 3. Practical problems related to reduction of a general equation to the standard form and to discuss nature of conicoid, when all the characteristics roots of discriminant cubic are different from zero. 4. Practical problems related to reduction of a general equation to the standard form and to discuss nature of conicoid, when one root of characteristics roots of discriminant cubic is zero. 5. Formulation and solution of real life situations which uses mathematical knowledge and characteristics of sphere (at least two). 6. Formulation and solution of real life situations which uses mathematical knowledge and characteristics of cone (at least two). 7. Formulation and solution of real life situations which uses mathematical knowledge and characteristics of cylinder (at least two). 8. Practical problems to understand geometrical meanings of gradient, divergence and curl. 9. Practical problems to demonstrate use of vector identities based on gradient, divergence and curl. 10. Practical problems to study applications of Gauss Divergence theorem. 11. Practical problems to study applications of Stoke's theorem. 12. Practical problems to study applications of Green's theorem.	CLO ₄	30
	Contact Hours		75

Evaluation Methods					
Internal Assessment	TH-25	PR-5	End Term Examination: 70	TH-50	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/ assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva- voce/Lab records etc.:	NA	5	Written Examination	50	NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Bell, R. J. T. (2022). *An elementary treatise on coordinate geometry of three dimensions*. Legare Street Press.
2. Thomas, G. B., Jr., Hass, J., Heil, C., & Weir, M. D. (2018). *Thomas' calculus* (14th ed.). Pearson Education.
3. Anton, H., Bivens, I., & Davis, S. (2016). *Calculus* (11th ed.). Wiley India.
4. Stewart, J. (2012). *Multivariable calculus* (7th ed.). Brooks/Cole, Cengage Learning.
5. Chatterjee, D. (2009). *Analytical geometry: Two and three dimensions*. Narosa Publishing House.
6. Spiegel, M. R., & Lipschutz, S. (2009). *Schaum's outline of vector analysis* (2nd ed.). McGraw-Hill Education.
7. Narayan, S., & Mittal, P. K. (2007). *Analytical solid geometry*. S. Chand Publishing.
8. Narayan, S., & Mittal, P. K. (2003). *A textbook of vector calculus*. S. Chand Publishing.
9. Strauss, M. J., Bradley, G. L., & Smith, K. J. (2002). *Calculus* (3rd ed.). Pearson Education.
10. Fuller, G., & Tarwater, D. (1992). *Analytic geometry* (7th ed.). Pearson.
11. Kindle, J. H. (1990). *Analytic geometry*. McGraw-Hill Education.
12. Klambauer, G. (1986). *Aspects of calculus*. Springer-Verlag.

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	75
Skill Enhancement	75
Communication Development	45
Current Issues and Social Awareness	10

MCC-7

Part A – Introduction

Name of the Subject	Mathematics		
Semester	IV		
Nature of Course/Course Composition	Theory + Practical		
Name of the Course	Linear Algebra		
Course Code	26L5.0-MAT-402		
Course Type	MCC		
Course Level	200-299		
Pre-requisite for the course	Mathematics as a subject at 4.0 Level (Class-XII)		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁ :	Have comprehensive knowledge and understanding of the concepts of vector space, subspace, linear span, linearly independence, basis, dimension and quotient space.	
	CLO ₂ :	Gain the procedural knowledge required to find the null space, range space, rank, nullity of linear transformation. Understand the proof of rank-nullity theorem and change of basis concept. Have deeper knowledge of the concept of algebra of linear transformations, dual spaces and bi-dual spaces.	
	CLO ₃ :	Find the eigen values, eigen vectors and minimal polynomials of linear transformations. Gain the theoretical knowledge and understanding of inner product space, Gram Schmidt orthogonalization process and Bessel's inequality. Attain the cognitive skills to apply the learnt concepts to solve mathematical problems.	
	CLO ₄ :	Attain cognitive and technical skills required for performing and accomplishing complex tasks related to problems of linear algebra. Have technical and practical skills required to solve problems related to linear algebra using built in functions of MAXIMA/SCILAB and other FOSS software.	
		Theory	Total
Credits		3	4
Teaching hours per week		3	5
Internal Assessment Marks		25	30
End Term Exam Marks		50	70
Max. Marks		75	100
Examination Duration (in Hours)		3	2

Part B- Contents of the Course

Instructions for Theory Paper-Setter

The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.



Instructions for Practical Examiner

Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes. The maximum marks for the write-up and execution of the practical will be 10.

	Topics	CLO's Attempt	Contact Hours
Unit-I	Vector spaces: Vector spaces, Subspaces, Linear sum and direct sum of subspaces, Linear span, Linearly independent and dependent subsets of a vector space, Finitely generated vector spaces, Existence theorem for basis of a finitely generated vector space, Invariance of the number of elements in basis of a finitely generated vector space, Dimension, Quotient space and its dimension.	CLO ₁	15
Unit-II	Homomorphisms : Linear transformations and linear functionals on vector spaces, Matrix of a linear transformation, Null space and range space of a linear transformation, Rank and nullity theorem, Singular and non-singular linear transformation, Change of basis. Algebra of linear transformations, Dual spaces, Bi-dual spaces, Annihilator of subspaces of finite dimensional vector space	CLO ₂	15
Unit-III	Eigen values, Eigen vectors, Minimal polynomial and diagonalization of a linear transformation. Inner product spaces: Inner product spaces, Cauchy-Schwarz inequality, Orthogonal sets and basis, Bessel's inequality for finite dimensional vector spaces, Gram-Schmidt orthogonalization process. Adjoint of a linear transformation and its properties, Unitary linear transformations.	CLO ₃	15
Practical	The practical component of the course has two parts, Problem Solving and Practical's using MAXIMA/Scilab/SageMath software. The examiner will set 4 questions at the time of practical examination asking two questions from the part (A) and two questions from the part (B) by taking course learning outcomes (CLOs) into consideration. The examinee will be required to solve one problem from the part (A) and to execute one problem successfully from the part (B). Equal weightage will be given to both the parts. The evaluation will be done on the basis of practical record, viva-voce, write up and execution of the program. (A) Problem Solving- Questions related to the following problems will be solved and record of those will be maintained in the Practical Notebook: 1. Problems based on Extension theorem. 2. Problems based on Existence theorem. 3. Problems to verify rank and nullity theorem. 4. Problems to find coordinates of a vector relative to an ordered basis. 5. Problems to determine basis and dimension of quotient space of a given finite dimensional vector space. 6. Problems related to change of basis. 7. Problems related to bi-dual spaces. 8. Problems related to the diagonalization of a linear transformation.	CLO ₄	30

	(B)The following practicals will be done using MAXIMA/Scilab/SageMath software and record of those will be maintained in the practical note book:				
	1. Practical problems to determine rank of a matrix associated with linear transformation. 2. Practical problems to determine Nullity of a matrix associated with linear transformation. 3. Practical problems to verify rank-nullity theorem. 4. Practical problems to find null space of matrix associated with linear transformation. 5. To determine eigen values of a matrix associated with linear transformation. 6. To determine normalized eigen vector of a matrix associated with linear transformation. 7. Practical problems related to inner product of vectors or functions. 8. Problems related to Gram-Schmidt orthogonalization process.				
	Contact Hours			75	
Evaluation Methods					
Internal Assessment	TH-25	PR-5	End Term Examination: 70	TH-50	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10
Part C-Learning Resources					
Recommended Books/e-resources/LMS:					
1. Hoffman, K., & Kunze, R. (2015). <i>Linear algebra</i> (2nd ed.). Prentice Hall. 2. Luther, I. S., & Passi, I. B. S. (2012). <i>Algebra</i> (Vol. 2). Narosa Publishing House. 3. Sahai, V., & Bist, V. (2013). <i>Linear algebra</i> (2nd ed.). Narosa Publishing House. 4. Lang, S. (2005). <i>Introduction to linear algebra</i> (2nd ed.). Springer India. 5. Bhattacharya, P. B., Jain, S. K., & Nagpaul, S. R. (1997). <i>Basic abstract algebra</i> (Indian ed.). Cambridge University Press. 6. Herstein, I. N. (1975). <i>Topics in algebra</i> . Wiley Eastern Ltd.					

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	75
Skill Enhancement	75
Communication Development	45

MCC-8

Part A – Introduction

Name of the Subject	Mathematics		
Semester	IV		
Nature of Course/Course Composition	Theory + Practical		
Name of the Course	Differential Equations-II		
Course Code	26L5.0-MAT-403		
Course Type	MCC		
Course Level	200-299		
Pre-requisite for the course	Differential Equations-I (26L5.0-MAT-301)		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁ :	Have the procedural knowledge and cognitive and technical skills of solving second and higher order linear partial differential equations (homogeneous and non-homogeneous). Develop the skills to find the solution of PDEs with variable coefficients.	
	CLO ₂ :	Classify and analyze second-order partial differential equations, reduce them to canonical forms, determine characteristic equations and curves, and solve nonlinear partial differential equations to model and address problems in science, engineering, and society.	
	CLO ₃ :	Apply analytical methods to solve Laplace, heat, and wave equations using Laplace and Fourier transforms. Analyze and model real-world problems involving ordinary and partial differential equations, and interpret their solutions using appropriate mathematical techniques.	
	CLO ₄ :	Acquire cognitive and technical skills to accomplish complex tasks of solving second order PDEs by analyzing different methods and using available softwares.	
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	5	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	

Part B- Contents of the Course

Instructions for Theory Paper-Setter

The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.



Instructions for Practical Examiner

Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes. The maximum marks for the write-up and execution of the practical will be 10.

