

Kurukshetra University, Kurukshetra

(Established by the State Legislature Act-XII of 1956)

("A⁺⁺" Grade, NAAC Accredited)



Revised 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 2025-26 (in phased manner)

DEPARTMENT OF MATHEMATICS

KURUKSHETRA UNIVERSITY, KURUKSHETRA -136119

HARYANA, INDIA


Chairman
Deptt. of Mathematics
K.U. KURUKSHETRA.

Kurukshetra University, Kurukshetra

Revised Scheme of Examination for the Mathematics Subject in Under Graduate Programmes

as per NEP 2020 Curriculum and Credit Framework for Undergraduate Programmes

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Semester	Course Type	Applicable Scheme	Course Code	Nomenclature of 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
1	CC-1 MCC-1	Scheme A, B & C	B23-MAT-101	CALCULUS	4	3	1	3	2	5	20	10	50	20	100	3	3
	MCC-2	Scheme C	B23-MAT-102	ADVANCED CALCULUS	4	3	1	3	2	5	20	10	50	20	100	3	3
	CC-M1	Scheme A, B & D	B23-MAT-103	BASIC CALCULUS	2	1	1	1	2	3	10	5	20	15	50	3	3
	MDC 1	Scheme A, B, C & D	B25-MAT-104	INTRODUCTORY MATHEMATICS	3	2	1	2	2	4	15	5	35	20	75	3	3
2	CC-2 MCC-3	Scheme A, B & C	B23-MAT-201	ALGEBRA AND NUMBER THEORY	4	3	1	3	2	5	20	10	50	20	100	3	3


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	DSEC-1	Scheme C	B23-MAT-202	PROGRAMMING IN C	4	3	1	3	2	5	20	10	50	20	100	3	3
	CC-M2	Scheme A, B & D	B23-MAT-203	BASIC ALGEBRA	2	1	1	1	2	3	10	5	20	15	50	3	3
	MDC 2	Scheme A, B, C & D	B25-MAT-204	MATHEMATICS FOR COMMERCE & SOCIAL SCIENCES	3	2	1	2	2	4	15	5	35	20	75	3	3
3	CC-3 MCC-4	Scheme A, B & C	B23-MAT-301	DIFFERENTIAL EQUATIONS-I	4	3	1	3	2	5	20	10	50	20	100	3	3
	MCC-5	Scheme B & C	B23-MAT-302	GROUPS AND RINGS	4	3	1	3	2	5	20	10	50	20	100	3	3
	MCC-2	Scheme B	B23-MAT-102	ADVANCED CALCULUS	4	3	1	3	2	5	20	10	50	20	100	3	3
	MDC 3	Scheme A, B, C & D	B25-MAT-303	APPLICABLE MATHEMATICS	3	2	1	2	2	4	15	5	35	20	75	3	3
	CC-M3	Scheme A, B & D	B25-MAT-304	DIFFERENTIAL EQUATIONS	4	3	1	3	2	5	20	10	50	20	100	3	3


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4	CC-4 MCC-6	Scheme A, B & C	B23- MAT- 401	ANALYTICAL GEOMETRY & VECTOR CALCULUS	4	3	1	3	2	5	20	10	50	20	100	3	3
	MCC-7	Scheme B & C	B23- MAT- 402	LINEAR ALGEBRA	4	3	1	3	2	5	20	10	50	20	100	3	3
	MCC-8	Scheme B & C	B23- MAT- 403	DIFFERENTIAL EQUATIONS-II	4	3	1	3	2	5	20	10	50	20	100	3	3
	DSE-1	Scheme B & C	B23- MAT- 404	PROBABILITY THEORY & STATISTICS	4	3	1	3	2	5	20	10	50	20	100	3	3
			Or														
		Scheme B & C	B23- MAT- 405	SPECIAL FUNCTIONS	4	3	1	3	2	5	20	10	50	20	100	3	3
5	CC-5 MCC-9	Scheme A, B & C	B23- MAT- 501	SEQUENCES AND SERIES	4	3	1	3	2	5	20	10	50	20	100	3	3
	MCC-10	Scheme B & C	B23- MAT- 502	MECHANICS-I	4	3	1	3	2	5	20	10	50	20	100	3	3
	DSE-2	Scheme B & C	B23- MAT- 503	LINEAR PROGRAMMING	4	3	1	3	2	5	20	10	50	20	100	3	3


