GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: METALLURGY
SUBJECT NAME: COMPUTER PROGRAMMING AND NUMERICAL METHODS
SUBJECT CODE: 2172113
B.E. 7th SEMESTER

Type of course: Mathematical

Prerequisite: NIL

Rationale:
To know about various types of Errors, Calculate the error correction and get actual root of the equation. Understand different methods of solution of the equations and compare them. Student will be made aware of different numerical methods which are used in metallurgical engineering. Students will prepare program for different methods.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	0	2	6	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**COMPUTATIONAL – TECHNIQUES** **C Programming:** Algorithms, effective procedures in problem solving, flowcharts, pseudo-code. C Preliminaries: Data types, constants, variables, type specification statements, operators and expressions, Library functions simple C programmes. Control Structures: Importance and types of structures, structured programming, if else, while, do-while, for, switch structure, go to, continue and break statement. Arrays, pointers, functions, text processing and programmes using the above features.	**18**	24
2	**Interpolation**: Finite differences, Newton's Forward Interpolation formula, Newton's Backward interpolation formula, Central Difference interpolation formula, Lagrange's formula, Newton's divided difference interpolation formula, Inverse Lagrange's interpolation formula, Interpolating with a cubic spline	**12**	20

	Curve Fitting: Method of Least Squares, Linear and polynomial regression		
3	**Numerical integration:** Trapezoidal Rule, Simpson's 1/3 Rule, Simpson's 3/8 Rule, Gaussian Quadrature Formula, Double integration using Trapezoidal Rule, Simpson's Rule	**6**	12
4	**Numerical Solution of Equations**: Solution of algebraic and transcendental equations – Bisection method, Method of false position, Newton-Raphson method, Secant method, Method of Successive Approximations, Fixed point iteration method, Solution of linear simultaneous equations- Gauss elimination method , Gauss elimination method with partial pivoting, Gauss-Jordan method, Inverse of a matrix by Gauss-Jordan method, Gauss-Seidel method, Gauss-Jacobi method **Eigen Values :**Power method	**16**	28
5	**Numerical solution of differential equations:** Euler's method, Modified Euler method, Runge-Kutta 4th Order method, Taylor's Series method, Finite difference methods for ordinary differential equations, Milne's and Adam's predictor and corrector methods	**8**	16

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	**20**	**30**	**30**	**05**	**00**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Sudhir Kareker Programming in C.
2. Kernigham B.W. and Ritchie D.M: The C programming Language, 2nd Edition.
3. Numerical Methods for Scientific & Engineering Computation by M.K. Jain, S.R.K. Iyengar, R.K. Jain Willey Eastern Ltd.
4. Computer Oriented Numerical Methods – V. Rajaraman, Prantice-Hall of India.
5. Introduction to Numerical Analysis – S.S. Sastry, Prantice-Hall of India.
6. Numerical Methods in Science & Engineering Prog.- By Dr. B. S. Grewal, Khanna Pub., New Delhi
7. Numerical Methods for engineers. S C Chapra and R P Canale .McGrow Hill International Edition
8. Computer Oriented Numerical Methods, R. S. Salaria., Khanna Publisher

Course Outcome:

After learning the course the students should be able to:

1. Solve algebraic and transcendental equations by various methods.
2. Solve system of linear equations.
3. Apply Numerical Integration.
4. Solve Differential Equations.
5. Write programs for various numerical methods

List of Experiments:

1. Develop C program to find a root of a non-linear equation using Bisection method.
2. Develop C program to find a root of a non-linear equation using False Position method.
3. Develop C program to find a root of a non-linear equation using Secant method.
4. Develop C program to find a root of a non-linear equation using Newton-Raphson method.
5. Develop C program to implement Trapezoidal Rule.
6. Develop C program to implement Simpsons 1/3rd Rule & Simpsons 3/8th Rule.
7. Develop C program to solve system of linear equations using Gauss Elimination method.
8. Develop C program to solve system of linear equations using Gauss Seidel method.
9. Develop C program for the Gauss Jacobi Interactive methods
10. Develop C program for Newton's Forward Difference Interpolation.
11. Develop C program for Newton's Backward Difference Interpolation.
12. Develop C program to implement Runge- Kutta 4^{th} order method.

Design based Problems (DP)/Open Ended Problem: Not proposed.

Major Equipment:

Computer

List of Open Source Software/learning website:

www.nptel.ac.in

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.