	Topics	CLO's Attempt	Contact Hours
Unit-I	Integral surfaces passing through a given curve, surfaces orthogonal to a given system of surfaces. Solutions of second and higher order linear partial differential equations (homogeneous and non-homogeneous) with constant coefficients. Solution of PDEs with variable coefficients.	<i>CLO₁</i>	12
Unit-II	Classification of linear partial differential equations of second order, Hyperbolic, parabolic and elliptic types. Reduction of second order linear partial differential equations to Canonical (Normal) forms and their solutions. Characteristic equations and characteristic curves of second order partial differential equation. Monge's method for solving second order partial differential equations. Solution of linear hyperbolic equation.	<i>CLO₂</i>	13
Unit-III	Method of separation of variables. Laplace's equation: occurrence, elementary solution, families of equipotential surfaces, boundary value problems, separation of variables. Wave equation: occurrence, elementary solution, separation of variables. Diffusion (Heat) equation: occurrence, elementary solution, separation of variables. Basics of Laplace transform and inverse Laplace transform. Solutions of ordinary and partial differential equations using Laplace transforms. Basics of Fourier transform and inverse Fourier transform. Solutions of partial differential equations using Fourier transform.	<i>CLO₃</i>	20
Practical	The practical component of the course has two parts, Problem Solving and Practical's with free and open source software (FOSS) Scilab/MAXIMA/SageMath The examiner will set 4 questions at the time of practical examination asking two questions from the part (A) and two questions from the part (B) by taking course outcomes (CLOs) into consideration. The examinee will be required to solve one problem from the part (A) and to execute one problem successfully from the part (B). Equal weightage will be given to both the parts. The evaluation will be done on the basis of practical record, viva-voce, write up and execution of the program.	<i>CLO₄</i>	30

	(A) Problem Solving-Questions related to the following problems will be solved and record of those will be maintained in the Practical Notebook: 1. Problems of solving homogenous linear partial differential equations of second and higher order. 2. Problems of solving non homogenous linear partial differential equations with constant coefficients. 3. Problems of solving partial differential equations with variable coefficients reducible to equations with constant coefficients. 4. Problems of reducing the second order partial differential equations to canonical form and solve it. 5. Problems of solving second order partial differential equations by Monge's method. 6. Solving problems of Wave, Heat and Laplace equations. 7. Solving ordinary and partial differential equations with the help of Laplace transform. 8. Solving partial differential equations with the help of Fourier transform. (B)The following practical's will be done using free and open source software (FOSS) Scilab/MAXIMA/SageMath record of those will be maintained in the practical note book: 1. To find the Solutions of second and higher order homogeneous linear partial differential equations. 2. To find the Solutions of second and higher order non-homogeneous linear partial differential equations. 3. To find characteristic equations of second order partial differential equation. 4. To find the solution of one dimensional Wave equations. 5. To find the solution of two dimensional Wave equations 6. To find the solution of one dimensional Heat equations. 7. To find the solution of two dimensional Heat equations. 8. To find the solution of Laplace equations. 9. To find the solutions of ordinary and partial differential equations with the help of Laplace transform 10. Solving partial differential equations with the help of Fourier transform.		
	Contact Hours	75	



Evaluation Methods					
Internal Assessment	TH-25	PR-5	End Term Examination: 70	TH-50	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Kreyszig, E. (2011). *Advanced engineering mathematics* (10th ed.). John Wiley & Sons.
2. Myint-U, T., & Debnath, L. (2013). *Linear partial differential equations for scientists and engineers* (4th ed.). Springer India.
3. Piaggio, H. T. H. (2004). *An elementary treatise on differential equations and their applications*. CBS Publishers & Distributors.
4. Rao, S. B., & Anuradha, H. R. (1996). *Differential equations with applications*. Universities Press.
5. Sneddon, I. N. (2006). *Elements of partial differential equations*. Dover Publications.
6. Spiegel, M. R. (2005). *Schaum's outline of Laplace transforms*. McGraw-Hill Education.
7. Sneddon, I. N. (1974). *The use of integral transforms*. McGraw-Hill.
8. Debnath, L., & Bhatta, D. (2014). *Integral transforms and their applications* (3rd ed.). CRC Press.

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	75
Skill Enhancement	75
Communication Development	45

DSE-1

Part A – Introduction			
Name of the Subject	Mathematics		
Semester	IV		
Nature of Course/Course Composition	Theory + Practical		
Name of the Course	Probability Theory & Statistics		
Course Code	26L5.0-MAT-404		
Course Type	DSE		
Course Level	200-299		
Pre-requisite for the course	Mathematics as a subject at level 4.0 (Class XII)		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	<i>CLO₁</i> :	Analyze and solve probabilistic problems using probability theory, Bayes' theorem, mathematical expectation, moments, moment generating functions, and standard probability distributions, and select appropriate statistical techniques for real-life applications.	
	<i>CLO₂</i> :	Gain the knowledge of the concepts of uniform, normal, beta, gamma, Cauchy, lognormal, Laplace distributions and their applications in real life statistical models.	
	<i>CLO₃</i> :	Apply statistical techniques to compute and interpret covariance, correlation coefficients, linear regression models, and least squares estimates, and analyze real-world datasets to investigate relationships among variables and solve practical statistical problems.	
	<i>CLO₄</i> :	Attain cognitive and technical skills required for performing and accomplishing complex tasks relating to realistic statistical models. To attain technical skills to demonstrate measures of central tendency and dispersion, rank correlation, fitting of different distributions using built in functions of SPSS/ Excel software	
	Theory		Total
Credits	3		4
Teaching hours per week	3		5
Internal Assessment Marks	25		30
End Term Exam Marks	50		70
Max. Marks	75		100
Examination Duration (in Hours)	3		2



Part B- Contents of the Course

Instructions for Theory Paper-Setter

The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.

Instructions for Practical Examiner

Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes. The maximum marks for the write-up and execution of the practical will be 10.

	Topics	CLO's Attempt	Contact Hours
Unit-I	Basic notions of probability, Conditional probability and independence, Baye's theorem. Random variables: Discrete and continuous, Cumulative distribution function (c.d.f.), Probability mass function (p.m.f.), Probability density functions (p.d.f.), Illustrations and properties of random variables, univariate transformations with illustrations. Two dimensional random variables: Discrete and continuous, Joint, Marginal and conditional c.d.f., p.d.f., p.m.f, independence of variables, bivariate transformations with illustrations. Mathematical expectation, Moments, Moment generating function, Joint moment generating function, Characteristic function.	<i>CLO₁</i>	18
Unit-II	Discrete probability distributions: Uniform, Binomial, Negative binomial, Geometric and Poisson. Continuous probability distributions: Uniform, Normal, Beta, Gamma, Cauchy, Exponential, lognormal and Laplace distribution, properties and limiting/approximation cases.	<i>CLO₂</i>	15
Unit-III	The Correlation coefficient, Covariance, Calculation of covariance from joint moment generating function, Linear regression, The method of least squares, Fitting of curves, Exponential curves.	<i>CLO₃</i>	12
Practical	The practical component of the course has two parts, Problem Solving and Practical's using SPSS/Excel software. The examiner will set 4 questions at the time of practical examination asking two questions from the part (A) and two questions from the part (B) by taking course learning outcomes (CLOs) into consideration. The examinee will be required to solve one problem from the part (A) and to execute one problem successfully from the part (B). Equal weightage will be given to both the parts. The evaluation will be done on the basis of practical record, viva-voce, write up and execution of the program.	<i>CLO₄</i>	30

	Problem Solving-Questions related to the practical applications based on following problems will be worked out and record of those will be maintained in the Practical Note Book: 1. Problems based on conditional probability. 2. Problems based on Bayes' Theorem. 3. Problems based on probability density function. 4. Problems based on joint probability distribution function of random variables. 5. Problems to find marginal probability distribution and conditional probability distribution function of random variables. 6. Problems to compute Karl Pearson's coefficient of correlation for given bivariate frequency distribution. 7. Problems to find Spearman's rank correlation coefficient for given data. 8. Problems related to realistic models involving binomial distribution. 9. Application based problems involving Poisson distribution. 10. Problems involving normal distribution to solve real life models. 11. Problem solving related to expectation and moment of random variables. (B) The following practicals will be done using SPSS/ Excel software and record of those will be maintained in the practical note book: 1. Problems related to measures of central tendency. 2. Problems related to measures of dispersion. 3. Fitting of binomial distribution. 4. Fitting of Poisson distribution. 5. Fitting of normal distribution. 6. Fitting of lines of regression. 7. Fitting of curves by least square method. 8. Regression analysis. 9. Practical problems related to correlation coefficients and rank correlation.		
	Contact Hours	75	



Evaluation Methods					
Internal Assessment	TH-25	PR-5	End Term Examination: 70	TH-50	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	50	NA
Mid-Term Exam:	15	NA	Write-up and execution of the practical	NA	10

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Gupta, S. C., & Kapoor, V. K. (2020). *Fundamentals of mathematical statistics*. Sultan Chand & Sons.
2. Gupta, S. P. (2019). *Statistical methods*. Sultan Chand & Sons.
3. Das, N. G. (2017). *Statistical methods*. McGraw-Hill Education.
4. Miller, I., & Miller, M. (2014). *John E. Freund's mathematical statistics with applications* (8th ed.). Pearson.
5. Ross, S. M. (2014). *Introduction to probability models* (11th ed.). Elsevier.
6. Hogg, R. V., McKean, J. W., & Craig, A. T. (2013). *Introduction to mathematical statistics* (7th ed.). Pearson Education.
7. David, S. (2003). *Elementary probability* (2nd ed.). Cambridge University Press.
8. Pitman, J. (1993). *Probability*. Springer-Verlag.

