COMPUTATIONAL METHODS

Course Code	22MEMD1T5A	**Year**	I	**Semester**	I
Course Category	Programme Elective	**Branch**	ME	**Course Type**	Theory
Credits	4	**L-T-P**	4-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	40	**Semester End Evaluation:**	60	**Total Marks:**	100

Course outcomes: At the end of the course, the student will be able to:

CO	Statement	BTL	Units
CO1	Solve the linear and non linear system of equations using numerical methods and understand the concept of numerical integration.	L3	1
CO2	Solve the boundary value and characteristic value problems and using regression analysis fit an approximation of functions.	L3	2
CO3	Find the temperature distribution in a rectangular plates using finite difference method.	L3	3
CO4	Find the temperature distribution in a rod and solve the wave equation by finite difference method.	L3	4

Contribution of Course outcomes towards achievement of programme outcomes & Strength of correlations (High:3, Medium: 2, Low:1)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	3		1		1							1
CO 2	3	3	3		1		1							1
CO 3	3	3	3		1		1							1
CO 4	3	3	3		1		1							1

Syllabus		
Unit	**Contents**	**Mapped CO**
1	**INTRODUCTION TO NUMERICAL METHODS APPLIED TO ENGINEERING PROBLEMS:** Examples, solving Sets of equations – Matrix notation – Determinants and inversion – Iterative methods –Relaxation methods – System of non-linear	**CO1**

	equations. **NUMERICAL INTEGRATION:** Newton-Cotes integration formulas – Simpson's rules, Gaussian quadrature. Adaptive integration.	
2	**BOUNDRY VALUE PROBLEMS AND CHARACTERISTIC VALUE PROBLEMS:** Shooting method – Solution through a set of equations – Derivative boundary conditions – Rayleigh – Ritz method –Characteristic value problems. **CURVE FITTING AND APPROXIMATION OF FUNCTIONS:** Least square approximation fitting of non- linear curves by least squares –regression analysis- multiple linear regression, non linear regression.	**CO2**
3	**NUMERICAL SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS:** Laplace's equations – Representations as a difference equation – Iterative methods for Laplace's equations – poisson equation – Examples – Derivative boundary conditions – Irregular and non – rectangular grids – Matrix patterns, sparseness – ADI method – Finite element method.	**CO3**
4	**PARABOLIC PARTIAL DIFFERENTIAL EQUATIONS:** Explicit method- Crank-Nickelson method – Derivative boundary condition, Stability and convergence criteria– Finite element for heat flow. **HYPERBOLIC PARTIAL DIFFERENTIAL EQUATIONS:** Solving wave equation by finite differences- stability of numerical method – method of characteristics-wave equation in two space dimensions.	**CO4**

Learning Resources
Text Book(s): 1. Numerical Methods for Engineers by Steven C.Chapra, Raymond P.Canale, Tata Mc- Graw hill. 2. Applied numerical analysis by Curtis F.Gerald, partick.O.Wheatly, Addison- wesley, 1989. 3. Numerical methods (2nd edition) by Douglas J..Faires,Riched Burden, Brooks/cole publishing , 1998.
References: **1.** Numerical mathematics and computing (4th edition) by Ward cheney & David Kincaid, Brooks/cole publishing 1999. **2.** Mathematical Methods for Physics and Engineering by Riley K.F.M.P.Hobson &Bence S.J, Cambridge University press, 1999.