Course code	Course Name	L-T-P-Credits	Year of Introduction
AO367	NUMERICAL PROGRAMMING	3-0-0-3	2016

Prerequisite : Nil

Course Objectives

- To introduce advanced mathematical modeling concepts

Syllabus

Matlab – Solving equations - Linear Algebra – Linear systems- Nonlinear Systems - Eigenvalues and Eigenvectors - Interpolation, Least Squares Fitting – Integration - Plotting Functions of Two Variables - Differential Equations - Finite Difference Method – Floating point arithmetic

Expected Outcome

- The students will be able to solve mathematical problems using numerical methods

Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 8th Edition, Wiley.
2. John J. Mathews and Kurtis D. Fink, Numerical Methods using Matlab, 4th Edition, Pearson Prentice Hall.
3. K.Srinivasa Raju and D. Nagesh Kumar, "Multi criterion Analysis in Engineering and Management", PHI Learning Pvt. Ltd., New Delhi, India, ISBN 978-81-203-3976-7, pp.288, 2010.
4. Phillips G.M.M. and Peter J. Taylor, Theory and Applications of Numerical Analysis, 2nd Edition, Elsevier Science & Technology Books.
5. Todd Young and Martin J. Mohlenkamp, Introduction to Numerical Methods and Matlab Programming for Engineers, Department of Mathematics Ohio University Athens, OH 45701
6. William H Press, Saul A Teukolsky, William T Vetterling and Brain P Flannery, Numerical Recipes in C, 2nd Edition, Cambridge University Press

Course Plan

Module	Contents	Hours	End Sem. Exam Marks
I	Matlab and Solving Equations - Vectors, Functions, and Plots in Matlab-Matlab Programs	1	15%
	Newton's Method and Loops	1	
	Controlling Error and Conditional Statements	2	
	The Bisection Method and Locating Roots - Secant Methods - Computations	2	
II	Linear Algebra - Matrices and Matrix Operations in Matlab	1	15%
	Introduction to Linear Systems - Accuracy, Condition Numbers and Pivoting	3	
	LU Decomposition - Nonlinear Systems - Newton's Method	2	
	Eigenvalues and Eigenvectors - Application of Eigenvectors: Vibrational Modes	4	

FIRST INTERNAL EXAM			
III	Functions and Data - Polynomial and Spline Interpolation	2	15%
	Least Squares Fitting: Noisy Data - Integration: Left, Right and Trapezoid Rules	1	
	Midpoint and Simpson's Rules - Plotting Functions of Two Variables	3	
	Double Integrals for Rectangles - Double Integrals for Non-rectangles - Gaussian Quadrature	1	
IV	Differential Equations - Reduction of Higher Order Equations to Systems	1	15%
	Euler Methods - Higher Order Methods	2	
	Multi-step Methods	2	
	ODE Boundary Value Problems and Finite Differences	2	
SECOND INTERNAL EXAM			
V	Finite Difference Method – Nonlinear ODE - Parabolic PDEs	1	20%
	Explicit Method - Solution Instability for the Explicit Method - Implicit Methods	1	
	Insulated Boundary Conditions - Finite Difference Method for Elliptic PDEs -	1	
	Convection-Diffusion Equations - Determining Internal Node Values	2	
VI	Floating point arithmetic, linear systems, nonlinear equations	1	20%
	Eigen value and Eigen vector problems, interpolation and polynomial approximation, basics of iterative methods.	2	
	numerical methods for ordinary differential equations, numerical optimization	1	
	numerical methods for partial differential equations, numerical integration, engineering applications	1	
END SEMESTER EXAM			

Question Paper Pattern

Maximum marks: 100 Exam duration: 3 hours

The question paper shall consist of three parts

Part A

4 questions uniformly covering modules I and II. Each question carries 10 marks

Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part B

4 questions uniformly covering modules III and IV. Each question carries 10 marks

Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part C

6 questions uniformly covering modules V and VI. Each question carries 10 marks

Students will have to answer any four questions out of 6 (4X10 marks =40 marks)

Note: In all parts, each question can have a maximum of four sub questions, if needed.