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	75
Skill Enhancement	75
Communication Development	45
Current Issues and Social Awareness	05
Public policies	10

DSE-1

Part A – Introduction

Name of the Subject	Mathematics		
Semester	IV		
Nature of Course/Course Composition	Theory + Practical		
Name of the Course	Special Functions		
Course Code	26L5.0-MAT-405		
Course Type	DSE		
Pre-requisite for the course	Calculus and Differential Equations of level 100-199		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	<i>CLO₁</i> :	Understand the concept of singular points of differential equations and apply the power series method to obtain their solutions. Analyze Hypergeometric differential equations, explain the properties of Hypergeometric functions, and solve Hypergeometric differential equations using appropriate analytical techniques.	
	<i>CLO₂</i> :	Gain a comprehensive understanding of Bessel's differential equation, Bessel functions, Legendre's differential equation, and Legendre functions. Develop the ability to solve Bessel's and Legendre's differential equations, analyze the properties of their corresponding functions, and apply these special functions to solve mathematical, physical, and engineering problems.	
	<i>CLO₃</i> :	Have the knowledge of theoretical concepts of Hermite's differential equation and Hermite functions. Acquire the skills to use Hermite function for solving mathematical and scientific problems.	
	<i>CLO₄</i> :	Attain the cognitive and technical skills required for performing and accomplishing complex tasks related to series solution of differential equations, Hypergeometric, Bessel's, Legendre's and Hermite's differential equations. Acquire analytical and numerical skills to solve mathematical and scientific problems involving these differential equations and the special functions.	
	Theory	Practical	Total
Credits	3	1	4
Teaching hours per week	3	2	5
Internal Assessment Marks	25	5	30
End Term Exam Marks	50	20	70
Max. Marks	75	25	100
Examination Duration (in Hours)	3	2	



Part B- Contents of the Course

Instructions for Theory Paper-Setter

The paper setter shall prepare 7 questions selecting two questions from each of the three units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 4 short answer type questions carrying two marks each (total 08 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt four questions: the compulsory question no. 1 and 1 question from the each of the three units.

Instructions for Practical Examiner

Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes. The maximum marks for the write-up and execution of the practical will be 10.

	Topics	CLO's Attempt	Contact Hours
Unit-I	Series solution of differential equations: Power series method, Hypergeometric Series, Hypergeometric function and its integral representation, Hypergeometric differential equation and solutions, Contiguous function relations, Simple transformations.	<i>CLO₁</i>	14
Unit-II	Bessel equation and its solution, Bessel functions and their properties, Convergence, Recurrence relations and generating functions, Bessel's integral, Orthogonality of Bessel functions. Legendre differential equation and its solution, Legendre functions and their properties, Recurrence relations and generating functions, Orthogonality of Legendre polynomials, Rodrigues' formula for Legendre polynomials, Laplace integral representation of Legendre polynomial.	<i>CLO₂</i>	17
Unit-III	Hermite differential equation and its solutions, Hermite function and its properties, Recurrence relations and generating functions, Orthogonality of Hermite polynomials, Rodrigues' formula for Hermite Polynomial.	<i>CLO₃</i>	14
Practical	The practical component of the course has two parts, Problem Solving and Practicals using MAXIMA/Scilab/MATLAB software. The examiner will set 4 questions at the time of practical examination asking two questions from the part (A) and two questions from the part (B) by taking course learning outcomes (CLOs) into consideration. The examinee will be required to solve one problem from the part (A) and to execute one problem successfully from the part (B). Equal weightage will be given to both the parts. The evaluation will be done on the basis of practical record, viva-voce, write up and execution of the program.	<i>CLO₄</i>	30



	(A) Problem Solving- Questions related to the following problems will be solved and record of those will be maintained in the Practical Notebook: 1. Problems solving for ordinary differential equations using Frobenius method. 2. Problems based on Hypergeometric differential equation. 3. Problems involving Bessel's differential equation. 4. Problems related to Legendre differential equation. 5. Problems to find solution of Hermite differential equation. 6. Problems based on recurrence relations and generating functions of Bessel's function. 7. Problems based on recurrence relations and generating functions of Legendre's polynomial. 8. Problems based on recurrence relations and generating functions of Legendre's polynomial. (B)The following practicals will be done using MATLAB/SCILAB/MAXIMA software and record of those will be maintained in the practical note book: 1. Practical problems for plotting of the Bessel's functions of first kind of order 0 to 3 2. Practical problems to find zeros of Bessel's function of first and second kind. 3. Practical problems to find zeros of first derivative of Bessel function of first kind and Legendre's polynomial. 4. Practical problems for plotting of Legendre polynomial for $n=1$ to 5 in the interval $[0,1]$ and verifying graphically that all roots of Legendre polynomial lies in the interval $[0,1]$. 5. Practical problems related to coefficients of Legendre polynomial. 6. Practical problems based on plotting of Hermite polynomial. 7. Practical problems related to realistic models involving Bessel differential equation and their solutions. 7. Practical problems related to realistic models involving Legendre's differential equations and their solutions.		
	Contact Hours	75	
Evaluation Methods			
Internal Assessment	TH-25	PR-5	End Term Examination: 70
Class Participation:	5	0	Lab record
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination
Mid-Term Exam:	15	NA	Write-up and execution of the practical

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Kreyszig, E. (2011). *Advanced engineering mathematics* (10th ed.). John Wiley & Sons.
2. Ross, S. L. (2007). *Differential equations* (3rd ed.). Wiley India.
3. Bell, W. W. (2004). *Special functions for scientists and engineers*. Dover Publications.
4. Andrews, L. C. (1992). *Special functions of mathematics for engineers*. Oxford University Press.
5. Rainville, E. D. (1960). *Special functions*. Macmillan.
6. Andrews, G. E., Askey, R., & Roy, R. (1999). *Special functions*. Cambridge University Press.

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	75
Skill Enhancement	75
Communication Development	45



MDC-1

Part A – Introduction

Name of the Subject	Mathematics		
Semester	I		
Nature of Course/Course Composition	Theory + Practical		
Name of the Course	Introductory Mathematics		
Course Code	26L4.5-MDC-MAT-101		
Course Type	MDC		
Course Level	100-199		
Pre-requisite for the course	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Gain the knowledge of set theory, types of sets and operations on sets. Have the knowledge of the basic concepts of complex numbers and acquire skills to solve linear inequalities and quadratic equations.	
	CLO ₂	Gain the knowledge of the concepts of Arithmetic progression, Geometric progression and Harmonic progression, and find A.M., G.M. and H.M. of given numbers. Have the conceptual knowledge of straight lines and circles. Find out the slope of a line, angle between two lines, and know about various forms of a straight line and the standard form of a circle.	
	CLO ₃	Attain the skills to make use of the learnt concepts of Introductory Mathematics in multidisciplinary learning contexts and to know their applications.	
	Theory	Practical	Total
Credits	2	1	3
Teaching hours per week	2	2	4
Internal Assessment Marks	15	05	20
End Term Exam Marks	35	20	55
Max. Marks	50	25	75
Examination Duration (in Hours)	02	02	

Part B- Contents of the Course

Instructions for Theory Paper-Setter

The paper setter shall prepare 5 questions selecting two questions from each of the two units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 7 short answer type questions carrying one mark each (total 07 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt three questions: the compulsory question no. 1 and 1 question from the each of the two units.

Instructions for Practical Examiner

Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes. The maximum marks for the write-up and execution of the practical will be 10.



	Topics	CLO's Attempt	Contact Hours
Unit-I	Sets and their representations, Empty set, Finite and infinite sets, Subsets, Equal sets, Power sets, Universal set, Union and intersection of sets, Difference of two sets, Complement of a set, Venn diagram, De-Morgan's laws and their applications. Complex numbers, Operations on complex numbers, Modulus and argument of a complex number. Quadratic Equations, Solution of quadratic equations.	CLO_1	15
Unit-II	Arithmetic Progression, Geometric Progression, Arithmetic Mean (A.M.), Geometric Mean (G.M.), Relation between A.M., G.M. Straight lines: Slope of a line and angle between two lines, Different forms of equation of a line: Parallel to co-ordinate axes, Point-slope form, Slope-intercept form, Two-point form, General form; Distance of a point from a straight line. Standard Form of a Circle and Its Properties.	CLO_2	15
Practical	The examiner will set 4 questions at the time of practical examination by taking course learning outcomes (CLOs) into consideration. The examinee will be required to solve 2 questions. The evaluation will be done on the basis of practical record, viva-voce and written examination. Problem Solving- Questions related to the practical problems based on following topics will be worked out and record of those will be maintained in the Practical Note Book: 1 Problems related to union, intersection, difference and complement of sets. 2 Problems based on De Morgan's Laws. 3 Problems related to Venn diagrams. 4 Problems to find nth term of A.P. and G.P. 5 Problems to find sum of n terms of A.P. and G.P. 6 Problems to find A.M. and G.M 7 Problems to find modulus and argument of a complex number. 8 Problems involving formulation and solution of quadratic equations in one variable. 9 Problems based on angle between two lines. 10 Problems involving straight lines and their slope. 11 Problems related to a circle.	CLO_3	30
Contact Hours			60

Evaluation Methods					
Internal Assessment	TH-15	PR-5	End Term Examination: 55	TH-35	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	35	NA
Mid-Term Exam:	5	NA	Write-up and execution of the practical	NA	10

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Young, C. Y. (2021). *Algebra and trigonometry*. Wiley.
2. Loney, S. L. (2016). *The elements of coordinate geometry (Cartesian coordinates)* (2nd ed.). G. K. Publications Pvt. Ltd.
3. Pinter, C. C. (2014). *A book of set theory*. Dover Publications.
4. Dyke, J. V., Rogers, J., & Adams, H. (2011). *Fundamentals of mathematics* (10th ed.). Brooks/Cole.
5. Tussy, A., Gustafson, R., & Koenig, D. (2010). *Basic mathematics for college students* (4th ed.). Brooks/Cole.