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			Or														
		Scheme B & C	B23-MAT-504	COMPUTER PROGRAMMING	4	3	1	3	2	5	20	10	50	20	100	3	3
	DSE-3	Scheme B & C	B23-MAT-505	NUMBER THEORY & CRYPTOGRAPHY	4	3	1	3	2	5	20	10	50	20	100	3	3
			Or														
		Scheme B & C	B23-MAT-506	INTEGRAL TRANSFORMS AND FOURIER ANALYSIS	4	3	1	3	2	5	20	10	50	20	100	3	3
6	CC-6 MCC-11	Scheme A, B & C	B23-MAT-601	NUMERICAL ANALYSIS	4	3	1	3	2	5	20	10	50	20	100	3	3
	MCC-12	Scheme B & C	B23-MAT-602	REAL ANALYSIS	4	3	1	3	2	5	20	10	50	20	100	3	3
	DSE-4	Scheme B & C	B23-MAT-603	MECHANICS-II	4	3	1	3	2	5	20	10	50	20	100	3	3
			Or														
		Scheme B & C	B23-MAT-604	CLASSICAL MECHANICS	4	3	1	3	2	5	20	10	50	20	100	3	3


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	DSE-5	Scheme B & C	B23-MAT-605	DISCRETE MATHEMATICS	4	3	1	3	2	5	20	10	50	20	100	3	3
			Or														
		Scheme B & C	B23-MAT-606	MATHEMATICAL MODELLING	4	3	1	3	2	5	20	10	50	20	100	3	3
	CC-M6	Scheme A, B & D	B25-MAT-607	NUMERICAL METHODS	4	3	1	3	2	5	20	10	50	20	100	3	3
		Scheme B & C			Total	Theory	Tutorial/ Practical	L	T	Total	Internal Assessment Marks	End term Examination Marks	Total Marks	Examination hours			
7	CC-H1	Scheme B & C	B23-MAT-701	REAL ANALYSIS-II	4	3	1	3	1	4	30	70	100	3			
	CC-H2	Scheme B & C	B23-MAT-702	COMPLEX ANALYSIS	4	3	1	3	1	4	30	70	100	3			
	CC-H3	Scheme B & C	B23-MAT-703	THEORY OF ORDINARY DIFFERENTIAL EQUATIONS	4	3	1	3	1	4	30	70	100	3			
	DSE-6	Scheme B & C	B23-MAT-704	MECHANICS OF SOLIDS	4	3	1	3	1	4	30	70	100	3			


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			Or											
		Scheme B & C	B23-MAT-705	DIFFERENTIAL GEOMETRY	4	3	1	3	1	4	30	70	100	3
	PC-H1	Scheme B & C	B23-MAT-706	PROGRAMMING LAB-I	4	2	2 Practical	2	4	6	15(T)+15(P)	35(T)+35(P)	100	3 +3
8	CC-H4	Scheme B & C	B23-MAT-801	ABSTRACT ALGEBRA	4	3	1	3	1	4	30	70	100	3
	CC-H5	Scheme B & C	B23-MAT-802	TOPOLOGY	4	3	1	3	1	4	30	70	100	3
	CC-H6	Scheme B & C	B23-MAT-803	MEASURE AND INTEGRATION	4	3	1	3	1	4	30	70	100	3
	DSE-7	Scheme B & C	B23-MAT-804	FIELD THEORY	4	3	1	3	1	4	30	70	100	3
			Or											
		Scheme B & C	B23-MAT-805	ADVANCED DIFFERENTIAL EQUATIONS	4	3	1	3	1	4	30	70	100	3


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	PC-H2	Scheme B & C	B23-MAT-806	PROGRAMMING LAB-2	4	0	4 Practical	0	8	8	30	70	100	3			
	Research	Scheme B & C	B23-MAT-807	DISSERTATION	12							300	300				
	Scheme of VAC, SEC and VOC courses																
Semester	Course Type	ApplicableScheme	Course Code	Nomenclature of the Course	Credits			Contact hours L: Lecture P: Practical			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
3	VAC-3	Scheme C	B23-VAC-308	Mathematics in India: From Vedic Period to Modern Times	2	2	0	2	0	2	15	0	35		50	3	
4	VAC-3	Scheme A, B & D	B23-VAC-418	Mathematics in Everyday Life	2	2	0	2	0	2	15	0	35		50	3	


