MA 301T NUMERICAL TECHNIQUES (Sem. VI - SPT)										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory		Internal Assessment	Term Work	Practical/Viva	Total Marks
					ES (3.0Hrs)	MS (2.0Hrs)				
3	1	---	7	4	60	30	10	---	---	100

UNIT 1 **7**

Numerical Solution of Algebraic & Transcendental equations: Introduction, Descarte's Sign rule, Bisection Method, Method of false position, Secant method, Iteration method, Extended method of iteration, Newton-Raphson method, It's applications, Solution of nonlinear simultaneous equations, Newton-Raphson method for multiple roots, Horner's method, Lin-Bairstow's method or Method for Complex Root, Graeffe's root squaring method, Comparison of various methods.

UNIT 2 **10**

Finite Differences: Introduction, Finite differences, Operators: Forward Difference, Backward Difference, Central Difference, Shift Operator, Averaging Operator. Relation between operators, Factorial Notation, Synthetic Division, and Missing term Technique.

Interpolation: Newton Gregory Forward Interpolation Formula, Newton Gregory Backward Interpolation Formula, Gauss's Forward and Backward Interpolation Formula, Stirling'sCentral Difference Formula, Lagrange's Interpolation Formula for unevenly spaced Formula, Inverse Interpolation, Divided Differences, Properties of Divided Differences, Newton's Divided Difference Formula, Relation between Divided Differences and Ordinary Differences.

UNIT 3 **15**

Numerical Differentiation: Introduction, Formulae for Derivatives.

Numerical Integration : Introduction, Newton-Cotes's Quadrature Formula, Trapezoidal rule, Simpson'sone-third rule, Simpson's Three-Eighth rule, Weddle's rule, Romberg's method, Double Integration.

Solution of Simultaneous Algebraic Equations: Direct methods, Iterative methods: Gauss-Jacobi's method, Gauss-Seidal method, Relaxation method.

Numerical Solution of Ordinary Differential Equation: Taylor's method, Euler's method, Runge – Kuttamethod, Modified Euler's method, Predictor Corrector method: Adam's method& Milne's method.

Numerical Solution of Partial Differential Equation: Difference Quotients, Graphical representation, Classification of PDE's of 2^{nd} order, Elliptic equations, Solutions of Laplace equation by Liebmann's iteration method, Poisson's equation, Parabolic equation(One dimension heat equation), Bender-Schmidt method Crank- Nicholson method.

UNIT 4 **3**

Introduction to Finite Elements Methods: Introduction to Finite Element Methods, Functionals, Base Functions. Methods of Approximation: The Rayleigh-Ritz Method, The Galerkin Method. The FEM for one dimensional problems and applications to two dimensional problems.

APPROXIMATE TOTAL35 Hours

Texts and References

1. B.S. Grewal, Numerical Methods in Engineering and Science with Programs in C & C++,Khanna Publishers2010.
2. S.S. Sastry, Introductory Methods for Numerical Analysis, 4^{th} Ed., Prentice Hall of India (2009).
3. M.K. Jain, S.R.K. Iyenger and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 5^{th} Ed., New Age International (2007).
4. J N Reddy, An Introduction to Finite Element Method,McGraw Hill.
5. R.K. Jain & S.R.K. Iyenger, Advanced Engineering Mathematics, 3^{rd} Ed., Narosa (2002).
6. S C Chapra, Raymond P. Canale,Numerical Methods for Engineers, Tata McGraw Hill Pub. Co. Ltd.

Semester-1

Course code	Course Name	L-T-P	Credit
SSE501	**Mathematical Techniques**	**3–0–0**	**6**

Content:

Differential equations of higher order including partial differential equation; Infinite and power series. Vectors: vector algebra in 2 and 3 spaces, vector calculus in multiple variables, gradients, divergence, curl, line integral, Green's theorem, surface integral, Stoke's Theorem, Applications. Matrices: basic concepts (addition, multiplication, rank, linear independence etc), Inverse of matrix, solutions of linear systems, Eigen values, eigenvectors, symmetric matrices, complex matrices. Different transformations: Fourier, Laplace, Z transform, etc. Data analysis and probability theory; Mathematical statistics. Complex Analysis: Complex Analytic Functions, Complex Integrals, Laurent Series, Complex Integration by Method of Residues, Conformal Mapping and Applications

Books & References:

[1] E. Kreyszig, Advanced Engineering Mathematics 9th ed, John wiley sons.
[2] Arfken and Weber, Mathematical Methods for Physicists 6th ed. Elsevier (2005).
[3] KF Riley, MP Hobson, SJ Bence,Mathematical Methods for Physics and Engineering 3rd ed., Cambridge 2006.
[4] Earl A. Coddington, An Introduction to Ordinary Differential Equations. Prentice-Hall India (1968).
[5] Mark J. Ablowitz and Athanassios S. Fokas Complex Variables: Introduction and Applications (Cambridge Texts in Applied Mathematics), Cambridge, (2003)
[6] Tristan Needham, Visual Complex Analysis. Oxford University Press (1999).

For information only

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Sr. No.	BRANCH	Semester	Course Code	Course Name
1	ALL (SOT & SPT)	B.Tech.-I	MA 101T	MATHEMATICS - I
2	ALL (SOT & SPT)	B.Tech.-I&II	MA 102T	COMPUTER PROGRAMMING
3	ALL (SOT & SPT)	B.Tech.-I&II	MA 102P	COMPUTER PROGRAMMING
4	ALL (SOT & SPT)	B.Tech.-II	MA 103T	MATHEMATICS - II
5	ALL (SOT)	B.Tech.-III	MA 201T	MATHEMATICS – III (SOT)
6	ALL (SOT)	B.Tech.-IV	MA 202T	MATHEMATICS - IV
7	SPT	B.Tech.-III	MA 203T	MATHEMATICS – III (SPT)
7	SPT	B.Tech.-VI	MA 301T	NUMERICAL METHODS
8	SPT & Nuclear Engg.	M.Tech.-I	MA 501T	ADVANCED NUMERICAL METHODS & COMPUTER PROGRAMMING
9	SPT & Nuclear Engg.	M.Tech.-I	MA 501P	ADVANCED NUMERICAL METHODS & COMPUTER PROGRAMMING
10	Energy Systems & Technology	M.Tech.-I	MA 502T	MATHEMATICAL TECHNIQUES

11	SPT	B.Tech.	MA 204T	GEOSTATISTICS (ELECTIVE)