

**B.Tech. Year – 2 (Semester IV)**
**Subject Code: 01MA0201**
**Subject Name: Numerical Analysis (ME/AUTO/CIVIL)**

**Objectives:** Following are the main objectives of Learning above course

- 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.
- To get the detailed knowledge about different numerical methods which are used in engineering field, with emphasis on how to prepare program for different methods.

**Credits Earned: 5 Credits**

**Course Outcomes:** After completion of this course, student will be able to

- Be aware of the use of numerical methods in modern scientific computing.
- Be familiar with finite precision Computing.
- Be familiar with numerical solutions of nonlinear equations in a single variable
- Be familiar with numerical interpolation and approximation of functions
- Be familiar with numerical integration and differentiation
- Be familiar with numerical solution of ordinary differential equations
- Be familiar with calculation and interpretation of errors in numerical methods.
- Be familiar with programming with numerical packages like MATLAB.

**Teaching and Examination Scheme**

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA	CSE	Viva (V)	Term work (TW)	
4	2	-	5	50	30	20	25	25	150

**Contents:**

<b>Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
1	<b>Numerical Analysis and Computers:</b> Concepts and definition, Representation of numbers in computers, types of errors, basic sources of errors, significant digits ,computer arithmetic, errors in computations with digital computers.	<b>8</b>
2	<b>Approximate solutions of nonlinear equations and system of linear equations</b>  Bisection method, Method of false position, Method of Iteration, Newton-Raphson method for single variable convergence criteria and rate of convergence and for simultaneous equations with two variables, Convergence criteria and rate of convergence, Convergence criteria and error estimates for these methods.	<b>12</b>
3	<b>Numerical Differentiation and Integration</b>  Approximate differentiation based on Newton's interpolation, Newton – cotes quadrature formula, trapezoid rule, Simpson's rules , Remainder terms, error bounds and estimates of these rules, Gaussian integration.	<b>10</b>
4	<b>Interpolation, Curve fitting</b>  Finite differences of various orders, difference table, Newton's formulae for interpolation, Lagrange's Interpolation formula, Error estimates of these formulae.	<b>10</b>
5	<b>Numerical solution of ordinary differential equation</b>  Single step methods – Taylor series, Euler's and modified Euler, Runge - Kutta method of 2 <sup>nd</sup> and 4 <sup>th</sup> order, Multistep Methods- Milne's and Adam's – Bashforth predictor corrector methods.	<b>10</b>

6	<b>Solution of system of linear equations</b>  Direct methods: Gauss elimination, Gauss Jordan and Crout's LU-factorization methods, Indirect methods: Gauss Seidel and Jacobi's methods.	<b>10</b>
<b>Total Hours</b>		<b>60</b>

❖ **Reference Books:**

1. Introductory Methods of Numerical Analysis – S.S. Sastry, Prentice Hall of India
2. Computer Oriented Numerical Methods – V Rajaraman, Prentice Hall of India
3. Numerical methods with programs in C++ - S Balachandra Rao & C K Shantha
4. Numerical Methods with programs in C and C++ - Veerarajan & Ramchndran. Tata McGraw Hill
5. A textbook of Computer based numerical and Statistical Techniques – A. K. Jaiswal & Anju Khandelwal, New Age International Publishers.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
20%	20%	30%	15%	10%	5%

**Instructional Method:**

- a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- c. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- d. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

**URL Links:**

Web site: 1. <http://numericalmethods.eng.usf.edu>

2. <http://mathworld.wolfram.com/>

3. <http://en.wikipedia.org/wiki/Math>