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4	VAC-4	Scheme C	B23-VAC-418	Mathematics in Everyday Life	2	2	0	2	0	2	15	0	35		50	3	
2	SEC-2	Scheme A, B, C & D	B23-SEC-203	Calculation Skills with Vedic Mathematics-I	3	2	1	2	2	4	15	5	35	20	75	3	3
2	SEC-2	Scheme A, B, C & D	B23-SEC-225	Numerical Ability Enhancement Skills	3	2	1	2	2	4	15	5	35	20	75	3	3
3	SEC-3	Scheme A, B, C & D	B23-SEC-303	Calculation Skills with Vedic Mathematics-II	3	2	1	2	2	4	15	5	35	20	75	3	3
3	SEC-3	Scheme A, B, C & D	B23-SEC-324	Learning MATLAB Skills	3	2	1	2	2	4	15	5	35	20	75	3	3
3	SEC-3	Scheme A, B, C & D	B23-SEC-326	Quantitative Aptitude	3	2	1	2	2	4	15	5	35	20	75	3	3
3	SEC-3	Scheme A, B, C & D	B23-SEC-327	Reasoning	3	2	1	2	2	4	15	5	35	20	75	3	3
6	SEC-4	Scheme A, B, C & D	B23-SEC-406	Basic Mathematical Techniques	3	2	1	2	2	4	15	5	35	20	75	3	3


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Course composition- Theory/Theory +Tutorial

Course Credit	Internal Assessment marks	End term exam marks	Total marks
2	15	35	50
3	25	50	75
4	30	70	100

Course composition- Theory+Practical

Course Credit	Theory		Practical		Total marks
Theory +Practical	Internal Assessment marks	End term exam marks	Internal Assessment marks	End term exam marks	
1+1	10	20	5	15	50
2+1	15	35	5	20	75
2+2	15	35	15	35	100
3+1	20	50	10	20	100
0+4	NA	NA	30	70	100

1. Internal assessment (30%) shall be broadly based on the following defined components of;

- Class participation
- Seminar/Presentation/Assignment/Quiz/class test, etc.
- Mid Term Exam

Total Internal Assessment Marks (Theory)	Class Participation	Seminar/Presentation/Assignment/Quiz/class test, etc.	Mid-Term Exam
10	4	-	6
15	4	4	7
20	5	5	10
25	5	7	13
30	5	10	15


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Total Internal Assessment Marks (Practicum)	Class Participation	Seminar/Demonstration/Viva-Voce/Lab record, etc.	Mid-Term Exam
5		5	NA
10		10	NA
15	5	10	NA
30	5	10	15


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MDC-1

Session: 2025-26

Part A–Introduction

Subject	Mathematics		
Semester	I		
Name of the Course	Introductory Mathematics		
Course Code	B25-MAT-104		
Course Type: (CC/MCC/MDC/CC- M/DSEC/VOC/DSE/PC/AEC/VAC)	MDC		
Level of the course	100-199		
Pre-requisite for the course (if any)	NA		
Course Learning Outcomes (CLOs):	After completing this course, the learner will be able to: 1. Gain the knowledge of set theory, types of sets and operations on sets. Understand various concepts of matrices and determinants, and acquire the cognitive skills to apply different operations on matrices and determinants. 2. To acquire skills to solve linear inequalities and quadratic equations. 3. Gain the knowledge of the concepts of Arithmetic progression and Geometric progression, find A.M., and G.M. of given numbers. 4. Have the conceptual knowledge of straight lines. Find out the slope of a line, angle between two lines, and know about various forms of a straight line. 5. Attain the skills to make use of the learnt concepts of Introductory Mathematics in multidisciplinary learning contexts and to know their applications.		
CLO 5 is related to the practical components of the course.			
	Theory	Practical	Total
Credits	2	1	3
Contact Hours	2	2	4
Internal Assessment Marks	15	5	20
End Term Examination Marks	35	20	55
Examination Time	3 Hrs	3Hrs	
Max. Marks:75			

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

Note: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will contain 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question.

