Semester: V Semester		
COMPUTATIONAL ADVANCED NUMERICAL METHODS (GLOBAL ELECTIVE)		
Course Code: 16G5B12		**CIE Marks: 100**
Credits: L:T:P:S: 4:0:0:0		**SEE Marks: 100**
Hours: 44		**SEE Duration: 3Hrs**

Course Learning Objectives:	
1	Adequate exposure to learn alternative methods and analyze mathematical problems to determine the suitable numerical techniques.
2	Use the concepts of interpolation, eigen value problem techniques for mathematical problems arising in various fields.
3	Solve initial value and boundary value problems which have great significance in engineering practice using ordinary and partial differential equations.
4	Demonstrate elementary programming language, implementation of algorithms and computer programs to solve mathematical problems.

Unit-I	
ALGEBRAIC AND TRANSCENDENTAL EQUATIONS Roots of equations in engineering practice, Polynomials and roots of equations. Fixed point iterative method, Aitken's process, Muller's method, Chebychev method.	**08 Hrs**
Unit -II	
INTERPOLATION Introduction to finite differences. Finite differences of a polynomial. Divided differences and Newton's divided difference interpolation formula. Hermite interpolation. Spline interpolation - cubic spline interpolation.	**08 Hrs**
Unit -III	
DIFFERENTIAL EQUATIONS Solution of first and second order ODE using spline interpolation. Boundary value problems (BVP's)–Trapezoidal method and Shooting method. Finite difference method for linear and nonlinear problems, Rayleigh-Ritz method.	**09 Hrs**
Unit -IV	
EIGEN VALUE PROBLEMS Eigen values and Eigen vectors, Power method, Inverse Power method. Bounds on Eigen values, Greschgorin circle theorem, Jacobi method for symmetric matrices, Givens method.	**09 Hrs**
Unit -V	
COMPUTATIONAL TECHNIQUES Algorithms and computer programs for Fixed point iterative method, Aitken's – process, Muller's method, Chebychev method, Newton's divided difference method. Hermite interpolation, Cubic spline interpolation, Power method, Inverse Power method. Trapezoidal method, Shooting method, Rayleigh-Ritz method, Jacobi method and Givens method.	**10 Hrs**

Course outcomes: On completion of the course, the student should have acquired the ability to	
CO1	Identify and interpret the fundamental concepts of Polynomials and roots of equations, Finite differences, Eigen values and Eigen vectors and corresponding algorithms and computer programs.
CO2	Apply the knowledge and skills of numerical methods to solve algebraic and transcendental equations, Solution of ODE using spline interpolation, Eigen value problems numerically using computer programs.
CO3	Analyze the physical problem to establish mathematical model and use appropriate method to solve and optimize the solution of roots of equations in engineering practice, interpolating the polynomial, Boundary value problems of ODE and PDE, Eigen value problems numerically using computer programs.
CO4	Distinguish the overall mathematical knowledge gained to demonstrate and analyze the problems of finding the roots of equations, Interpolation, Differential equations, Eigen value problems arising in real-life situations.

Reference Books:	
1	Steven C Chapra, Raymond P Canale; Numerical Methods for Engineers, Tata Mcgraw Hill;5th edition; 2011; ISBN-10: 0-07-063416-5.
2	Richard L. Burden and J. Douglas Faires; Numerical Analysis; Cengage Learning; 9th edition; 2012; ISBN-13: 978-81-315-1654-6.
3	M K Jain, S. R. K. Iyengar, R. K. Jain; Numerical methods for scientific and engineering computation; New Age International Publishers; 6th edition; 2012; ISBN-13: 978-81-224-2001-2.
4	Curtis F. Gerald and G. Patrick; Applied Numerical Analysis, Wheately-Pearson Education Ltd; 7th Edition; 2004; ISBN-13: 978-0321133045.
e Books and online learning materials:	
1	http://books.google.co.in/books/about/Advanced_Engineering_Mathematics.html?id=9nFDvk9yr3kC&redir_esc=y
2	http://ocw.mit.edu/courses/mathematics/
Online Courses and Video Lectures:	
1	http://nptel.ac.in/courses.php?disciplineId=111
2	https://www.khanacademy.org/
3	https://www.class-central.com/subject/math (MOOCS)

Continuous Internal Evaluation (CIE) (Theory – 100 Marks)	
Evaluation	Marks
Quiz -1	10
Test -1	50
Quiz -2	10
Test -2	50
Quiz -3	10
Test -3	50
Assignment	10
Final evaluation Quiz 10+10+10 = 30; Test 50+50+50 = 150 Reduced to 60; Assignment 10	

Note: The faculty teaching the course may adapt additional methods for evaluation within the total maximum marks.

	What		To whom	Frequency of conduction	Max Marks	Evidence	Contribution to Course Outcome		
Direct Assessment Methods	CIE	Quiz	Students	Three	30	Answer Scripts	80%	100%	90%
		Test		Two	60				
		Assignment		2 phases	10	Reports			
	SEE	Semester End Examination		End of every semester Consisting of Part-A and Part-B	100	Answer Scripts	20%		
Indirect Assessment	Course End Survey		Students	End of course		Questionnaire Based on COs	10%		

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO2	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO3	**2**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO4	**3**	**3**	**1**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**3**