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	60
Skill Enhancement	60
Communication Development	30

MDC-2**Part A – Introduction**

Name of the Subject	Mathematics		
Semester	II		
Nature of Course/Course Composition	Theory + Practical		
Name of the Course	Mathematics for Commerce and Social Sciences		
Course Code	26L4.5-MDC-MAT-201		
Course Type	MDC		
Course Level	100-199		
Pre-requisite for the course	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Understand and have the procedural knowledge of the concepts of matrices and determinants to solve simultaneous linear equations.	
	CLO ₂	Have the conceptual knowledge of compound interest, annuity, loan, debenture and sinking funds and attain skills to use these concepts in problem solving. Gain the knowledge and understanding of the concepts of Linear programming and develop skills of formulating and solving linear programming problems based on real world problems.	
	CLO ₃	Attain the cognitive and technical skills required for accomplishing assigned tasks relating to the chosen fields of learning in the context of broad multidisciplinary contexts to solve commercial and social real world problems using Mathematics	
	Theory	Practical	Total
Credits	2	1	3
Teaching hours per week	2	2	4
Internal Assessment Marks	15	05	20
End Term Exam Marks	35	20	55
Max. Marks	50	25	75
Examination Duration (in Hours)	02	02	

Part B- Contents of the Course**Instructions for Theory Paper-Setter**

The paper setter shall prepare 5 questions selecting two questions from each of the two units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 7 short answer type questions carrying one mark each (total 07 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt three questions: the compulsory question no. 1 and 1 question from the each of the two units.

Instructions for Practical Examiner

Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes. The maximum marks for the write-up and execution of the practical will be 10.

	Topics	CLO's Attempt	Contact Hours
Unit-I	Matrices and Determinants: Definition of a matrix, Order, Equality, Types of matrices, Operations on matrices: addition, multiplication and multiplication with a scalar and their simple properties, Symmetric and skew-symmetric matrices. Minors, Co-factors, Determinant, Properties of determinants and applications of determinants in finding the area of a triangle, Adjoint and inverse of a square matrix, Solutions of simultaneous linear equations upto order 3.	<i>CLO₁</i>	15
Unit-II	Simple Interest and Compound Interest. Annuities: Types of annuities, Present value and amount of an annuity (including the case of continuous compounding), Valuation of simple loans and debentures, Problems related to sinking funds. Linear inequalities, Algebraic solutions of linear inequalities in two variables and their graphical representation. Linear Programming: Formulation of linear programming problems (LPP) and their solution by graphical and Simplex methods. Applications of linear programming in solving social science and business problems.	<i>CLO₂</i>	15
Practical	The examiner will set 4 questions at the time of practical examination by taking course learning outcomes (CLOs) into consideration. The examinee will be required to solve 2 questions. The evaluation will be done on the basis of practical record, viva-voce and written examination. Problem Solving-Questions related to the practical applications based on following problems will be worked out and record of those will be maintained in the Practical Note Book: 1. Problems to find sum of matrices. 2. Problems to find product of matrices. 3. Problems to find determinant of a matrix. 4. Problems to find inverse of a matrix. 5. Problems to find solution of system of linear equations. 6. Problems to find determinant of a square matrix of order 3. 7. Problems to find simple and compound interest. 8. Problems based on annuity. 9. Valuation of simple loans and debentures. 10. Problems to represent solutions of linear inequalities graphically. 11. Formulation of real life commercial and social science problems (LPP) related to maximizing profits, minimizing costs, minimal usage of resources etc. and their solutions.	<i>CLO₃</i>	30
Contact Hours			60

Evaluation Methods					
Internal Assessment	TH-15	PR-5	End Term Examination: 55	TH-35	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	35	NA
Mid-Term Exam:	5	NA	Write-up and execution of the practical	NA	10

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Dowling, E. T. (2020). *Schaum's outline of calculus for business, economics, and the social sciences*. McGraw Hill Education.
2. Lipschutz, S., & Lipson, M. L. (2013). *Linear algebra* (4th ed.). McGraw-Hill Education.
3. Sancheti, D. C., & Kapoor, V. K. (2011). *Business mathematics*. Sultan Chand & Sons.
4. Holden, K. (2010). *Introductory mathematics for business and economics*. Ane Books Pvt. Ltd.
5. Dowling, E. T. (2009). *Schaum's outline of mathematical methods for business and economics* (3rd ed.). McGraw-Hill Education.
6. Don, E., & Lerner, J. (2009). *Schaum's outline of basic business mathematics* (2nd ed.). McGraw-Hill Education.
7. Paul, L. N. (2002). *Linear programming: An introductory analysis*. Tata McGraw-Hill.
8. Taha, H. (2017). *Operations Research: An Introduction* (10th ed.). London: Pearson.

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	60
Entrepreneurship	10
Skill Enhancement	60
Communication Development	30
Public policies	10



MDC-3

Part A – Introduction

Name of the Subject	Mathematics		
Semester	III		
Nature of Course/Course Composition	Theory + Practical		
Name of the Course	Mathematics for All		
Course Code	26L5.0-MDC-MAT-301		
Course Type	MDC		
Course Level	200-299		
Pre-requisite for the course	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Apply the principles of differentiation and integration to determine the rate of change of various functions and solve problems in mathematics and related disciplines. Understand the concept of solving first order ordinary differential equation.	
	CLO ₂	Analyze and interpret data using suitable methods of data representation, measures of central tendency, correlation analysis, and curve fitting techniques to solve statistical problems and support evidence-based decision-making.	
	CLO ₃	Attain a range of cognitive and technical skills to differentiate and integrate various functions. Use procedural knowledge to solve simple first order differential equations. Have technical and practical skills required for selecting and using suitable methods for data representation and measure of central tendency.	
	Theory	Practical	Total
Credits	2	1	3
Teaching hours per week	2	2	4
Internal Assessment Marks	15	05	20
End Term Exam Marks	35	20	55
Max. Marks	50	25	75
Examination Duration (in Hours)	02	02	

Part B- Contents of the Course

Instructions for Theory Paper-Setter

The paper setter shall prepare 5 questions selecting two questions from each of the two units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 7 short answer type questions carrying one mark each (total 07 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt three questions: the compulsory question no. 1 and 1 question from the each of the two units.

Instructions for Practical Examiner

Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes. The maximum marks for the write-up and execution of the practical will be 10.



	Topics	CLO's Attempt	Contact Hours
Unit-I	The concept of differentiation, differentiation of simple functions, second order differentiation, Maxima and minima of a function, Use of differentiation for solving problems related to real-life situations, and having applications in business and social studies, Maxima and minima of a function and their applications to Revenue, Cost, Demand, Production, Profit functions and other functions related to commercial and social Problems. Integration of simple algebraic, trigonometric and exponential functions. Solutions of Ordinary Differential Equations of First Order and Degree one with Variable Separable.	<i>CLO₁</i>	15
Unit-II	Presentation of data: Frequency distribution and cumulative frequency distribution, Diagrammatic and graphical presentation of data, Construction of bar, Pie diagrams, Histograms, Frequency polygon, Frequency curve and Ogives. Measures of central tendency: Arithmetic mean, Median, Mode, Geometric mean and Harmonic mean for ungrouped and grouped data. Measures of dispersion: Concept of dispersion, Mean deviation and its coefficient, Range, Variance and its coefficient, Standard deviation. Correlation: Concept and types of correlation, Methods of finding correlation: Scatter diagram, Karl Pearson's coefficients of correlation, Rank correlation. Linear regression: Principle of least square, Fitting of straight line, Two lines of regression, Regression coefficients.	<i>CLO₂</i>	15
Practical	The examiner will set 4 questions at the time of practical examination by taking course learning outcomes (CLOs) into consideration. The examinee will be required to solve 2 questions. The evaluation will be done on the basis of practical record, viva-voce and written examination. Problem Solving- Questions related to the practical applications based on following problems will be worked out and record of those will be maintained in the Practical Note Book: 1. Problems to find derivatives of simple functions. 2. Problems to find first and second derivatives of functions. 3. Problems related to application of maxima and minima in real world problems. 4. Demonstrate skills of finding integration of simple functions.	<i>CLO₃</i>	30

	5. Representation of data using Bar and pie diagrams. 6. Representation of data using Histogram, Frequency polygon, Frequency curves and Ogives. 7. Problems to compute measures of central tendency. 8. Problem to calculate Karl Pearson’s coefficient of correlation. 9. Problem to fit the straight line for the given data. 10. Problem to find lines of regression. 11. Practical Problems Involving Solution of Simple First Order Differential Equations.				
	Contact Hours	60			
Evaluation Methods					
Internal Assessment	TH-15	PR-5	End Term Examination: 55	TH-35	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	35	NA
Mid-Term Exam:	5	NA	Write-up and execution of the practical	NA	10
Part C-Learning Resources					
Recommended Books/e-resources/LMS:					
1. Prasad, G. (2016). <i>Differential calculus</i> (19th ed.). Pothishala Pvt. Ltd. 2. Thomas, G. B., Jr., Hass, J., Heil, C., & Weir, M. D. (2018). <i>Thomas' calculus</i> (14th ed.). Pearson Education. 3. Ross, S. L. (1984). <i>Differential Equations</i> (3rd ed.). John Wiley & Sons. 4. Gupta, S. C., & Kapoor, V. K. (2014). <i>Fundamentals of mathematical statistics</i> . S. Chand Publishing. 5. Hogg, R. V., McKean, J. W., & Craig, A. T. (2013). <i>Introduction to mathematical statistics</i> (7th ed.). Pearson Education. 6. Dyke, J. V., Rogers, J., & Adams, H. (2011). <i>Fundamentals of mathematics</i> . Cengage Learning. 7. Tussy, A. S., Gustafson, R. D., & Koenig, D. (2010). <i>Basic mathematics for college students</i> . Brooks/Cole. 8. Klambauer, G. (1986). <i>Aspects of calculus</i> . Springer-Verlag.					

