Department of Liberal Education
Era University, Lucknow
Course Outline
Effective From: 2023-24

Name of the Program	**B.A. / B.Sc. (LIBERAL EDUCATION)**			**Year/ Semester:**	**1st / 2nd**
Course Name	**Linear Algebra and Calculus**	**Course Code:**	**MT102**	**Type:**	**Theory**
Credits	**05**			**Total Sessions Hours:**	**75 Hours**
Evaluation Spread	**Internal Continuous Assessment:**	**50 Marks**		**End Term Exam:**	**50 Marks**
Type of Course	○ Compulsory	◉ Core		○ Creative	○ Life Skill
Course Objectives	1. To familiarize students with mathematical concepts and terminology involved in linear algebra. 2. To introduce the importance of linear algebra, applied to computer and other natural sciences. 3. To introduce the concept of linear equations, matrix algebra and determinants. 4. Understand limits and rates of change, continuity, differential calculus and various rules to find the differentiation of algebraic and transcendental functions, application of differentiation in real life situation. 5. Understand integral calculus and various rules to integrate the functions. Application of definite integrals.				
Course Outcomes (CO): *After the successful course completion, learners will develop following attributes:*					
Course Outcome (CO)	**Attributes**				
CO1	Students will be able to understand the concept of matrix, type of matrices, algebraic properties of matrices and method to find the invertible matrix.				
CO2	Understand the concept of determinant, properties of determinant and use of it to find the solution of matrix using Cramer's rule.				
CO3	Compute limits (tangents and velocities) which give rise to differential calculus (derivative). Calculate derivatives of algebraic and transcendental functions and to use derivative to solve problems (rate of change and approximation of functions).				
CO4	Understand the concept of integral calculus (*indefinite and definite integrals).* Able to understand the application of integration.				
Pedagogy	Interactive, discussion-bases, student-centered, presentation.				
Internal Evaluation Mode	Mid-term Examination: 20 Marks Activity: 10 Marks Class test: 05 Marks Online Test/Objective Test: 05 Marks Assignments/Presentation: 05 Marks Attendance: 05 Marks				
Session Details	**Topic**			**Hours**	**Mapped CO**
Unit 1	**Matrix:** Introduction of Matrix, basic properties of matrices, Type of Matrices, additions, subtractions and multiplications of matrices and their properties. Elementary operation on a matrix, Elementary			18	CO1

	matrix, Orthogonal matrix, Cofactor matrix and Adjoint matrix. Inverse of Square matrix, Properties of Inverse Matrix, Rank of Matrix and Application of Matrix. **Activity:** **Preparation for activity:** To enjoy the study of matrix and its properties. **Case** : When three persons A, B and C play match with each other, also the paths exist when each one of them goes to other an comes back.		
Unit 2	**Determinant:** Determinants: Evaluating Determinant of order 2 and order 3. Properties of Determinants. Application of Determinant: Area of triangle in determinants form, Test for collinear points and Inverse of matrix using adjoint matrix. Solution of system of linear equation by Cramer's rule, Matrix method and Gauss-Elimination method. Eigenvalues and Eigenvectors. **Activity:** **Preparation for activity:** To enjoy the study of determinant and its properties. **Case:** When we take a calendar of any month of any year amazing matrix exist.	17	CO1, CO2
Unit 3	**Limits:** Introduction to Limit, Limit of a Function Numerically. Determining limits graphically, Infinite limit. **Continuity:** Continuity of a Function. Discontinuity of functions. Tangents, velocities, and other rate of change. **Differentiation:** Introduction of differentiability of functions, differentiation rules, concept of differential coefficients, Derivative of a function, Derivative of a product of a constant and a function, Derivative of the sum or difference of two functions, Differentiation of standard functions, function of function, Parametric differentiation, Successive differentiation. **Activity:** Preparation for activity:Students will draw the graph of tangent and normal equations. **Case:** Find the equation of tangent and equation of normal of any curve at given point, also draw the graph on chart paper.	20	CO3
Unit 4	**Integral Calculus:** Indefinite Integrals: Introduction of Anti – differentiation or Integration, Indefinite Integrals of standard form, Basic formulas: Integration by parts, Integration by substitution and Partial fraction form. Definite integrals: Evaluation of definite integrals, Properties of definite integrals and applications. Introduction of double and triple integral. **Activity:** **Preparation for activity:** Students will study the application of integration. **Case:** Find the area by single integration and area between curves.	20	CO4

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2								2	2				
CO2										1	2			1
CO3						2	3		1			2		
CO4	1			1						1		1		1

Strong contribution-3, ***Average contribution-2 ,*** ***Low contribution-1,***

Suggested Readings:

Text- Books	1. Grewal, B. S., (2012). Higher Engineering Mathematics. Delhi: Khanna Publishers. 2. Narayan, S., Textbook of differential Calculus. Delhi, S. Chand Publishing House.
Reference Books	1. Dass, H. K., Introduction to Engineering Mathematics *(Volume1)*. Delhi: S. Chand & Company Pvt. Ltd. 2. Goel, M., Engineering Mathematics *I*, Delhi: University Science Press (An Imprint of Laxmi Publications Pvt. Ltd.)
Para Text	**Unit 1:** 1. https://www.youtube.com/watch?v=rS9AwyRbB7g **Unit 2:** 1. https://www.youtube.com/watch?v=vwJAYTWOa0g 2. https://www.youtube.com/watch?v=54_XRjHhZzI&t=1286s **Unit 3:** 1. https://www.youtube.com/watch?v=vKtSA-oeq4I 2. https://www.youtube.com/watch?v=962lLfW-8Jo 3. https://www.youtube.com/watch?v=EY6FHX6asU0 **Unit 4:** 1. https://www.youtube.com/watch?v=b2ZFpE_yrLg 2. https://www.youtube.com/watch?v=aiBD9aI69C8 3. https://www.youtube.com/watch?v=K0ORDCt5Ig0

Recapitulation & Examination Pattern

Internal Continuous Assesment:

Component	Marks	Pattern
Mid Semester	20	**Section A:** Contains **10** MCQs/Fill in the blanks/One Word Answer/ True-False type of questions. Each question carries **0.5 mark.** **Section B:** Contains **07** descriptive questions out of which **05** questions are to be attempted. Each question carries **03 marks**.
Activity	10	Will be decided by subject teacher.
Class Test	05	Contains **05 descriptive questions.** Each question carries **01** mark.
Online Test/ Objective Test	05	Contains **10 multiple choice questions.** Each question carries **0.5** mark.
Assignment/ Presentation	05	Assignment to be made on topics and instruction given by subject teacher.
Attendance	05	As per policy.
Total Marks	**50**	

Course created by: **Dr. Sheeba Rizvi**

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Signature:

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Signature: