P.B. SIDDHARTHA COLLEGE OF ARTS & SCIENCE

Siddhartha Nagar, Vijayawada – 520 010
Reaccredited at 'A+' level by NAAC
Autonomous&ISO 9001:2015 Certified

Title of the Course: NUMERICAL METHODS
Semester : II

Course Code	22MA2T2	Course Delivery Method	Blended Mode
Credits	4	CIA Marks	30
No. of Lecture Hours / Week	4	Semester End Exam Marks	70
Total Number of Lecture Hours	60	Total Marks	100
Year of Introduction : 2020-21	Year of offering : 2022-23	Year of Revision: ---	Percentage of Revision : ---

Course Objectives:
This Course introduces various Numerical methods for solving Mathematical problems that arise in Science and Engineering and helps to choose, develop and apply the appropriate Numerical techniques for the Mathematical problems.

CO-NO	COURSE OUTCOME	BTL	PO	PSO
CO1	solve first and second order Transcendental and Polynomial Equations using different iteration methods.	**K3**	**1**	**2**
CO2	solve System of Linear Algebraic Equations and Eigen Value Problems.	**K3**	**7**	**2**
CO3	compare the viability of different approaches to the numerical solution of problems arising in interpolation and approximation.	**K3**	**3**	**2**
CO4	evaluate a derivative at a value using an appropriate numerical method and calculate the value of a definite integral.	**K3**	**7**	**2**
CO5	derive and apply numerical methods like single step methods, multistep methods to solve the linear system of equations.	**K3**	**1**	**1**

Mapping of Course Outcomes:

CO-PO-PSO MATRIX										
	CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
22MA2T2	CO1	3								3
	CO2							3		3
	CO3	2								3
	CO4							3		3
	CO5	3							2	

UNIT-I:

Transcendental and Polynomial Equations: Introduction - Bisection method - Iteration methods based on first degree equation - Secant method –Regula-Falsi method - Newton Raphson method - Iteration method based on second degree equation – Muller method, Chebyshev method- Rate of convergence of Secant method - Newton Raphson method.

[Above topics from Chapter-2 of the Prescribed Book [1]]

UNIT-II:

System of Linear Algebraic Equation and Eigen Value Problems: Introduction - Direct methods - Gauss Elimination Method- Gauss – Jordan Elimination Method - Triangularisation method - Iteration Methods- Jacobi iteration Method - Gauss-Seidel Iteration Method - Eigen values and Eigen vectors. [Above topics from Chapter-3 of the Prescribed Book [1]]

UNIT-III:

Interpolation and Approximation: Introduction - Lagrange Interpolation – Newton's Divided Difference Interpolation - Finite Difference Operators - Interpolating Polynomials using finite differences- Gregory- Newton forward difference interpolation- Gregory- Newton Backward difference interpolation - Hermite interpolation - Approximation: Least Square approximation.

[Above topics from Chapter-4 of the Prescribed Book [1]]

UNIT-IV:

Numerical Differentiation and Integration: Introduction – Numerical differentiation: Methods based on Interpolation- Methods based on finite differences.

Numerical Integration: Trapezoidal rule – Simpson's rule -Composite integration methods.

[Above topics fromChapter-5 of the Prescribed Book [1]]

UNIT-V:

Numerical solutions to Ordinary Differential Equations – Euler Method–Backward Euler Method – Midpoint Method-Runge-Kutta methods: Euler - Cauchy Method- Modified Euler-Cauchy Method- Runge-Kutta second order method-Runge-Kutta fourth order method. [Above topics from Chapter- 6 of the Prescribed Book [1]]

PRESCRIBED BOOK :

1. "Numerical Methods for Scientific and Engineering Computation", M. K. Jain, S. R. K. Iyengar, R. K. Jain, New Age International, 6th Edition.

REFERENCE BOOK:

"An Introduction to Numerical Analysis" Kendall E. Atkinson.

Course has Focus on :Foundation

Websites of Interest:

1. www. nptel.ac.in
2. www.epgp.inflibnet.ac.in
3. www.ocw.mit.edu

P B SIDDHARTHA COLLEGE OF ARTS AND SCIENCE::VIJAYAWADA

(An Autonomous college in the jurisdiction of Krishna University)

M. Sc. Mathematics

Second Semester

NUMERICAL METHODS-22MA2T2

Time: 3 Hours **Max. Marks : 70**

SECTION-A

Answer all questions. **(5x4=20)**

1 a) Explain bisection method. (CO1, L1)

(OR)

b) Explain Regula-Falsi method. (CO1, L1)

2 a) Explain Gauss Elimination Method . (CO2, L2)

(OR)

b) Find the eigen values of the matrix $A=\begin{pmatrix}1 & 2 & 3\\ 5 & 0 & 2\\ 4 & 6 & 3\end{pmatrix}$ (CO2, L2)

3 a) Prove that (i) $\Delta=E-1$ (ii) $\nabla = 1 - E^{-1}$ (CO3, L1)

(OR)

b) Find the third difference with arguments 2,4,9,10 of the function $f(x) = x^3 - 2x$ (CO3, L1)

4 a) Explain Newton's backward interpolation method. (CO4, L2)

(OR)

b) Explain Simpson's $1/3^{rd}$ rule. (CO4, L2)

5 a) Solve the differential equation $y' = t + y$ with $y(1) = 0$, by Taylor series method to obtain $y(1.2)$ with $h = 0.1$. (CO5, L3)

(OR)

b) Explain second order Runge-Kutta method. (CO5, L3)

SECTION- B

Answer all questions. All questions carry Equal Marks. **(5x10 = 50)**

6 a) Use Newton-Raphson method to obtain a root, correct to 3 decimal places of the equation $x + \log x = 2$. (CO1, L3)

(OR)

b) Find a root of the equation $f(x) = x^3 - 4x - 9 = 0$, using the bisection method in four stages. (CO1, L3)

7 a)Solve the equations 10x+2y+z=9, 2x+3y-2z = -44, 2x+3y+10z=22 by using Gauss –Seidal method. (CO2, L3)

(OR)

b)Solve the system of linear equations $x_1+x_2+x_3=1$, $4x_1+3x_2-x_3=6$, $3x_1+5x_2+3x_3=14$, by triangulation method. (CO2,L3)

8 a)The values of x and y are given as below:

x	5	6	9	11
f(x)	12	13	14	16

Find the value of y at x=10 by using Lagrange's interpolation formula. (CO3, L4)

(OR)

b) Given the following values of f(x) and $f^1(x)$.

x	f(x)	$f^1(x)$
-1	1	-5
0	1	1
1	3	7

Estimate the values of f(−0.5) and $f^1(0.5)$ using Hermite interpolation. (CO3, L4)

9 a) The following data for f(x) =x^4 is given (CO4, L3)

x	0.4	0.6	0.8
f(x)	0.0256	0.1296	0.4096

Find $f^1(0.8)$ and $f^{11}(0.8)$ using quadratic interpolation.

(OR)

b) (i)Evaluate $\int_{-2}^{2} \frac{x}{5+2x}\,dx$ by using Trapezoidal rule with 5 ordinates.

(ii) Evaluate $\int_{0}^{2} \frac{dx}{x^3+x+1}$ by using Simpson's 1/3 rule with h=0.25 (CO4, L3)

10 a) Solve the initial value problem $y^1=-y^2$, with y(1)=1 using Euler method and compute y(1.2) using h=0.1. (CO5, L4)

(OR)

b) Solve $u^1=-2tu^2$ with u(0)=1 and h=0.2 on the interval [0, 0.4] using the fourth order classical Runge-Kutta method. (CO5, L4)

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