Subject Code: 01MA1401
Subject Name: Complex Variable & Numerical Analysis
B. Tech. Year - II (Semester - 4)

Objective of the Course : The subject aims to make the learner able to apply the knowledge of the Application of various Numerical Analysis methods in Engineering and real-world problems.

Credit Earned : 04

Course Outcome :
After successful completion of the course, it is expected that students will be able to,
1. Recognize the error in the number generated by the solution.
2. Compute solutions of algebraic and transcendental equations by numerical methods.
3. Apply methods of interpolation and extrapolation for prediction.
4. Use numerical methods and tools in the engineering problem-solving process.

Teaching and Examination Scheme :

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks			Practical Marks		
THEORY	TUTORIAL	PRACTICAL	C	ESE(E)	IA	CSE	Viva (V)	Term Work (TW)	
3	2	--	5	50	30	20	25	25	150

Content :

Sr. No.	Content	Total Hrs.
1	**Error Approximation and Roots of Equations** Approximations and errors in computation, Approximate numbers, significant figures, rounding off numbers, types of errors and basic sources of errors in numerical computation, Bisection method, Method of false position, Secant method, Newton- Raphson method, Rate of convergence, Dominant Eigenvalues and Eigenvector of matrix by Power methods.	08
2	**Numerical Integration** Newton – cotes quadrature formula, trapezoidal rule, Simpson's rules, Weddle's rule, error bounds, and estimates of these rules, Gaussian quadrature formula.	06

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3	**Interpolation and Curve Fitting:** Finite Differences, Forward, Backward and Central operators, Interpolation by polynomials: Newton's forward, Backward interpolation formula, Gauss & Stirling's central difference formula, Newton's divided and Lagrange's formula for unequal intervals. Least squares method, Fitting of Linear, Quadratic, Exponential and Logarithmic curves.	**To be covered in Tutorial hours**
4	**Numerical Solution of Ordinary Differential Equation** Taylor series, Picard's method, Euler's and modified Euler, Runge - Kutta method of 2nd and 4th order, Milne's predictor-corrector methods	**08**
5	**Solution of System of Linear Equations Using Numerical Techniques** Gauss elimination, Gauss elimination with partial pivoting, Gauss Jordan and LU-factorization methods, Indirect methods: Gauss-Seidel and Jacobi's methods	**07**
6	**Complex Variable** De Moivre's Theorem, Roots of a complex number, Logarithmic function and complex exponent function, Limit, Continuity and Differentiability of complex function, Analytic functions, Cauchy- Riemann equations, Necessary and Sufficient condition for analyticity, Properties of Analytic function, Laplace equation, Harmonic Conjugate functions, Complex Integration: Line Integral (contour integral) and its properties, Cauchy-Goursat Theorem, Cauchy Integral Formula, Liouville Theorem (without proof), Maximum Modulus Theorem (without proof)	**08**
7	**Applications of Numerical Methods by Excel:** Some basic EXCEL commands, solution of equations using EXCEL for Bisection Method, Secant Method and Newton Raphson Method.	**To be covered in Tutorial hours**

Distribution of Theory Marks

R Level	**U** Level	**A** Level	**N** Level	**E`** Level	**C** Level
20	**30**	**25**	**15**	**10**	**--**

Legends: R: Remember**; U:** Understand**; A:** Apply**; N:** Analyze**; E:** Evaluate**; C**: Create

List of Tutorials :

1. Theory and Example on roots of equations.

2. Theory and Example on Numerical Integration.

3. Theory and Example on Interpolation and curve fitting.

4. Theory and Example on Numerical solution of ordinary differential equation

5. Theory and Example on system of linear equation.

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Reference books :

1. S. D. Conte and Carl de Boor, Elementary Numerical Analysis- An Algorithmic Approach (3rd Edition), McGraw-Hill, 1980.
2. C. E. Froberg, Introduction to Numerical Analysis (2nd Edition), Addison-Wesley, 1981
3. C. F. Gerald and P. O. Wheatley, Applied Numerical Analysis (5th Edition), Addison-Wesley, Singapore, 1998.
4. S. C. Chapra and R. P. Canale, Numerical Methods for Engineers, Tata McGraw Hill, 2003.
5. R. V. Churchill and J. W. Brown, Complex Variables and Applications (7th Edition), McGraw-Hill (2003)

List of Open Base Software / learning website :

1. http://numericalmethods.eng.usf.edu
2. http://mathworld.wolfram.com/
3. http://en.wikipedia.org/wiki/Mat

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