DEPARTMENT OF MATHEMATICS

Semester: III **Integrated M.Sc. Mathematics** **Academic Year: 2019 -20**

Subject: 060090303 CC7 Fundamentals of Numerical Analysis

Teaching Schedule

Course Objectives: To study the fundamental concepts and mathematical steps for solution of equations, solution of linear system, Eigen value problems and interpolation methods so that students get sound knowledge and important aspects of the subject.

Course outcomes: Upon completion of the course, students shall be able to

CO1: calculate the numerical error viz. absolute error, relative error and percentage error in the solution.

CO2: understand the different numerical approach to solve the Algebraic and Transcendental equations with error part.

CO3: develop skill of solving the linear system of equations through various matrix Inversion methods.

CO4: derive all eigen values or a maximum eigen value and the related eigen vectors of a Matrix.

CO5: predict the missing data within the range of given information using various difference operators like forward, backward and central.

CO6: achieve numerical solution as an alternative way of analytical solution of a problem.

Unit	Sub Unit	No. of Lect.(s)	Topics	Reference Chapter/ Additional Reading	Teaching Methodology to be used	Active Learning Activities	Evaluation Parameter
Unit 1: Error analysis and solutions of algebraic and transcendental equations:							
[10]	1.1	2	Errors in computations	Ch#1, Ch#2 Numerical Methods for Scientists and Engineers, K. Sankara Rao	Chalk & Talk	**For Slow Learner:** Students must write answer of question(s) given by teacher after completion of each method and verified by teacher to resolve any query of students. **For Active Learner:** Student will solve exercise given in book after completion of Unit.	Unit Test -1 Assignment-1
	1.2	1	Bisection method				
	1.3	1	Regular-Falsi Method				
	1.4	2	Iteration method				
	1.5	1	Newton-Raphson method				
	1.6	1	Secant method				
	1.7	2	system of non- linear equations				

Unit 2: Numerical solution of linear system equations and matrix Inversion:							
[16]	2.1	2	Gauss Elimination method	Ch#3 Numerical Methods for Scientists and Engineers S.K. Sankara Rao	Chalk & Talk	**For Slow Learner:** Students must write answer of question(s) given by teacher after completion of each method and verified by teacher to resolve any query of students. **For Active Learner:** Student will solve exercise given in book after completion of Unit.	Unit Test -1 and 2 Assignment-2
	2.2	1	Partial pivoting				
	2.3	1	Gauss Jordan method				
	2.4	2	LU decomposition				
	2.5	1	Gauss Jacobi method				
	2.6	2	Gauss seidal method				
	2.7	2	Relaxation method				
	2.8	5	Matrix inversion method : Gaussian elimination method and Gauss Jordan method				
Unit 3: Eigen value problems:							
[06]	3.1	1	Jacobi method	CH#4 Numerical Methods for Scientists and Engineers S.K. Sankara Rao	Chalk & Talk	**For Slow Learner:** Students must write answer of question(s) given by teacher after completion of each method and verified by teacher to resolve any query of students. **For Active Learner:** Student will solve exercise given in book after completion of Unit.	Unit Test -2 Assignment-3
	3.2	1	Power method				
	3.3	1	QL method				
	3.4	1	Qr method				
	3.5	1	LU method				
	3.6	1	Generalized Eigen value problem				
Unit 4: Interpolation:							
[20]	4.1	1	Finite differences operators	CH#6 Numerical Methods for Scientists and Engineers S.K. Sankara	Chalk & Talk	**For Slow Learner:** Students must write answer of question(s) given by teacher after completion of each method and verified by teacher to resolve any query of students.	Internal Examination Assignment-4
	4.2	3	Newton's formulae for interpolation				
	4.3	2	Central difference Interpolation formulae				
	4.4	2	Lagrange's Interpolation				

			formulae	Rao		**For Active Learner:** Student will solve exercise given in book after completion of Unit.	
	4.5	2	Divided Differences				
	4.6	3	Inverse interpolation				
	4.7	4	Interpolation in two dimensions				
	4.8	3	Cubic spline interpolation				

Text books:

1. K. Sankara Rao. ," Numerical Methods for Scientists and Engineers"- PHI learning private Ltd., 2012

Reference books:

1. S. S. Sastry , " Intriduction of Numerical Analysis"- PHI learning private Ltd. , 2010.
2. Golub. G. H. and Ortega. J. M., "Scientific Computing and differential equations: An introduction to Numerical Methods", Academic Press, 1992.
3. Atkinson. K. E., "An introduction to Numerical Analysis", Wiley, 1989.
4. Jain. M. K., Iyenger. S. R. K., Jain. R. K., "Numerical Methods for Scientific and Engineering Computation", New Age International Pvt. Ltd., 1996.
5. Conte. S. D. and de Boor. C., "Elementary Numerical Analysis-An Algorithmic Approach", McGraw- Hill, 1981.

Course Objectives and Course Outcomes Mapping:

- Understand the fundamentals concepts of numerical methods: CO1, CO2,CO5, CO6
- To become familiar with problem solving techniques: CO2, CO3, CO4

Course Units and Course Outcomes Mapping:

Unit No.	Unit	Course Outcomes					
		CO1	CO2	CO3	CO4	CO5	CO6
1	Error analysis and solutions of algebraic and transcendental equations	✓	✓				✓
2	Numerical solution of linear system equations and Matrix Inversion	✓		✓			✓
3	Eigen value problems				✓		✓
4	Interpolation					✓	✓

Programme Outcomes (PO)

PO1: Knowledge

Provides knowledge about the fundamentals of pure, applied and computing mathematics and its applications to students that creates the opportunities in industries and research centers.

PO2: Core Competence

Creates competency in science and mathematics to formulate, analyses and solve problem and/or also to pursue advanced study or research.

PO3: Breadth

Trains students having good knowledge in unearth core of academia and industry by the roots of mathematics.

PO4: Evaluation

Imparts in students to raise trial and error-based curiosity and problem-solving functionality with research based advanced tutorial for higher level decision makings tools.

Programme Outcomes and Course Outcomes mapping:

Programme Outcomes	Course Outcomes					
	CO1	CO2	CO3	CO4	CO5	CO6
PO1	✓		✓		✓	
PO2	✓	✓		✓	✓	✓
PO3		✓			✓	
PO4			✓			✓