SARDAR VALLABHBHAI PATEL EDUCATION SOCIETY'S

R. N. G. PATEL INSTITUTE OF TECHNOLOGY - RNGPIT

An Autonomous Institute u/s UGC Act 1956

Approved by AICTE & affiliated to Gujarat Technological University

Bardoli - Navsari Road, At: Isroli (tajpore), Po: Afwa, Tal: Bardoli, Dist: Surat, Pin - 394620

Phone: 95129 00457, 95129 00458• Email: Info@rngpit.ac.in • Website: www.rngpit.ac.in

Program Name: Integrated M.Sc. (IT)
Level: Post Graduate Program
Branch: Integrated M.Sc. (IT)
Course / Subject Code : 1BS301
Course / Subject Name: Numerical Methods

w. e. f. Academic Year:	2025-26
Semester:	3rd
Category of the Course:	Multi Disciplinary

Prerequisite:	Fundamentals of Calculus, linear algebra and differential equations.
Rationale:	The study of curve fitting, Approximation of errors, Roots of Equations, Interpolation, Numerical Integration, Numerical Differentiation, Ordinary differential equations, Systems of linear equations, Iterative methods.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes
01	Apply the method of least squares to fit different types of curves to data.
02	Solve algebraic, transcendental equations and system of linear equations by various methods and find approximate roots.
03	Use relevant numerical techniques for interpolation with equal and unequal intervals.
04	Compute definite integral for given data and calculate value of derivative of a function at some assigned value of x.
05	Find numerical solution of ordinary differential equation by various methods.
06	Apply iterative techniques such as Gauss-Seidel and Jacobi methods to solve systems of linear equations

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	**T**	**PR**	**C**	Theory		Tutorial / Practical		
				ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	0	3	70	30	0	0	100

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Curve Fitting:** Least Square method, Curve Fitting of Linear, quadratic and exponential curves.	06	15%
2.	**Approximations and Errors:** Approximate numbers, Significant figures, Rounding off, Types of errors, Error in the approximation of a function, Order of approximation. **Roots of Equations:** Bisection method, Regula Falsi method(Method of False Position or Interpolation method), NR method, Secant method, Successive approximation method, Budan's Theorem.	07	15%
3.	**Interpolation:** Newton's Forward Difference Interpolation, Newton's Backward Difference Interpolation. Lagrange's Interpolation method, Inverse Interpolation, Newton's Divided Difference Interpolation, Error Estimates.	10	20%
4.	**Numerical Differentiation:** Using Newton's Forward Difference, Newton's Backward Difference, Stirling, Newton's Divided Difference formula (First and Second Order Differentiation only) **Numerical Integration:** Newton-Cotes integration formulas: trapezoidal rule, Simpson's $\frac{1}{3}$ rules, Simpson's $\frac{3}{8}$ rules	10	20%
5.	**Ordinary differential equations:** Taylor Series method, Euler's method, Modified Euler's method, Runge – Kutta methods.	06	15%
6	**Systems of linear equations:** Matrix inversion, Gauss elimination method with partial pivoting. **Iterative methods:** Gauss Jacobi and Gauss-Seidel methods.	06	15%
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
10	**25**	**35**	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:
(a) Books:
1. "Introductory Methods of Numerical Analysis", S. S. Sastry, PHI Publication.
2. "Numerical Methods for Engineers", 5th Edition, Steven C Chapra, Raymond P Canale, McGraw Hill Publication, Special Indian Edition.
3. "Numerical Methods in Engineering & Science", Dr. B. S. Grewal, Khanna Publication.
4. "Computer Oriented Numerical Methods", R. S. Salaria, Khanna Publisher.
5. "Numerical Methods for Scientific and Engineering Computation", M.K.Jain, S.R.K. Iyenger, R.K.Jain, New Age publication.

(b) Open source software and website:
   1. https://archive.nptel.ac.in/courses/111/107/111107105/ (NPTEL)

CO- PO Mapping:

Semester 2	Numerical Methods(1BS301)										
	POs										
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	1	1	2	1	1	1	1	2
CO2	2	2	1	1	1	2	1	1	1	1	2
CO3	2	2	1	1	1	2	1	1	1	1	2
CO4	2	2	1	1	1	2	1	1	1	1	2
CO5	2	2	1	1	1	2	1	1	1	1	2
CO6	2	2	1	1	1	2	1	1	1	1	2

*Legend: '**3**' for high, '**2**' for medium, '**1**' for low and '**-**' for no correlation of each CO with PO.*

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