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	60
Skill Enhancement	60
Communication Development	30
Current Issues and Social Awareness	10
Public policies	10

VAC-3 (Scheme-C only)

Part A - Introduction			
Name of Subject	Mathematics		
Semester	III		
Nature of Course/Course Composition	Theory		
Nomenclature of the Course	Mathematics in India: From Vedic Period to Modern Times		
Course Code	26L5.0-VAC-MAT-301		
Course Type	VAC		
Course Level	100-109		
Pre-requisite for the course	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Develop an understanding of the evolution of Indian mathematics from the Vedic to the Medieval period, including the contributions of eminent Indian mathematicians and the Kerala School, and appreciate their role in the development of calculus, spherical trigonometry, astronomy, and the Indian Knowledge System.	
	CLO ₂	Develop an understanding of the growth of mathematics during the modern period, including the contributions of Srinivasa Ramanujan and other eminent mathematicians. Gain knowledge of the Fields Medal, Abel Prize, and the significant contributions of contemporary Indian mathematicians, fostering an appreciation of India's mathematical heritage and its global impact.	
	Theory	Tutorial	Total
Credits	2	0	2
Teaching Hours per week	2	0	2
Internal Assessment Marks	15	0	15
End Term Exam Marks	35	0	35
Max. Marks	50	0	50
Examination Duration (in Hours)	02	0	
Part B- Contents of the Course			
<u>Instructions for Paper- Setter:</u>			
The paper setter shall prepare 5 questions selecting two questions from each of the two units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 07 short answer type questions carrying one mark each (total 07 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt three questions: the compulsory question no. 1 and 1 question from the each of the two units.			

Unit	Topics	CLO's Attempt	Contact Hours
I	Ancient Period: Development of Indian mathematics during Vedic and Ancient period. Overview of the Vedic period, Mathematical ideas in the Vedas and manuscripts in Indian mathematics. Life, background, notable works, mathematical contribution of Baudhayana, Pingala, Aryabhata, Brahmagupta, Bhaskaracharya, Mahaviracharya and Lilavati. Medieval Period: Kerala School of Mathematics, Madhava of Sangamagrama, Nilakantha Somayaji, Jyesthadeva: Overview of historical backgrounds and their contribution.	CLO ₁	15
II	Modern Period: Srinivasa Ramanujan, Satyendra Nath Bose, Radhanath Sikdar, P.C. Mahalanobis, D.R. Kaprekar: Early life, Education, Challenges, Achievements and their contribution. Medals and Prizes in Mathematics and Contemporary Mathematicians: Introduction to the prestigious Fields Medal, Abel Prize and their significance. Biography and contributions of illustrious mathematicians from India: Subrahmanyan Chandrasekhar, C.R. Rao, S.R. Srinivasa Varadhan, Manjul Bhargava, Akshay Venkatesh, Harish-Chandra and Shakuntala Devi.	CLO ₂	15
Contact hours			30
Evaluation Methods			
Internal Assessment: 15 Marks		End Term Examination: 35 Marks	
• Class Participation:	5	Written Examination: 35	
• Seminar/presentation/assignment/quiz/class test etc.:	5		
• Mid-Term Exam:	5		
Part C-Learning Resources			
Recommended Books/Journals/ e-resources/ Learning Management Systems (LMS): 1. C. N. Srinivasiengar (1967). <i>History of Mathematics in India</i> . The World Press Pvt. Ltd., Calcutta. 2. A.K. Bag (1979). <i>A Cultural History of Mathematics in Ancient India</i> . Chaukhamba Orientalia, Varanasi. 3. George Gheverghese Joseph (2016). <i>Indian Mathematics: Engaging with the World from Ancient to Modern Times</i> . World Scientific. 4. T.A. Sarasvati Amma (2007). <i>Geometry in Ancient and Medieval India</i> . Motilal Banarsidass Publishers Limited 5. S. Balachandra Rao (1998). <i>Indian Mathematics and Astronomy: Some Landmarks</i> . Jnana Deep Publications 6. John Stillwell (2010). <i>Mathematics and its History</i> . Springer (Includes a section on Indian mathematics) 7. Ramakalyani V., Sita Sunder Ram (2021). <i>History and development of Mathematics in India</i> . National mission for Manuscripts and DK Printworld (P) Ltd, New Delhi. 8. Gerard G. Emch (2005). <i>Contribution to the history of Indian Mathematics</i> . Hindustan Book Agency. 9. R. B. Singh (2008). <i>Origin and development of Mathematics</i> . Vista International Publishing House, New Delhi.			

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	30
Skill Enhancement	30
Communication Development	15
Indian Knowledge System	30

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VAC-3 (Scheme A,B &D)**VAC-4 (Scheme-C)**

Part A - Introduction			
Name of Subject	Mathematics		
Semester	IV		
Nature of Course/Course Composition	Theory		
Nomenclature of the Course	Mathematics in everyday life		
Course Code	26L5.0-VAC-MAT-401		
Course Type	VAC		
Course Level	100-199		
Pre-requisite for the course	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Develop an understanding of simple and compound interest, income tax, EMI, profit and loss, ratio and proportion, work and time, time and distance, and coding–decoding. Apply mathematical concepts and analytical skills to solve financial and quantitative aptitude problems, compare the effects of compounding on long-term savings, and address real-life situations effectively.	
	CLO ₂	Develop the ability to apply concepts of sequences and series, arithmetic progression, geometric progression, permutations and combinations, measures of central tendency, graphical data representation, and linear programming to analyze data, conduct simple surveys, and solve quantitative and real-life problems effectively.	
	Theory	Tutorial	Total
Credits	2	0	2
Teaching Hours per week	2	0	2
Internal Assessment Marks	15	0	15
End Term Exam Marks	35	0	35
Max. Marks	50	0	50
Examination Duration (in Hours)	02	0	

Part B- Contents of the Course

Instructions for Paper- Setter:

The paper setter shall prepare 5 questions selecting two questions from each of the two units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 07 short answer type questions carrying one mark each (total 07 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt three questions: the compulsory question no. 1 and 1 question from the each of the two units.

Unit	Topics	CLO's Attempt	Contact Hours
I	Simple interest, Compound interest, Equated monthly installment (EMI), Direct tax calculation. Profit and loss, Work, time and distance, Coding and Decoding, Ratio and proportion, Trigonometry and its applications, Mensuration for practical purposes.	CLO ₁	15
II	Sequence and series, Arithmetic progression, Geometric progression, Permutation and combinations (simple problems). Mean, Mode, Median, Standard deviation, Variance. Bar graphs, Pie charts, Frequency polygons, Ogive. Linear equation in two variables. Linear programming problems (LPP): Graphical solution.	CLO ₂	15

Contact hours

30

Evaluation Methods

Internal Assessment: 15 Marks		End Term Examination: 35 Marks
• Class Participation:	5	Written Examination: 35
• Seminar/presentation/assignment/quiz/class test etc.:	5	
• Mid-Term Exam:	5	

Part C-Learning Resources

Recommended Books/Journals/ e-resources/ Learning Management Systems (LMS):

1. R. S. Aggarwal (2022). *Quantitative Aptitude*. S Chand & Company Limited, New Delhi.
2. Jaikishan & Premkishan (2022). *How to Crack Test of Reasoning in All Competitive Exams*. Arihant Publications.
3. A. Guha (2020). *Quantitative Aptitude* (7th Edition). Mc Graw Hill Publications.
4. R. V. Praveen (2016). *Quantitative Aptitude and Reasoning* (3rd Edition). PHI publications.
5. R.S. Aggarwal (2018). *A Modern Approach to Logical Reasoning* . S. Chand.
6. Richa Agarwal (2019). *How to Crack Test of Arithmetic*. Arihant Publications.

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	30
Skill Enhancement	30
Communication Development	15



SEC-2

Part A – Introduction			
Name of the Subject	Mathematics		
Semester	II		
Nature of Course/Course Composition	Theory + Practical		
Nomenclature of the Course	Calculation Skills with Vedic Mathematics-I		
Course Code	26L4.5-SEC-MAT-201		
Course Type	SEC		
Course Level	100-199		
Pre-requisite for the course	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Gain the knowledge of <i>Sutras</i> and <i>Upsutras</i> from Vedic Mathematics. Perform simple arithmetic calculations with speed and accuracy. Have the procedural knowledge of multiplication of complicated numbers quickly with the aid of Vedic <i>sutras</i> and generate tables of any number.	
	CLO ₂	Make use of Vedic <i>sutras</i> to quickly divide, and find LCM and HCF of many digit numbers. Acquire the cognitive skills to calculate square and cube roots of numbers speedily with accuracy.	
	CLO ₃	Attain skills to perform calculations in competitive examinations with speed and accuracy.	
	Theory	Practical	Total
Credits	2	1	3
Teaching hours per week	2	2	4
Internal Assessment Marks	15	05	20
End Term Exam Marks	35	20	55
Max. Marks	50	25	75
Examination Duration (in Hours)	02	02	
Part B- Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 5 questions selecting two questions from each of the two units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 7 short answer type questions carrying one mark each (total 07 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt three questions: the compulsory question no. 1 and 1 question from the each of the two units.			
<u>Instructions for Practical Examiner</u>			
Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.			

