



**SARVAJANIK UNIVERSITY**  
**Sarvajanik College of Engineering and Technology**  
**Bachelor of Technology**



**Mechanical Engineering Department**  
**B. Tech. Semester IV**

**Course Name:** Numerical Methods for Mechanical Engineers      **Course Code:** BTME13406  
**Type of course:** Professional Core Course (PCC)  
**Prerequisite:** Fundamental concepts of Mathematics  
**Rationale of Course:** This course will help to understand the basics of numerical algorithms and skills to implement algorithms to solve mathematical problems on the computer.

**Teaching and Examination Scheme:**

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	150
2	0	2	3	60	25	15	30	20	

**CA1:** Continuous Assessment (assignments/projects/open book tests/closed book tests) **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

**Contents:**

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1.	<b>Interpolation:</b> Finite Differences, Forward, Backward and Central operators, Interpolation by polynomials: Newton's forward, Backward interpolation formulae, Newton's divided Gauss & Stirling's central difference formulae and Lagrange's interpolation formulae for unequal intervals.	6	40%
2.	<b>Numerical Integration:</b> Newton-Cotes formula, Trapezoidal and Simpson's formulae, error formulae, Gaussian quadrature formulae.	6	
3.	<b>Linear and non-linear algebraic equation:</b> Solution of a System of Linear Equations: Gauss elimination, partial pivoting, Gauss-Jacobi method and Gauss-Seidel method.	8	30%



**SARVAJANIK UNIVERSITY**  
**Sarvajani College of Engineering and Technology**  
**Bachelor of Technology**



Sr. No.	Topics	Teaching Hrs.	Module Weightage
	Roots of Algebraic and Transcendental Equations: Bisection, false position, Secant and Newton-Raphson methods, Rate of convergence, Eigen values by Power and Jacobi methods.		
4.	<b>Numerical Solution of Ordinary Differential Equations:</b> Euler and Runge-Kutta methods.	4	30%
5.	<b>Probability and Statistics:</b> Probability, conditional probability; sampling theorems; median, mean, mode and standard deviation; binomial, random variables, normal and Poisson distributions.	6	

**Percentage Distribution of Marks as per Bloom's Taxonomy (Theory/Practical):**

% Distribution of Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	10	30	30	20	0

**Legends:** R: Remembrance, U: Understanding; A: Application, N: Analyze, E: Evaluate C: Create

**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 from above table.

**Reference Books:**

Sr. No.	Title of book /article	Author(s)	Publisher	Publication year	Publication edition
1.	Numerical Methods for Engineers	S. C. Chapra and R. P. Canale	Tata McGraw Hill, New Delhi	2015	7 <sup>th</sup>
2.	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons, Inc.	2011	10 <sup>th</sup>
3.	Applied Numerical Methods with MATLAB for Engineers & Scientists	S. C. Chapra	Tata McGraw Hill, New Delhi	2018	4 <sup>th</sup>
4.	Applied Numerical Analysis	C.F. Gerald and P.O. Wheatley	Pearson (Addison-Wesley)	1998	6 <sup>th</sup>
5.	Numerical Methods: For Scientific And Engineering Computation	M.K. Jain, S.R.K. Iyengar and R. K. Jain	New Age Pvt. Pub, New Delhi.	2003	4 <sup>th</sup>



**SARVAJANIK UNIVERSITY**  
**Sarvajanik College of Engineering and Technology**  
**Bachelor of Technology**



**Course Outcomes (CO's):**

CO. No.	CO Statements After learning this subject, students will be able to	Marks % weightage
CO-1	Use the concepts of interpolation for mathematical problems arising in various fields.	20
CO-2	Evaluate the numerical differentiation and integration.	20
CO-3	Solve the linear and non-linear algebraic equation.	30
CO-4	Solve the ordinary differential equations.	10
CO-5	Understand the terminologies of basic probability and apply the statistics for testing of the given sample data.	20

**Mapping of CO's with Program Outcomes (PO's) and Program Specific Outcomes (PSO's):**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	3	3	0	2	2	0	0	0	3	0	2	1	2	2	1
CO-2	2	1	0	1	1	0	0	0	2	0	1	1	2	2	0
CO-3	2	1	0	0	1	0	0	0	2	0	1	1	1	2	1
CO-4	1	1	0	0	1	0	0	0	1	0	0	0	1	2	3
CO-5	3	3	0	3	1	0	0	0	2	0	3	1	2	2	3
<b>Ration ale*</b>	<b>11</b>	<b>9</b>	<b>0</b>	<b>6</b>	<b>6</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>10</b>	<b>0</b>	<b>7</b>	<b>4</b>	<b>8</b>	<b>10</b>	<b>8</b>

**Rationale - Mapping of CO's with PO's and CO's with PSO's:** This course highly maps with PO 1, 9, and PSO 2 as it provides the application of numerical mathematics to solve complex problems involved in mechanical engineering, real world problems and in research with the aid of computing and analysis software.

**List of Practicals:**

1. Introduction to MATLAB / Scilab / EES solver.
2. Program on Roots of equation methods.
3. Program on Numerical Integration methods.
4. Program on Simultaneous Equation methods.
5. Program on Ordinary Differential Equations.
6. Program on application of Numerical method for mechanical engineering problems.
7. Apply the probability concept to evaluate real world engineering problems.
8. Apply the statistics for testing the significance of the given large and small sample data.



**SARVAJANIK UNIVERSITY**  
**Sarvajnik College of Engineering and Technology**  
**Bachelor of Technology**



**Major Machines and its Equipment available:**

1. Computational facility
2. MATLAB/ Scilab / EES software

**List of Open Source/learning website:**

1. [https://onlinecourses.nptel.ac.in/noc19\\_ma21/preview](https://onlinecourses.nptel.ac.in/noc19_ma21/preview)

**List of Open Source Software: Nil**