VIII Semester (2019-20)

15UMAE875	Applied Numerical Methods	(4 - 0 - 0) 4 : 52 Hrs.

Course Learning Objectives:
Study the numerical methods to solve algebraic, transcendental equations, partial differential equations and boundary value differential equations.

Course outcome:

COs	Description of the Course Outcome: At the end of the course the student will be able to:	Mapping to Pos (1-12)		
		Mastering 3	Moderate 2	Introductory 1
CO-1	Apply the techniques of QR and singular value decomposition, least square approximation in solving inconsistent linear systems.		1	
CO-2	Employ interpolation and extrapolation to analyze the experimental data and predict.		1	
CO-3	Apply Numerical method to solve boundary valued differential equation.	1		
CO-4	Apply Numerical Integration to compute Area .	2		
CO-5	Apply the concept of Rank to solve Engineering Application Problems.	1		
CO-6	Apply suitable Numerical method to solve partial differential equation.		1	

Contents:

Chapter I

Linear Algebra -I:
Condition number of a matrix L-U factorization method (Crout's method), Partition method. Bounds for Eigen values, Jacobi's method. Given's method. **10 Hrs**

Chapter II

Linear Algebra-II: Gram-Schmidt orthogonalization process. QR decomposition, singular value decomposition, least square approximations**.** Applications of SVD-PCA (Principal component analysis. Multi-regression analysis. **10 Hrs**

Chapter III

Interpolation and extrapolation
Central differences, central difference interpolation formulae. Gauss's forward interpolation formula. Gauss's backward interpolation formula, Stirling's interpolation formula, Everett's interpolation formula, Bessel's interpolation formula. Cubic Spline interpolation.

Numerical Differentiation
Derivatives using Stirling's formula, Bessel's formula.

Numerical Integration

Romberg integration, Gaussian quadrature, double integration by Trapezoidal and Simpson's l/3rd rules. **12 Hrs**

Chapter IV

Numerical solution of ODE:

Picard's method, Taylor's series method for simultaneous first order ordinary differential equations and second order Oedinary differential equations. Runge-Kutta method for simultaneous first order O.D.E and second order O.D.E, Linear Shooting method. Finite difference method. **10 hrs**

Chapter V

Numerical solution of PDE:

Numerical solution of one dimensional heat equation. Bendre-Schmidt's method. Crank-Nicolsen method. Numerical solution of one dimensional wave equation; explicit method problems. Numerical solution of two dimensional Laplace equation. **10 Hrs**

References

1. Richard. L. Burden, J. Douglas Faires, Numerical Analysis, Thompson Publishing Company edition - 2001.
2. M.K. Jain, S.R.K. lyengar and R.K. Jain - Numerical methods for scientific and Engineering computation New Age Internationa! Publisher - 5lh edition - 2007.
3. Anthony Ralston, Philip Rabinowitz - A first course in Numerical Analysis - McGraw Hill Publication - 2"J edition – 2001
4. B.S.Grewal-Numerical methods in engineering and science- Khanna Publishers 9th edition- 2010.

Pos-	PO-1	PO-2
Mapping Level	**2**	**3**