	Topics	CLO's Attempt	Contact Hours
Unit-I	History of Vedic Mathematics and introduction to its <i>Sutras</i> and <i>Upsutras</i>. Addition in Vedic Mathematics: Without Carrying, Dot Meth method subtraction in Vedic Mathematics: <i>Nikhilam Navatashcaramam Dashatah</i> (All from 9 last 10). Fraction: Addition and Subtraction. Multiplication of two numbers of two digits (<i>Ekadhikena Purvena</i> method), Multiplication of two numbers of three digits, (<i>Ekanyunena Purvena</i> method, <i>Urdhva Tiryagbhyam</i> method, <i>Nikhilam Navatashcaramam Dashatah</i> method), Combined Operations, Generating Tables (<i>Nikhilam</i>).	<i>CLO₁</i>	15
Unit-II	Division: <i>Nikhilam Navatashcaramam Dashatah</i> (two digits divisor), <i>ParavartyaYojyet</i> Method (three digits divisor). Divisibility: <i>Ekadhikena Purvena</i> Method (two digits divisor), <i>Eknunen Purvena</i> Method (two digits divisor) LCM, HCF. Squares of any two digits numbers: Base method, Squares of numbers ending in 5: <i>Ekadhikena Purvena</i> Method. Square Roots: Dwandwa Yoga (Duplex) Method, Square root (four digit number). Cubing: Yavadunam Method, Cube root (six digit numbers)	<i>CLO₂</i>	15
Practical	The examiner will set 4 questions at the time of practical examination by taking course learning outcomes (CLOs) into consideration. The examinee will be required to solve 2 questions. The evaluation will be done on the basis of practical record, viva-voce and written examination. Problem Solving-Questions related to the following problems will be solved and record of those will be maintained in the Practical Note Book: 1. Addition of two 5-digit numbers by without carrying and dot method. 2. Subtraction of 5-digit numbers by base method. 3. Multiplication of 2-digit numbers by base method. 4. Multiplication of 3-digit numbers by numbers consisting of all 9s. 5. Multiplication of 3-digit numbers by numbers consisting of all 1s. 6. Multiplication of 3-digit numbers by Vinculum method. 7. Division of 2-digit and 3-digit numbers. 8. Generating table of any number.	<i>CLO₃</i>	30

	9. Square of any 2-digit number by base method. 10. Square of any number ending with 5. 11. Square root of 4-digit numbers. 12. Cube root of 6-digit numbers. 13. LCM and HCF of numbers. 14. Answer checking by digit-sum method.					
Contact Hours					60	
Evaluation Methods						
Internal Assessment	TH-15	PR-5	End Term Examination: 55	TH-35	PR-20	
Class Participation:	5	0	Lab record	NA	05	
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05	
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	35	NA	
Mid-Term Exam:	5	NA	Write-up and execution of the practical	NA	10	
Part C-Learning Resources						
Recommended Books/Journals/ e-resources/ Learning Management Systems (LMS):						
1. U. S. Patankar and S. M. Patankar (2018). <i>Elements of Vedic Mathematics</i> . TTU Press. 2. V.Singhal (2014). <i>Vedic Mathematics for all ages</i> . Motilal Banarsidas Publishers. 3. R.K.Thakur (2013). <i>The Essentials of Vedic Mathematics</i> . Rupa Publications. New Delhi. 4. P. Tiwari and V.K. Pandey (2012). <i>Vedic Mathematics - Modern Research Methods</i> . Campus Books International. 5. S. K. Kapoor (2006). <i>Vedic Geometry Course</i> . Lotus Press. 6. A. Gupta (2004). <i>Power of Vedic Mathematics with Trigonometry</i> . Jaico Publishing House. 7. S.B.K. Krishna Trithaji (1990). <i>Vedic Mathematics</i> . Motilal Banarsidas, New Delhi.						

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	60
Skill Enhancement	60
Communication Development	30
Indian Knowledge System	60

SEC-2

Part A – Introduction			
Name of the Subject	Mathematics		
Semester	II		
Nature of Course/Course Composition	Theory + Practical		
Nomenclature of the Course	Numerical Ability Enhancement Skills		
Course Code	26L4.5-SEC-MAT-202		
Course Type	SEC		
Course Level	100-199		
Pre-requisite for the course	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Understand real number system, fundamental arithmetical operations, use of BODMAS rule and solve typical expressions accurately and fast. Acquire skill to identify types of given sequences/series and apply suitable method to find a particular term, sum of specific number of terms and practice this learning in real life mathematical problems.	
	CLO ₂	To formulate equations for specific mathematical problem and making use of mathematical skills to solve that. Have a deeper and comprehensive understanding of the basic concepts of Percentage, Profit & Loss, Alligation or mixture, Averages and acquire skill to use this knowledge in real life problems	
	CLO ₃	Attain cognitive and analytical skills to identify, analyze and generate solutions to realistic problems by exploring procedural knowledge associated with the problems. Have analytical skills to compare and recognize various geometrical figures available in surroundings with mathematical figures and determine areas and volumes of the same.	
	Theory	Practical	Total
Credits	2	1	3
Teaching hours per week	2	2	4
Internal Assessment Marks	15	05	20
End Term Exam Marks	35	20	55
Max. Marks	50	25	75
Examination Duration (in Hours)	02	02	

Part B- Contents of the Course

Instructions for Theory Paper-Setter

The paper setter shall prepare 5 questions selecting two questions from each of the two units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 7 short answer type questions carrying one mark each (total 07 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt three questions: the compulsory question no. 1 and 1 question from the each of the two units.

Instructions for Practical Examiner

Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.

	Topics	CLO's Attempt	Contact Hours
Unit-I	Real number system, Operations on numbers, Tests for divisibility of natural numbers, Decimals, Fractions, Square roots, Cube roots, Surds and indices, Use of BODMAS. HCF, LCM of integers, Ratio and Proportion, Progressions: Arithmetic Progression, Geometric Progression, Harmonic Progression with their simple and basic practical applications, Number series completion.	CLO ₁	15
Unit-II	Percentage, Profit & Loss, Alligation or mixture, Average, Average speed problems, Calendar. Logarithms, Area of Quadrilaterals (Parallelogram, Square, Rectangle, Rhombus, Trapezium), Volume and surface area of Cube, Cuboid, Cylinder, Cone, Sphere and Hemisphere.	CLO ₂	15
Practical Components	The examiner will set 4 questions at the time of practical examination by taking course learning outcomes (CLOs) into consideration. The examinee will be required to solve 2 questions. The evaluation will be done on the basis of practical record, viva-voce, written examination. Problem Solving- Questions related to the following problems will be solved and their record will be maintained in the Practical Notebook: 1. To solve problems related to the simplification of expression involving fractions having use of BODMAS. 2. Practical problems of salary increment, population increase etc. & apply formula for n^{th} term and sum of n terms based on A.P. and G.P.	CLO ₃	30



	3. Working out average speed during a trip from a destination to another destination assuming non uniform speed taking at least three variation in magnitude of speed. 4. Practical problems related to ratio and proportion. 5. Practical problems related to two digit numbers and reversal of digits at unit and ten's places. 6. Draw a chart for quadrilateral (Parallelogram, Square, Rectangle, Rhombus, Trapezium) mentioning their properties, surface area and perimeter. 7. Draw 3-D figures Cuboid, Cube, Cylinder, Cone, Sphere and Hemisphere and problems solving for the surface area and volume of these figures. 8. Derive a formula to determine average speed of a person travelling from a destination 'A' to another destination 'B' with a speed of x km/h and returning back with a speed of y km/hr. 9. 'M' offers a discount of 25% on a book to 'A' and for the same book, he offers 'B' a discount of 10% and again an additional discount of 15%. Analyze, which has to pay more for the same book. 10. Problem of determining single discount in percent equivalent to successive discount of x %, y % and z %. 11. Problem of determining loss percent when a person sells two similar items, one at a gain of x % and the other at a loss of x %. 12. To solve problem related to the value of an item after 'n' years if it depreciates at the rate of 'r %' per annum when its present value 'P' is given. 13. Problem of determining the value of an item 'n' years ago if its depreciation rate 'r %' per annum and present value 'P' is given. 14. Problem of percentage reduction in consumption of a commodity if its price increases 'r %' so as not to increase the expenditure. 15. Problem to find the ratio in which two or more ingredients at the given price must be mixed to produce a mixture of a desired price.		
Contact Hours			60



Evaluation Methods					
Internal Assessment	TH-15	PR-5	End Term Examination: 55	TH-35	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	35	NA
Mid-Term Exam:	5	NA	Write-up and execution of the practical	NA	10

Part C-Learning Resources

Recommended Books/Journals/ e-resources/ Learning Management Systems (LMS):

1. R. S. Aggarwal (2022). *Quantitative Aptitude*. S Chand & Company Limited, New Delhi.
2. A. Guha (2020). *Quantitative Aptitude* (7th Edition). Mc Graw Hill Publications.
3. V. Dyke, J. Rogers and H. Adams (2011). *Fundamentals of Mathematics*, Cengage Learning.
4. A.S. Tussy, R. D. Gustafson and D. Koenig (2010). *Basic Mathematics for College Students*. Brooks Cole.
5. C. C. Pinter (2014). *A Book of Set Theory*. Dover Publications.
6. G. Klambauer (1986). *Aspects of calculus*. Springer-Verlag.

