KU5DSEMAT301: NUMERICAL ANALYSIS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
V	DSE	300-399	KU5DSEMAT301	4	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4		1	30	70	100	2

Course Description

This course offers a comprehensive introduction to Numerical Analysis, focusing on the development and analysis of algorithms for obtaining approximate solutions to mathematical problems. Topics include error analysis, solutions of nonlinear equations, interpolation and polynomial approximation, numerical differentiation and integration, and the numerical solution of systems of linear equations and ordinary differential equations. Emphasis is placed on both the theoretical understanding of numerical methods and their practical implementation using computational tools. The course is designed to equip students with the skills needed to solve real-world problems where exact analytical solutions are difficult or impossible to obtain.

Course Prerequisite

Derivatives, integrals and the fundamentals of differential equations.

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Understand solution of transcendental equation	Understand
2	Understand bisection and Regula-falsi method	Understand
3	Understand Lagrange interpolation, Finite difference operators and finite differences, Newton's interpolation formulae	Understand
4	Understand Trapezoidal rule and Simpson's rule	Understand
5	Understand Taylor series method, Euler method, Runge-Kutta methods (2^{nd} order). .	Understand

Mapping of Course Outcomes to PSOs							
	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✔						
CO 2	✔						
CO 3	✔						
CO 4	✔						
CO 5	✔						

COURSE CONTENTS

Contents for Classroom Transaction

MODULE	UNIT	DESCRIPTION	HOURS
I		**Solution of Algebraic and Transcendental Equation**	**14**
	1	Introduction to solution of algebraic and transcendental equation	
		a) Initial approximations	
	2	Bisection method,	
	3	Regula-falsi method	
II		**Interpolation**	**15**
	1	Interpolation with unevenly spaced points	
		a) Lagrange interpolation	
	2	Interpolation with uniform spaced points	
		a) Finite difference operators and finite differences (exclude central difference operator, table 4.6 and relations between differences and derivatives)	
		b) Newton's interpolation formulae	
III		**Numerical Integration**	**12**
	1	Trapezoidal rule	
	2	Simpson's rule	
IV		**Numerical Solutions of Ordinary Differential Equations**	**14**
	1	Introduction	
	2	Taylor series method	
	3	Euler method	
	4	Runge Kutta methods (2^{nd} order).	

V	**Teacher Specific Module**	**5**
	Directions	
	7. Central difference 8. Runge Kutta methods (4^{th} order).	

Essential Readings

1. Mathematical Methods, S. R. K. Iyengar, R.K. Jain. Narosa (2^{nd} edition)

Reference Distribution

Module	Unit	Reference No.	Sections	Remarks
I	1	1	3.2	
	2	1	3.3	
	3	1	3.4	
II	1	1	4.2	4.2.2 and 4.2.3 excluded
	2	1	4.3	exclude central difference operator, table 4.6 and relations between differences and derivatives
III	1	1	6.3.1	
	2	1	6.3.2	
IV	1	1	7.1	
	2	1	7.3	
	3	1	7.4	
	4	1	7.5	4^{th} order excluded

Suggested Readings

1. S. S. Sastry, Introductory Methods of Numerical Analysis, PHI (5^{th} edition)

2. S. Sankara Rao, Numerical methods of Scientists and Engineers (Third Edn), PHI; 2007

3. F.B. Hildebrand, Introduction Numerical Analysis, Dover publications, 2013.

4. J.B. Scarborough, Numerical Mathematical Analysis, Oxford and IBH, 2005.

Assessment Rubrics

Evaluation Type		Marks
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper	12
b)	Assignment	12
c)	Seminar	6
Total		**100**

* A student has to appear for at least two written tests. The average mark of the best two tests is to be considered for the internal mark.

** **Use of Scientific Calculators below 100 functions (that is, upto *fx 99*) shall be permitted.**