Unit	Topics	Contact Hours
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. An introduction to matrices and their types, Operations on matrices, Symmetric and skew-symmetric matrices, Minors, Co-factors. Determinant of a square matrix.	8
II	Linear inequalities, Algebraic solutions of linear inequalities in two variables and their graphical representation. Quadratic equations, Solution of quadratic equations.	8
III	Arithmetic progression, Geometric progression, Arithmetic mean (A.M.), Geometric mean (G.M.), Relation between A.M. and G.M.	8
IV	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.	8
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.	30

2. Problems based on De Morgan's Laws. 3. Problems related to Venn diagrams. 4. Problems to find determinant of a square matrix of order 3. 5. Problems to find nth term of A.P. and G.P. 6. Problems to find sum of n terms of A.P. and G.P. 7. Problems to find A.M. and G.M. of given numbers. 8. Problems involving formulation and solution of quadratic equations in one variable. 9. Problems to represent solutions of linear inequalities graphically. 10. Problems based on angle between two lines. 11. Problems involving straight lines and their slope.	
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Suggested Evaluation Methods

Internal Assessment: ➤ Theory 15 • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.: 4 • Mid-Term Exam: 7 ➤ Practicum 5 • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: 5 • Mid-Term Exam:	End Term Examination: ➤ Theory 35 Written Examination ➤ Practicum 20 Lab record, viva-voce, written examination.
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Part C-Learning Resources

Recommended Books:

1. C. Y. Young (2021). *Algebra and Trigonometry*. Wiley.
2. S.L. Loney (2016). *The Elements of Coordinate Geometry (Cartesian Coordinates)* (2nd Edition). G.K. Publication Private Limited.
3. Seymour Lipschutz and Marc Lars Lipson (2013). *Linear Algebra*. (4th Edition) Schaum's Outline Series, McGraw-Hill.
4. C.C.Pinter (2014). *A Book of Set Theory*. Dover Publications.
5. J. V. Dyke, J. Rogers and H. Adams (2011). *Fundamentals of Mathematics* (10th Edition), Brooks/Cole.
6. A.Tussy, R. Gustafson and D. Koenig (2010). *Basic Mathematics for College Students* (4th Edition). Brooks Cole.

Part A–Introduction

Subject	Mathematics
Semester	II
Name of the Course	Mathematics for Commerce and Social Sciences
Course Code	B25-MAT-204
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	MDC
Level of the course	100-199
Pre-requisite for the course (if any)	NA
Course Learning Outcomes(CLOs): CLO 5 is related to practical components of the course.	After completing this course, the learner will be able to: 1. Understand and have the procedural knowledge of the concepts of matrices and determinants to solve simultaneous linear equations. 2. Gain the knowledge to find derivatives of simple functions related to commerce and social sciences. Acquire skills to make use of derivatives in realistic problems of the discipline. 3. Have the conceptual knowledge of compound interest, annuity, loan, debenture and sinking funds and attain skills to use these concepts in problem solving. 4. 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. 5. 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
Contact Hours	2	2	4
Internal Assessment Marks	15	5	20
End Term Examination Marks	35	20	55
Examination Time	3Hrs	3Hrs	

Max. Marks: 75

Part B-Contents of the Course

Instructions for Paper- Setter

Note: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will contain 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question.

Unit	Topics	Contact Hours
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. 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.	8
II	Differentiation, Derivatives of simple functions and other functions 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.	8
III	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.	8
IV	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.	8

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 derivatives of simple functions related to commerce and social sciences. 7. Problems to find maxima of profit function, production, demand function and minima of cost function. 8. Problems to find simple and compound interest. 9. Problems based on annuity. 10. Formulation of real life commercial and social science problems (LPP) related to maximizing profits, minimizing costs, minimal usage of resources etc. and their solutions using graphical method. 11. Problems to solve LPP using simplex method.	30
Suggested Evaluation Methods		
Internal Assessment: ➤ Theory 15 • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.: 4 • Mid-Term Exam: 7 ➤ Practicum 5 • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: 5 • Mid-Term Exam:		End Term Examination: ➤ Theory 35 Written Examination ➤ Practicum 20 Lab record, viva-voce, written examination.
Part C-Learning Resources		
Recommended Books: 1. E.T. Dowling (2020). <i>Schaum outlines of Calculus for Business, Economics and the Social Sciences</i>. McGraw Hill. 2. S.C. Gupta and V.K. Kapoor (2014). <i>Fundamentals of Mathematical Statistics</i>. S. Chand & Sons, Delhi. 3. Seymour Lipschutz and Marc Lars Lipson (2013). <i>Linear Algebra</i>. (4th Edition) Schaum's Outline Series, McGraw-Hill. 4. D.C. Sancheti and V.K. Kapoor (2011). <i>Business Mathematics</i>. Sultan Chand and Sons. 5. Holden (2010). <i>Introductory Mathematics for Business and Economics</i>. Ane/pal Exclusive.		