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	60
Skill Enhancement	60
Communication Development	30

SEC-3

Part A – Introduction			
Name of the Subject	Mathematics		
Semester	III		
Nature of Course/Course Composition	Theory + Practical		
Nomenclature of the Course	Calculation Skills with Vedic Mathematics-II		
Course Code	26L5.0-SEC-MAT-301		
Course Type	SEC		
Pre-requisite for the course	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Gain the knowledge to perform multiplication, division, HCF, LCM and factorization of polynomials using Vedic Sutras. Have the procedural knowledge to apply Vedic sutras to solve linear equations, quadratic equations and simultaneous equations.	
	CLO ₂	Gain the cognitive skills to evaluate determinant, inverse of a matrix, derivative and integration of functions with speed and accuracy using Vedic Mathematics. Have the knowledge and understanding of the concepts of Vedic Geometry and Trigonometry.	
	CLO ₃	Attains the cognitive and technical skills to use Vedic sutras and upsutras for solving Algebra, Calculus and Geometry problems with speed and accuracy.	
	Theory	Practical	Total
Credits	2	1	3
Teaching hours per week	2	2	4
Internal Assessment Marks	15	05	20
End Term Exam Marks	35	20	55
Max. Marks	50	25	75
Examination Duration (in Hours)	02	02	
Part B- Contents of the Course			
<u>Instructions for Theory Paper-Setter</u>			
The paper setter shall prepare 5 questions selecting two questions from each of the two units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 7 short answer type questions carrying one mark each (total 07 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt three questions: the compulsory question no. 1 and 1 question from the each of the two units.			
<u>Instructions for Practical Examiner</u>			
Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.			



	Topics	CLO's Attempt	Contact Hours
Unit-I	Multiplication (Quadratic expressions of single variable), Urdhwatirygbhyaam Method, Combined Operations. Division and Factorization: Division (Divisor: Linear expression of single variable), Factorization (Quadratic and cubic polynomials of two variables) , Factorization of quadratic polynomial containing more than two variables. LCM and HCF of polynomials. Solution of Simple Equation, solution of linear equation in one variable, solution of linear equations in two variables, solution of quadratic equations, Solution of simultaneous equations.	CLO ₁	15
Unit-II	Determinant. Inverse of a Matrix. Derivative. Integration. Concept of Baudhayana Number (BN), BN of an angle, Multiplication of a constant in a BN, BN of complementary angles, BN of sum and difference ($\alpha \pm \beta$) of an angle, BN of half angle. Pythagorean triple, Trigonometric relation for half, twice and thrice of angle, sum, difference of angles using triples Vedic Geometry: Angle between two lines, perpendicular distance of line from a point.	CLO ₂	15
Practical Components	The examiner will set 4 questions at the time of practical examination by taking course learning outcomes (CLOs) into consideration. The examinee will be required to solve 2 questions. The evaluation will be done on the basis of practical record, viva-voce and written examination. Problem Solving -Questions related to the following problems will be solved and record of those will be maintained in the Practical Note Book: 1. Multiplication of algebraic polynomials. 2. Division of two polynomials. 3. Factorization of quadratic and cubic polynomials in two or more than two variables. 4. LCM and HCF of algebraic expressions. 5. Solution of linear equations of one and two variables. 6. Solution of quadratic equations. 7. Solution of simultaneous equations. 8. Determinant of order 3 and 4. 9. Derivative of composite functions. 10. Integration of product of two functions without using traditional by-parts method.	CLO ₃	30

	11. Trigonometric relation for twice of angle. 12. Trigonometric relation for thrice of angle. 13. Sum and difference of angles using triples 14. Angle between two straight lines. 15. Perpendicular Distance of line from a point.				
Contact Hours					60
Evaluation Methods					
Internal Assessment	TH-15	PR-5	End Term Examination: 55	TH-35	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/ quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva- voce/Lab records etc.:	NA	5	Written Examination	35	NA
Mid-Term Exam:	5	NA	Write-up and execution of the practical	NA	10
Part C-Learning Resources					
Recommended Books/Journals/ e-resources/ Learning Management Systems (LMS):					
1. U. S. Patankar and S. M. Patankar (2018). <i>Elements of Vedic Mathematics</i> . TTU Press.					
2. V. Singhal (2014). <i>Vedic Mathematics for all ages</i> . Motilal Banarsidas Publishers.					
3. R. K. Thakur (2013). <i>The Essentials of Vedic Mathematics</i> . Rupa Publications. New Delhi.					
4. P. Tiwari and V.K. Pandey (2012). <i>Vedic Mathematics - Modern Research Methods</i> . Campus Books International.					
5. S. K. Kapoor (2006). <i>Vedic Geometry Course</i> . Lotus Press.					
6. A. Gupta (2004). <i>Power of Vedic Mathematics with Trigonometry</i> . Jaico Publishing House.					
7. S.B.K. Krishna Tirthaji (1990). <i>Vedic Mathematics</i> . Motilal Banarsidas, New Delhi.					

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	30
Skill Enhancement	60
Communication Development	15
Indian Knowledge System	30

SEC-3

Part A – Introduction			
Name of the Subject	Mathematics		
Semester	III		
Nature of Course/Course Composition	Theory + Practical		
Nomenclature of the Course	Learning MATLAB Skills		
Course Code	26L5.0-SEC-MAT-302		
Course Type	SEC		
Course Level	200-299		
Pre-requisite for the course	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Develop an understanding of memory and file management, flow control, and the MATLAB programming environment. Apply MATLAB tools for matrix operations, built-in functions, and graphical visualization to solve computational problems and generate plots for analysis, reports, and presentations.	
	CLO ₂	Develop proficiency in using MATLAB to solve polynomial, algebraic, transcendental, and ordinary differential equations, and systems of linear equations. Apply MATLAB tools for curve fitting, interpolation, numerical differentiation, numerical integration, and statistical analysis to solve scientific, engineering, economic, and commercial problems.	
	CLO ₃	Develop cognitive and technical skills to use MATLAB tools in solving various data handling problems related with multidisciplinary subjects and bridge the skill gap. Learn tools and built in functions of MATLAB in solving stated problems. Learn technical skills and understand how to analyze all the results graphically in a very easy manner.	
	Theory	Practical	Total
Credits	2	1	3
Teaching hours per week	2	2	4
Internal Assessment Marks	15	05	20
End Term Exam Marks	35	20	55
Max. Marks	50	25	75
Examination Duration (in Hours)	02	02	



Part B- Contents of the Course

Instructions for Theory Paper-Setter

The paper setter shall prepare 5 questions selecting two questions from each of the two units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 7 short answer type questions carrying one mark each (total 07 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt three questions: the compulsory question no. 1 and 1 question from the each of the two units.

Instructions for Practical Examiner

Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.

	Topics	CLO's Attempt	Contact Hours
Unit-I	Introduction, starting and quitting a MATLAB session, Desktop tools and development environment: command window, command history window, work space current directory, edit window, figure window, help feature. Types of files, Platform dependence, Search path. Control flow and operators, Hierarchy of operations, built in functions, Round off functions, controlling command window input and output. Matrix generation, Array operations: Matrix arithmetic operations, Array arithmetic operations, transposing a matrix, reshaping matrices, concatenating a matrix, special matrices viz. eye, zeros, ones, rand, randn, diag, diag etc., vector generation using linspace, logspace Use of matrix built-in functions: det, diag, eig, inv, norm, rank, sqrtm, expm, logm, rank, lu etc. Basic plotting: creating simple plots, adding title, axis label, and annotations, multiple data in one plot, specifying line style and colors, figure tools, plot editing mode, using function to edit graphs, modify the graph to enhance the presentation, multiple plots in one figure, visualizing functions of two variables: mesh and surface plots. Use of built-in functions plot, subplot, fplot, xlabel, ylabel, title, legend, axis, hold, line, ezplot, ezpolar, ezplot3, ezcontour, ezcontourf, ezsurf, ezsurfc, ezmesh, ezmeshf, view, meshgrid, rotate3d etc. for plotting.	CLO ₁	15



Unit-II	Polynomials, entering a polynomial, polynomial evaluation, roots of polynomial, polynomial arithmetic, polynomial integration (using MATLAB command), polynomial differentiation (using MATLAB command), Evaluation of polynomials. Computation with MATLAB: Solutions of system of linear algebraic equations in many variables, Root finding by iterative simulations, solution of a transcendental equation. Basic symbolic calculus, solutions of first order linear differential equations, first order linear differential equations with initial conditions, second order linear differential equations Use of built-in functions syms, expand, solve, inline, collect, subs, simplify, roots, fzero, feval, fsolve, ode23, ode45 etc. Curve fitting: Linear, quadratic and cubic, Curve fitting with polynomial function, Interpolation, Numerical differentiation, Numerical integration Data Analysis and Statistics: plotting of statistical measures (mean, mode, median, standard deviation, sum, cumulative sum, largest value, smallest value, cumulative product, difference between the successive data points etc.), plot histogram, pie chart, bar graph etc. Use of built-in functions polyfit, polyval, interp1, interp2, interp3, spline, interpft, diff, trapz, quad, quad1, dblquad, mean, median, std, max, min, sum, cumsum, prod, cumprod, sort, pie, pie3, polar, hist, bar, bar3, diff etc.	CLO ₂	15
Practical	The examiner will set 4 questions at the time of practical examination by taking course learning outcomes (CLOs) into consideration. The examinee will be required to solve two problems. The evaluation will be done on the basis of practical record, viva-voce, write up and execution of the program.	CLO ₃	30

