GUJARAT TECHNOLOGICAL UNIVERSITY

AERONAUTICAL ENGINEERING (01)
NUMERICAL METHODS
SUBJECT CODE: 2140105
B.E. 4th SEMESTER

Type of Course: Engineering Science

Prerequisite: Basic calculus, algebra

Rationale: "Numerical methods" is a course which has applications in mathematical modeling of real world problems.

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		
3	2	0	6	70	20	10	30	0	20	150

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	Root finding Bisection Methods, False position Methods, Newton – Raphson Methods, Secant Methods and Successive Approximation Methods	06	30 %
2	Interpolation Techniques Newton's interpolation methods for forward interpolation, backward interpolation and Newton's divided interpolation method, Langrange's interpolation methods, Stirling's interpolation methods, Cubic spline interpolation, interpolation by iteration	06	
3	Numerical Integration Trapezoidal rule, Simpson's 1/3rd and 3/8th rule, Weddle's rule	03	10 %
4	Solution of system of linear equations using Numerical Techniques Gauss – Jacobi iterative methods, Gauss – Seidel iterative methods	02	
5	Numerical Solution of Ordinary differential equations Solution of Initial value problems by Taylor's series, Picard's methods of successive approximation, Runge – Kutta Method of order 2 and 4, Solution of Boundary value problems by Finite – Difference Methods, Shooting methods	07	20 %
	Numerical Solution of Partial differential equations Finite difference approximation to derivatives, solution of Laplace equation, Successive over-relaxation methods, parabolic equations	07	20 %
	Curve Fitting Least square curve fitting procedures for linear and non linear curves	04	10 %
	Finite Element methods Methods of Approximation - Rayleigh – Ritz Method, Galerkin Methods	04	10 %

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
R Level	U Level	A Level	N Level	E Level
25%	20%	30%	5%	20%

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate 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. Introductory Methods of Numerical Analysis—S.S.Sastry.
2. Numerical Methods for Scientific and Engineering Computation—M. K. Jain, S.R. K. Iyengar, R.K. Jain.
3. Finite Element Procedure—Klaus Jiirgen Bathe.
4. Numerical Methods ---E. Bala guruswamy.
5. Numerical Methods – P. Kandasamy, K. Thilagavathy, K. Gunavathi

Course Outcomes:
After successful completion of course students should be able to

1. To know about the fundamental methods of root finding
2. To understand the steps involved in interpolation of data
3. To understand the real world problem with the use of solution of both ordinary and partial differential equations
4. To be able to apply regression and finite element method to the practical problems.

List of Tutorials:

1. Problem solving in roots finding methods
2. Practice on interpolation methods, (Number of tutorials two).
3. Practice on numerical integration and solving system of simultaneous equations.
4. Practice on solution of ordinary differential equations. (Number of tutorials two)
5. Practice examples on solution of Partial differential equation.(Number of tutorials two)
6. Practice examples on curve fitting and finite element method.(Number of tutorials two)

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.