

MAT3005	Applied Numerical Methods	L	T	P	J	C
		3	2	0	0	4
Pre-requisite	MAT2002 – Applications of Differential and Difference Equations	Syllabus Version				
		1.1				
Course Objectives						
The aim of this course is to						
<ol style="list-style-type: none"> 1. cover certain basic, important computer oriented numerical methods for analyzing problems that arise in engineering and physical sciences. 2. use MATLAB as the primary computer language to obtain solutions to a few problems that arise in their respective engineering courses. 3. impart skills to analyse problems connected with data analysis, 4. solve ordinary and partial differential equations numerically 						
Course Outcome						
At the end of the course the student should be able to						
<ol style="list-style-type: none"> 1. Observe the difference between exact solution and approximate solution. 2. Use the numerical techniques to find the solution of algebraic equations and system of equations. 3. Fit the data using interpolation technique and spline methods. 4. Find the solution of ordinary differential equations, Heat and Wave equation numerically. 5. Apply calculus of variation techniques to extremize the functional and also find approximate series solution to ordinary differential equations 						
Student Learning Outcomes		1, 2, 7, 9				
<ol style="list-style-type: none"> 1. Having an ability to apply mathematics and science in engineering applications 2. Having a clear understanding of the subject related concepts and of contemporary issues 7. Having computational thinking (Ability to translate vast data in to abstract concepts and to understand database reasoning) 9. Having problem solving ability- solving social issues and engineering problems 						
Module:1	Algebraic and Transcendental Equations	5 hours				
General iterative method- rates of convergence- Secant method - Newton – Raphson method- System of non-linear equations by Newton’s method.						
Module:2	System of Linear Equations and Eigen Value Problems	6 hours				
Gauss –Seidel iteration method. Convergence analysis of iterative methods-LU Decomposition -Tri diagonal system of equations-Thomas algorithm- Eigen values of a matrix by Power and Jacobi methods.						
Module:3	Interpolation	6 hours				
Finite difference operators- Newton’s forward-Newton’s Backward- Central differences- Stirling’s interpolation - Lagrange’s interpolation - Inverse Interpolation-Newton’s divided difference-Interpolation with cubic splines.						
Module:4	Numerical Differentiation and Integration	6 hours				
Numerical differentiation with interpolation polynomials-maxima and minima for tabulated values-Trapezoidal rule, Simpsons 1/3 rd and 3/8 th rules. –Romberg’s method. Two and Three						

point Gaussian quadrature formula.			
Module:5	Numerical Solution of Ordinary Differential Equations		8 hours
First and second order differential equations - Fourth order Runge – Kutta method. Adams-Bashforth-Moulton predictor-corrector methods. Finite difference solution for the second order ordinary differential equations.			
Module:6	Numerical Solution of Partial Differential Equations		6 hours
Classification of second order linear partial differential equations-Laplace equation –Gauss-Seidal method-One dimensional heat equation- Schmidt explicit method-Crank-Nicolson implicit method.-One dimensional wave equation–Explicit method.			
Module:7	Variational Methods		6 hours
Introduction - functional –variational problems- extremals of functional of a single dependent variable and its first derivative- functional involving higher order derivatives- Isoperimetric problems- Galerkins- Rayleigh Ritz methods.			
Module:8	Contemporary Issues		2 hours
Industry Expert Lecture			
	Total lecture hours:		45 hours
Tutorial	<ul style="list-style-type: none"> • A minimum of 10 problems to be worked out by students in every Tutorial Class. • Another 5 problems per Tutorial Class to be given for practise. 		30 hours
Text Book(s)			
<ol style="list-style-type: none"> 1. Numerical Methods for Scientific and Engineering, M. K. Jain, S. R. K. Iyengar and R. K. Jain, New Age International Ltd., 6th Edition, 2012. 2. Applied Numerical Analysis, C. F. Gerald and P.V. Wheatley, Addition-Wesley, 7th Edition, 2004. 			
Reference Books			
<ol style="list-style-type: none"> 1. Introductory Methods of Numerical Analysis, S.S. Sastry, PHI Pvt. Ltd., 5th Edition, New Delhi, 2009. 2. Applied Numerical Methods Using MATLAB, W.Y. Yang, W. Cao, T.S. Chung and J. Morris, Wiley India Edn., 2007. 3. Numerical Methods for Engineers with Programming and Software Applications, Steven C. Chapra and Ra P. Canale, 7th Edition, Tata McGraw Hill, 2014. 4. Numerical Analysis, R.L. Burden and J. D. Faires, 4th Edition, Brooks Cole, 2012. 5. Numerical Methods: Principles, Analysis and Algorithms, Srimanta Pal, Oxford University Press India, 2009. 			
Mode of evaluation: Internal Assessment (CAT, Quizzes, Digital Assignments) & Final Assessment Test (FAT)			
Recommended by Board of Studies		25-02-2017	
Approved by Academic Council		No.47	Date 05-10-2017