6. E.T. Dowling (2009). *Schaum outlines of Mathematical methods for Business and Economics*. McGraw Hill.
7. E. Don and J. Lerner (2009). *Schaum's outline of Basic Business Mathematics* (2nd Edition). McGraw Hill.
8. L.N.Paul (2002). *Linear Programming: an introductory analysis*. Tata Mcgraw Hill. New Delhi.

MDC-3

Session: 2025-26			
Part A – Introduction			
Subject	Mathematics		
Semester	III		
Name of the Course	Applicable Mathematics		
Course Code	B25-MAT-303		
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	MDC		
Level of the course	200-299		
Pre-requisite for the course (if any)	NA		
Course Learning Outcomes (CLOs):	After completing this course, the learner will be able to: 1. Gain knowledge about quadratic and cubic equations and methods to solve quadratic and cubic equations. Learn the methods to solve simultaneous linear equations in two and three variables. 2. Understand the concepts of probability, conditional probability and Binomial distribution. 3. Acquire cognitive and technical knowledge about a variety of methods of representation of statistical data and methods of measure of central tendency. Analyze the problem and apply the best measure of central tendency to draw inferences from the available data. 4. Understand the concept of correlation, correlation methods and conclude about the type of correlation for the available data. Comprehend the skills of curve fitting. 5. Attain a range of cognitive and technical skills related to various concepts of probability. Have technical and practical skills required for selecting and using suitable methods for data representation and measure of central tendency.		
CLO 5 is related to practical components of the course.			
	Theory	Practical	Total
Credits	2	1	3
Contact Hours	2	2	4
Internal Assessment Marks	15	5	20
End Term Examination Marks	35	20	55
Examination Time	3Hrs	3Hrs	
Max. Marks:75			

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

Note: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will contain 7 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question.

Unit	Topics	Contact Hours
I	Solution of simple quadratic and cubic equations, Solution of simultaneous linear equations upto three variables. Binomial Theorem for positive index and its simple applications.	8
II	Probability, Events, Exhaustive Events, Mutually Exclusive Events, Conditional Probability, Multiplication Theorem on Probability, Independent Events, Theorems of Total Probability, Binomial Distribution for positive index.	8
III	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.	8
IV	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.	8

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. Real life problems leading to quadratic equations. 2. Problem involving solution of simple cubic equations. 3. Formulation and solution of realistic problems to solve system of linear equations. 4. Problems based on Binomial theorem for positive index. 5. Problems based on conditional probability. 6. Problems based on theorems of total probability. 7. Problems based on Binomial distribution for positive index. 8. Problems to compute measures of central tendency. 9. Problems to calculate measures of dispersion. 10. Problem to calculate Karl Pearson's coefficient of correlation. 11. Problem to fit the straight line for the given data. 12. Problem to find lines of regression.	30
Suggested Evaluation Methods		
Internal Assessment: ➤ Theory 15 • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.: 4 • Mid-Term Exam: 7 ➤ Practicum 5 • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: 5 • Mid-Term Exam:		End Term Examination: ➤ Theory 35 Written Examination ➤ Practicum 20 Lab record, viva-voce, written examination.

Part C-Learning Resources

Recommended Books:

1. S.C. Gupta and V.K. Kapoor (2014). *Fundamentals of Mathematical Statistics*, S. Chand & Sons, Delhi.
2. R.V. Hogg, J. W. McKean and A. T. Craig (2013). *Introduction to Mathematical Statistics* (7th edition), Pearson Education.
3. J. 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. G. Klambauer (1986). *Aspects of calculus*. Springer-Verlag.

