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:**	**2nd / 4th**
Course Name	**Numerical Analysis**	**Course Code:**	**MT202**	**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	The objective of this course is to provide conceptual understanding of various numerical methods, in particular, with reference to numerical solution of nonlinear equations and system of linear equations, interpolation, numerical differentiation and integration and numerical solution of ordinary differential equations. Important theorems and different formulae for various numerical methods to be covered with an aim of helping the students to understand the fundamentals, concepts and practical use of these methods in the field of computer sciences and applications.				

Course Outcomes (CO): *After the successful course completion, learners will develop following attributes:*

Course Outcome (CO)	**Attributes**
CO1	Using appropriate numerical methods, determine the solutions to given non-linear equations.
CO2	Using appropriate numerical methods, determine approximate solutions to linear equations.
CO3	Using appropriate numerical methods, determine approximate solutions to systems of ordinary equations.
CO4	Demonstrate the use of interpolation methods to find intermediate values in given graphical and/or tabulated data.
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	**Error:** Machine epsilon, absolute, relative and percentage errors, , General error formula. **Algebraic and Transcendental Equations:** Bisection method, Iteration method, False position method, Newton-Raphson method, Ramanujan's Method, Iterative method for solution of system of equations, Jacobi and Gauss-Seidel method.	20	CO1

	Activity: To find the the root of non-linear equation.		
Unit 2	**Finite Differences and Interpolation:** Introduction, Difference operator, Difference tables, Factorial polynomials, Summation of series. Newton's forward and backward differences, Lagrange's interpolation, Newton's divided difference formula for unequal interval, Gauss's Interpolation formula, Starling formula. Bessel's formula for equal interval. **Activity:** Application based calculation using Interpolation formula.	20	CO4
Unit 3	**Numerical Integration and differentiation:** Introduction, Numerical differentiation, Numerical integration by Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule, Boole's and Weddle's rule. **Activity:** Find the maximum and minimum value using numerical differentiation methods.	20	CO2
Unit 4	**Solution of Differential Equations:** Picard's method, Euler's method, modified Euler's method, Taylor's series method and Ranga-Kutta method for 2^{nd} and 4^{th} order. **Activity:**Assignment based on application of different method.	15	CO3

CO-PO and PSO Mapping

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

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

Suggested Readings:

Text- Books	1. Sastry, S. S., (2012). Numerical Analysis. Prentice Hall India Learning Private Limited. 2. Kandasamy, P., Numerical Method. Delhi: S. Chand & Co Ltd.
Reference Books	1. Goel, M. Computer Based Numerical Technique. Delhi: S. Chand and Sons Publication.
Para Text	**Unit 1:** 1. https://www.youtube.com/watch?v=PBjGdQOghJE **Unit 2:** 1. https://www.youtube.com/watch?v=1pJYZX-tgi0 2. https://www.youtube.com/watch?v=hFVo0BovG4c 3. https://www.youtube.com/watch?v=8T9X-xU2dSM **Unit 3:** 1. https://www.youtube.com/watch?v=7eHuQXMCOvA 2. https://www.youtube.com/watch?v=3j0c_FhOt5U **Unit 4:** 1. https://www.youtube.com/watch?v=iviiGB5vxLA 2. https://www.youtube.com/watch?v=KMt8KtSmDno

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: