BVM ENGINEERING COLLEGE [AN AUTONOMOUS INSTITUTION]

2BS05: NUMERICAL METHODS IN MANUFACTURING
CREDITS - 4 (LTP:3,0,1)
***2nd* Year, B. Tech. (*Production*)**

Course Objective:
To introduce numerical techniques used in analysis of numerous manufacturing processes.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	CE	ESE	CE	150
3	0	2	4	60	40	20	30	

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Introduction to Numerical Analysis:** **Basics of Numerical Analysis:** Significant figures, Accuracy and Precision, accuracy of numbers, computer representation of numbers **Error Analysis:** Error definitions, Round-off errors and truncation errors in numerical computation, error propagation, total numerical error, blunders, formulation errors, data uncertainty	05
2	**Roots of Non-linear Equations:** Bisection method, False-position method, Secant method, Iteration method, Newton-Raphson method.	08
3	**Solution of Linear Equations & Eigenvalue Problems:** Cramer's rule, Gauss Elimination without and with partial pivoting, pitfalls of Gauss Elimination methods, Gauss-Jordon, LU decomposition, Iterative methods: Jacobi's iteration and Gauss Seidel method, Matrix inversion, Eigenvalues & Eigenvectors, properties of eigenvalues, power method	08
4	**Regression & Interpolation** **Regression:** Least squares regression, Curve fitting, polynomial regression, multiple linear regression **Interpolation:** Newton's Forward interpolation, Backward interpolation and Divided-difference formula, Lagrange interpolating polynomials.	06
5	**Numerical Differentiation & Integration:** **Numerical Differentiation:** Derivatives using Newton's Forward-differences, Backward-differences, Center-differences. **Numerical Integration:** Trapezoidal rule, Simpson's 1/3 and 3/8 rule, Gauss quadrature	06

Unit No.	Topics	Teaching Hours
6	**Numerical Solution of Ordinary Differential Equations:** Initial-Value and Boundary-Value Problems, Single Step and Multi-Step Methods, Picard's method, Taylor series method, Euler's method, Modified Euler's method, Runge-Kutta method, Shooting Method.	09
	Total	**42**

List of References:

1. Chapra S. and Canale R., "*Numerical Methods for Engineers*", 6th edition, Tata McGraw-Hill.
2. C.F. Gerald and O.P. Wheatley, "*Applied Numerical Analysis*" 7th edition, Addison Wesley.
3. Sastry S. S., "*Introductory Methods of Numerical Analysis*", 5th edition, Prentice Hall of India.
4. Grewal B. S. "*Numerical Methods in Engineering and Science*", Mercury Learning and information.
5. Jain M. K., Iyengar SRK and Jain R.K., "*Numerical Methods for Scientific & Engineering Computation*",6th Edition, New Age International Publishers.
6. Balagurusamy E., "*Numerical Methods*", Prentice Hall of India.
7. Chapra S. C., "*Applied Numerical Methods with MATLAB*", 3rd edition, Tata McGraw Hill Publishing Co Ltd.
8. Dukkipati R. V., "*Applied Numerical Methods Using MATLAB*", New Age International Publishers.

List of Practical:

Students are required to prepare algorithms on the following topics:

1. Introduction to Matlab for Mathematical methods.
2. Introduction to Numerical & Error Analysis.
3. Program to find roots of non-linear equations using:
   a.Bisection Method. b. False Position Method. c. Newton-Raphson Method.
4. Program to solve linear equations using:
   a.Gauss Elimination Method. b. Gauss-Jordan Method. c. LU Decomposition Method. d. Gauss-Seidel Method.
5. Program to implement Power Method.
6. Program to implement Least Squares Method.
7. Program to apply
   a. Newton's forward interpolation formula. b. Lagrange's interpolation formula. c. Newton's divided difference formula.
8. Program to find derivatives using forward difference formula.
9. Program to implement Numerical integration:
   a. Trapezoidal Rule b. Simpson's Rule
10. Program to implement a system of ODEs:
    a. Euler's Method b. Modified Euler's Method c. Runge-Kutta Method

Course Outcomes (COs):

At the end of this course students will be able to ……

1. Evaluate errors associated with computation methods.
2. Demonstrate practice of numerical techniques for accurate and efficient solution of models based on linear/nonlinear systems of equations, ordinary differential equations.
3. Formulate numerical models for various manufacturing processes.
4. Apply various numerical models and methods for drawing conclusions and making decisions under uncertainty in Production engineering contexts.
5. Use software tools for implementation and application of numerical methods to visualization of results.