Session: 2025-26	
Part A–Introduction	
Subject	Mathematics
Semester	III
Name of the Course	Differential Equations
Course Code	B25-MAT-304
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC-M
Level of the course	200-299
Pre-requisite for the course (if any)	Mathematics as a subject at 4.0 Level (Class XII)
Course Learning Outcomes (CLOs):	After completing this course, the learner will be able to: 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. 2. Have procedural knowledge and cognitive and technical skills of solving homogeneous and non-homogeneous second order linear ordinary differential equations with constant coefficients and with variable coefficients. 3. Gain knowledge of basic concepts of partial differential equations. To learn methods and techniques for solving linear PDEs of first order and to acquire technical skills for accomplishing assigned tasks relating to formulation and solution of PDEs in broad multi disciplinary contexts. 4. To understand compatible systems and to learn cognitive and technical skills required for selecting and using relevant Charpit method and Jacobi method. 5. 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 software.
CLO 5 is related to the practical component.	

	Theory	Practical	Total
Credits	3	1	4
Contact Hours	3	2	5
Internal Assessment Marks	20	10	30
End Term Examination Marks	50	20	70
Examination Time	3 Hours	3 Hours	

Max. Marks:100

Part B-Contents of the Course

Instructions for Paper- Setter

Note: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will contain 5 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question.

Unit	Topics	Contact Hours
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.	12
II	Orthogonal trajectories of one-parameter families of curves in a plane. Solutions of linear ordinary differential equations with constant coefficients, linear non-homogeneous differential equations.	12
III	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.	12
IV	Genesis of Partial differential equations (PDE), Concept of linear and non-linear PDEs. Complete solution, general solution and singular solution of a PDE. 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 $q = \partial z / \partial y$. Compatible systems of first order equations. Charpit's method, Special types of first order PDEs, Jacobi's method.	12

Practical

The practical component of the course has two parts, Problem Solving and Practical's using MAXIMA 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.

(B) The following practicals will be done using MAXIMA 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. Solution of differential equations with constant coefficients using MAXIMA.
5. Solution of differential equations with variable coefficients using MAXIMA.
6. Solution of partial differential equations using MAXIMA.
7. To find the solutions Linear differential equations of second order using built in functions of MAXIMA software.

	8. To find numerical solution of a first order ODE using plotdf built in function of MAXIMA. 9. To find exact solutions of first and second order ODEs using ode2 and ic1/ic2 built in functions of MAXIMA. 10. To find exact solutions of first and second order ODEs using desolve and atvalue built in functions of MAXIMA.	
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➤ **Suggested Evaluation Methods**

Internal Assessment: ➤ Theory 20 • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 ➤ Practicum 10 • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam:	End Term Examination: ➤ Theory 50 Written Examination ➤ Practicum 20 Lab record, viva-voce, write up and execution of the program
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Part C-Learning Resources

Recommended Books:

1. Erwin Kreyszig (2011). *Advanced Engineering Mathematics* (10th edition). J. Wiley & Sons.
2. B. Rai& D. P. Choudhury(2006). *Ordinary Differential Equations - An Introduction*. Narosa Publishing House Pvt. Ltd. New Delhi.
3. Shepley L. Ross (2014). *Differential Equations* (3rd edition). Wiley India Pvt. Ltd.
4. George F. Simmons (2017). *Differential Equations with Applications and Historical Notes* (3rd edition). CRC Press. Taylor & Francis.
5. Ian N. Sneddon (2006). *Elements of Partial Differential Equations*. Dover Publications

CC-M6

Session: 2025-26	
Part A – Introduction	
Subject	Mathematics
Semester	VI
Name of the Course	Numerical Methods
Course Code	B25-MAT-607
Course Type: (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	CC-M
Level of the course	300-399
Pre-requisite for the course (if any)	Mathematics as a subject at level 4.5
Course Learning Outcomes (CLOs):	After completing this course, the learner will be able to: 1. Understand the different types of errors, learn techniques to obtain numerical solutions of algebraic and transcendental equations. 2. Have the knowledge and attain numerical skills to find solutions of system of linear equations by different methods. 3. Gain the knowledge to understand the concept of interpolation and extrapolation. Learn various numerical methods to find the value of function and their derivatives using interpolation concept. 4. Have the procedural knowledge and acquire the skills to apply numerical methods for evaluating definite integrals. Learn single step and multi-step methods to solve first order ordinary differential equations. 5. Attain cognitive and technical skills required to solve scientific problems by applying numerical techniques. Learn to write and execute program of numerical methods based on C language.
CLO 5 is related to the practical component of the course.	