	The following practicals will be done using MATLAB/SCILAB software and record of those will be maintained in the practical note book: 1. Practical to demonstrate components in MATLAB/SCILAB environment. 2. Practical to demonstrate tool boxes in MATLAB/SCILAB environment. 3. Practical to demonstrate windows in MATLAB/SCILAB. 4. Program to generate odd/even numbers. 5. Practical to demonstrate basic matrix operations (addition, subtraction, multiplication, transpose, determinant, concatenation etc.). 6. Practical to find inverse of a matrix using built-in function. 7. Practical to determine Eigen values and Eigen vectors of a square matrix using built-in functions. 8. Practical to find roots of an equation using built-in function. 9. Practical to demonstrate fsolve for solution of transcendental equations. 10. Practical to demonstrate built in plotting tools fplot, ezpolar, ezplot, ezcontour, ezsurf, ezcontourf etc. 11. Practical to add title, axis labels, line style, color, annotations etc. to a figure/graph. 12. Practical of solving system of linear equations. 13. Practical to determine a polynomial using method of Least Square Curve Fitting. 14. Practical to determine polynomial fit, analyzing residuals, exponential fit and error bounds from the given data. 15. Practical to fit a straight line of the type $y=ax+b$. 16. Practical to demonstrate statistical toolbox (mean, median, standard deviation, sort etc.). 17. Practical to demonstrate integration and differentiations commands. 18. Practical problems for solving differential equations.		
Contact Hours			60



Evaluation Methods					
Internal Assessment	TH-15	PR-5	End Term Examination: 55	TH-35	PR-20
Class Participation:	5	0	Lab record	NA	05
Seminar/presentation/assignment/quiz/class test etc.:	5	NA	Viva-Voce	NA	05
Seminar/Demonstration/Viva-voce/Lab records etc.:	NA	5	Written Examination	35	NA
Mid-Term Exam:	5	NA	Write-up and execution of the practical	NA	10

Part C-Learning Resources

Recommended Books/Journals/ e-resources/ Learning Management Systems (LMS):

1. Stephan J. Chapman (2020). *MATLAB Programming for Engineers* (6th edition). Cengage Learning.
2. William Palm Lii (2017). *A concise introduction to MATLAB* (2nd edition). Tata McGraw-Hill Education.
3. R. S. Gupta (2015). *Elements of Numerical Analysis* (2nd edition). Cambridge University Press.
4. Steven C. Chapra (2011). *Applied Numerical Methods with MATLAB* (3rd edition). Tata McGraw-Hill Education.
5. Rudra Pratap (2010). *Getting Started with MATLAB: A quick introduction for scientists and engineers*. Oxford University Press.
6. R. K. Bansal, A. K. Goel, M. K. Sharma (2009). *MATLAB and Its applications in Engineering*. Pearson Education India.
7. Dolores Etter (2014). *Introduction to MATLAB*, (3rd edition). Pearson Education India.
8. Marc E. Herniter (2000). *Programming in MATLAB* (1st edition). Cengage Learning.

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	60
Skill Enhancement	60
Communication Development	30

SEC-3

Part A – Introduction			
Name of the Subject	Mathematics		
Semester	III		
Nature of Course/Course Composition	Theory + Practical		
Nomenclature of the Course	Quantitative Aptitude		
Course Code	26L5.0-SEC-MAT-303		
Course Type	SEC		
Course Level	200-299		
Pre-requisite for the course	NA		
Course Learning Outcomes (CLOs) After completing this course, the learner will be able to:	CLO ₁	Comprehend the formulation of equations for specific mathematical problems and use mathematical skills to solve those. Acquire the procedural knowledge to analyze and solve problems related to work & time, work and wages and apply those in real life situations.	
	CLO ₂	To get deeper knowledge and understanding of concepts of Simple interest, Compound Interest, Partnership, Work and time and use this procedural knowledge to perform assigned tasks of solving such problems. Familiarize and get acquainted with various measures of central tendency and using cognitive skills to choose better of these for the available data and draw the inferences/results.	
	CLO ₃	Attain a range of cognitive and technical skills to analyze and comprehend various numerical concepts, e.g., Formulation of equations, S.I. & C.I., Work & time, Work & Wages, Set theory etc. and apply these learned skills and techniques to solve daily life mathematical problems accurately, logically and well in time.	
	Theory	Practical	Total
Credits	2	1	3
Teaching hours per week	2	2	4
Internal Assessment Marks	15	05	20
End Term Exam Marks	35	20	55
Max. Marks	50	25	75
Examination Duration (in Hours)	02	02	



Part B- Contents of the Course

Instructions for Theory Paper-Setter

The paper setter shall prepare 5 questions selecting two questions from each of the two units with consideration given to the Course Learning Outcomes. Among these, question number 1 will be compulsory question comprising 7 short answer type questions carrying one mark each (total 07 marks) and covering the entire syllabus. The remaining questions will be carrying 14 marks each. Examinees will be required to attempt three questions: the compulsory question no. 1 and 1 question from the each of the two units.

Instructions for Practical Examiner

Write-up and execution of the practical will be conducted as per the nature of the practical by the external examiner, with consideration given to the Course Learning Outcomes.

	Topics	CLO's Attempt	Contact Hours
Unit-I	Linear Equations, Quadratic equations, System of algebraic equations in two variables and their applications in simple problems: Problems on ages, Clocks. Time and distance: Problems based on trains, Boats and Streams, Pipes and Cistern. Work and time: Problems on work and time, Work and wages.	CLO ₁	15
Unit-II	Simple interest, Compound Interest, Partnership. Basic idea of set theory to solve practical problems. Trigonometric ratios and identities, Height and distance. Basic idea of Permutations and Combinations. Events and sample space, Probability. Data interpretation: Raw and grouped data, Bar Graph, Pie Chart, Mean, Median and Mode.	CLO ₂	15
Practical	The examiner will set 4 questions at the time of practical examination by taking course learning outcomes (CLOs) into consideration. The examinee will be required to solve 2 questions. The evaluation will be done on the basis of practical record, viva-voce, written examination. Problem Solving- Questions related to the following problems will be solved and their record will be maintained in the Practical Notebook: 1. To solve problems related to clocks. 2. To write the date of birth of your family members and determine the day of their birth.	CLO ₃	30

	3. Compare the simple interest and compound interest for a given amount deposited for fixed time at a fixed rate. 4. Problems related to upstream and downstream of boat. 5. Write down the sample space for tossing three coins one by one and determine the probabilities of occurrence of all possibilities of heads. 6. Problems related to partnership. 7. Draw Venn Diagram for the following (i) Union of sets (ii) Intersection of sets (iii) Difference of sets (iv) Symmetric difference (v) Complement of a set. 8. Draw a bar-graph for the percentage of expenditure occurred on miscellaneous heads (atleast 5 items) for your family income and write your observation in respect of bar- graph. 9. Draw a pie-chart by taking data of problem (8). 10. Taking the annual export data for three companies for last six years , draw a line- graph. 11. Write atleast two different practical problems related to set theory and solve them with the help of venn- diagram/formula. 12. Problem solving related to pipes and cisterns. 13. Problem solving related to determination of time taken by two trains of given lengths, to cross each other, when their speeds are given. 14. Problem solving related to permutation and combination. 15. Problems involving formulation and solution of quadratic equations in one variable. 16. Formulation and solution of realistic problems to solve system of linear equations.		
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	17. Draw the following: (i) linear equation $x = a$ (ii) linear equation $y = a$ (iii) linear equation $ax + by = c$. 18. Draw a graph for system of equations: $ax + by = c$; $dx + ey = f$ (a, b, c, d are real numbers) taking suitable values for a, b, c, d, e, f and depict the (i) Unique Solution (ii) No Solution (iii) Infinitely many solution. Also state the condition for general system $ax + by = c$; $dx + ey = f$ to have all three possibilities for solution (Unique Solution, No Solution & Infinitely many solution).		
Contact Hours			60
Evaluation Methods			
Internal Assessment	TH-15	PR-5	End Term Examination: 55
			TH-35 PR-20
Class Participation:	5	0	Lab record
Seminar/presentation/assignment/ quiz/class test etc.:	5	NA	Viva-Voce
Seminar/Demonstration/Viva-voce/ Lab records etc.:	NA	5	Written Examination
Mid-Term Exam:	5	NA	Write-up and execution of the practical
Part C-Learning Resources			
Recommended Books/Journals/ e-resources/ Learning Management Systems (LMS): 1. R. S. Aggarwal (2022). <i>Quantitative Aptitude</i>. S Chand & Company Limited, New Delhi. 2. A. Guha (2020). <i>Quantitative Aptitude</i> (7th Edition). Mc Graw Hill Publications. 3. V. Dyke, J. Rogers and H. Adams (2011). <i>Fundamentals of Mathematics</i>, Cengage Learning. 4. A.S. Tussy, R. D. Gustafson and D. Koenig (2010). <i>Basic Mathematics for College Students</i>. Brooks Cole. 5. C. C. Pinter (2014). <i>A Book of Set Theory</i>. Dover Publications. 6. G. Klambauer (1986). <i>Aspects of calculus</i>. Springer-Verlag.			

Content Mapping with NEP thrust areas

Field	Hours devoted
Employability	60
Skill Enhancement	60
Communication Development	15