	Theory	Practical	Total
Credits	3	1	4
Contact Hours	3	2	5
Internal Assessment Marks	20	10	30
End Term Examination Marks	50	20	70
Examination Time	3 Hours	3 Hours	

Max. Marks: 100

Part B- Contents of the Course

Instructions for Paper- Setter

Note: The examiner will set 9 questions asking two questions from each unit and one compulsory question by taking course learning outcomes (CLOs) into consideration. The compulsory question (Question No. 1) will contain 5 parts covering entire syllabus. The examinee will be required to attempt 5 questions, selecting one question from each unit and the compulsory question.

Unit	Topics	Contact Hours
I	Round-off error, Local and global truncation errors, convergence. Numerical methods for solving algebraic and transcendental equations: Bisection method, False position method, Fixed point iteration method, Newton-Raphson method and Secant method. Newton's iterative method for finding nth root of a number.	12
II	Numerical methods for solving simultaneous linear equations: Gauss-elimination method, Gauss-Jordan method, Triangularization method (LU decomposition method), Crout's method, Iterative methods: Jacobi's method, Gauss-Seidal method.	12
III	Finite Differences operators and their relations. Interpolation with equal intervals: Gregory–Newton forward and backward difference interpolations. Interpolation with unequal intervals: Newton's divided difference formulae, Lagrange's Interpolation formulae. Central Differences: Gauss forward and Gauss backward interpolation formulae, Sterling formula, Bessel's formula. Piecewise linear interpolation, Cubic spline interpolation. Numerical Differentiation: First and second derivative of a function using interpolation formulae.	12

IV	Numerical Integration: Newton-Cote's Quadrature formula, Trapezoidal rule, Simpson's one-third and three-eighth rule. Numerical solution of ordinary differential equations: Single step methods-Picard's method, Taylor's series method, Euler's method, Runge-Kutta Method. Multiple step methods: Predictor-corrector method, Modified Euler's method.	12
Practical		
	This course has programs, based on Programming in C, related to Numerical methods to solve mathematical 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. Practicals: 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 roots of algebraic and transcendental equations using Bisection method. 2. To find roots of algebraic and transcendental equations using Newton Raphson method. 3. To find roots of algebraic and transcendental equations using RegulaFalsi method. 4. To find solution of system of equations using Gauss Elimination method. 5. To find solution of system of equations using Gauss Seidal method. 6. To find approximate value of a function by Newton Forward Interpolation formula. 7. To find approximate value of a function by Newton Backward Interpolation formula. 8. To find approximate value of a function using Lagrange's Interpolation formula. 9. To find first and second order derivatives using interpolation formulas.	30

	10. To evaluate a definite integral using Trapezoidal Rule. 11. To evaluate a definite integral using Simpson 1/3 rule. 12. To evaluate a definite integral using Simpson 3/8 rule. 13. To solve an ordinary differential equation using Euler's method. 14. To find solution of an ordinary differential equation using modified Euler's method. 15. To solve an ordinary differential equation using Runge-Kutta second order and fourth order methods.	
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Suggested Evaluation Methods

Internal Assessment: ➤ Theory 20 • Class Participation: 5 • Seminar/presentation/assignment/quiz/class test etc.: 5 • Mid-Term Exam: 10 ➤ Practicum 10 • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.: 10 • Mid-Term Exam:	End Term Examination: ➤ Theory 50 Written Examination ➤ Practicum 20 Lab record, viva-voce, write-up and execution of programs
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Part C-Learning Resources

Recommended Books:

1. S.D. Conte and C. de Boor (2018). *Elementary Numerical Analysis: An algorithmic Approach*. SIAM.
2. A. Gupta and S.C. Bose (2012). *Introduction to Numerical Analysis* (3rd Edition). Academic Publishers.
3. M.K. Jain, S. R. K. Iyengar and R. K. Jain (2012). *Numerical Methods for Scientific and Engineering Computation* (6th Edition). New Age International Publishers.
4. B. Bradie (2007). *A Friendly Introduction to Numerical Analysis*. Pearson India.
5. C. F. Gerald and P. O. Wheatley (2007). *Applied Numerical Analysis* (7th Edition). Pearson Education India.
6. F.B. Hildebrand (2003). *Introduction to Numerical Analysis* (2nd edition). Dover Publication Inc.
7. R. J. Schilling and S. L. Harris (1999). *Applied Numerical Methods for Engineers using MATLAB and C*. S. Chand (G/L) & Company Ltd.