Title of the course : **ENGINEERING MATHEMATICS**
Subject Code : **AMT – 411**
Weekly load : 4 Hrs. LTP 3-1-0
Credit : 3 (Lecture 3; Tutorial 0; Practical 0)

Theory

Unit	**Main Topics**	**Course outlines**	**Lecture(s)**
Unit-1	1. Differential Calculus	Tracing of Standard Cartesian. Parametric and Polar Curves; Curvature of Cartesian, Parametric and Polar curves.	9
	2. Integral Calculus	Rectification of Standard curves; Areas bounded by standard curves; Volumes and surfaces of revolution of curves; Applications of integral calculus to find centre of gravity and moment of inertia	9
	3. Differential equation	Exact differential equations, Equations reducible to exact form by integrating factors; Solution of linear differential equation of first order- Leibnitz's linear and Bernoulli's equation. Higher order linear differential equation with constant coefficients, complementary function and particular integral. Method of variation of parameters. Cauchy's and Legendre's equations.	12
Unit-2	4.Matrices	Elementary transformations. Row reduced Echelon forms. Rank of a matrix. Normal form. Linearly dependent and independent vectors. System of linear equations. Linear transformations. Eigenvalues and eigenvectors. Properties of eigenvalues. Verification of Cayley-Hamilton Theorem and its use for finding inverse of a matrix.	10
	5. Infinite series	Convergence and divergence of positive term series, tests of convergence (without proofs), Comparison test, integral test, Ratio test, Cauchy's root test. Absolute and conditional convergence of alternating series- Leibnitz's test, Weirestrass M- test for series with general terms.	8
	6. Functions of complex variables	Limit of a complex function. Differentiation. Analyticity. Cauchy-Riemann equations. Harmonic functions. Conformal mapping. Some special transformations- translation, inversion and rotation.	12

Total = 60

Course Outcomes (COs):

Upon completion of this course, the student will be able to:

CO1: Understanding curve tracing, application of integral calculus and formation – solution of differential equations.

CO2: Find eigenvalues and eigenvectors of a matrix.

CO3: Understand concept of linearly independent and dependant vectors, solution of system of linear equations.

CO4: Understand the concept of convergence of infinite series and discuss the convergence/divergence of a series using different tests.

CO5: Understand the concepts of complex function theory.

CO/PO Mapping: (Strong (3)/Medium (2)/Weak (1) indicates strength of correlation)															
COs	Programme Outcomes (POs)												Program Specific Outcome (PSO)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	0	0	0	0	0	1	0	2	2	3	2
CO2	3	3	2	1	0	0	0	0	0	1	0	2	2	3	2
CO3	3	3	2	1	0	0	0	0	0	1	0	2	2	3	2
CO4	3	3	2	1	0	0	0	0	0	1	0	2	2	3	2
CO5	3	3	2	1	0	0	0	0	0	1	0	2	2	3	2

Recommended Books:

1. Danial A Murray, Elementary Course in Differential Equations, Longman (1902).
2. E. Kreyszig, Advanced Engineering Mathematics, Wiley Eastern Limited (2010).
3. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill (2006).
4. Peter V.O'Neil, Advanced Engineering Mathematics, CENGAGE Learning (2011) .
5. Gorakh Prasad, Differential Calculus, Pothishala (1968).
6. Gorakh Prasad, Integral Calculus, Pothishala (1961).

Title of the course : **HIGHER ENGINEERING MATHEMATICS**
Subject Code : **AMT – 511/AMT-521**
Weekly load : 4 Hrs. LTP 4-0-0
Credit : 4 (Lecture 4; Tutorial 0; Practical 0)

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Laplace Transforms	Laplace transforms of elementary functions. Properties of Laplace transform. Transform of derivatives and integrals. Evaluation of integrals by Laplace transforms. Inverse Laplace transforms. Convolution theorem. Solution of ordinary differential equations. Unit step function and unit impulse function. Engineering applications.	10
	2. Fourier Series	Fourier series. Change of interval. Even and odd functions. Half-range series. Applications to typical waveforms including saw-tooth, triangular, sine-wave etc. Parseval's theorem on Fourier constants.	8
	3. Partial Derivatives	Functions of two or more variables. Partial derivatives. Homogenous functions. Euler's Theorem. Total derivative. Derivative of an implicit function. Tangent and normal to a surface. Change of variables. Jacobian. Taylor's and Maclaurin's series expansions for a function of two variables, maxima and minima. Lagrange's method of undetermined multipliers. Differentiation under integral sign.	12
Unit-2	4. Multiple Integrals	Double integral. Change of order of integration. Triple integral. Change of variables. Applications to area and volume. Beta function. Gamma function. Their properties.	10
	5. Vector Differentiation	Scalar and vector fields, differentiation of vectors, velocity and acceleration, vector differential operators: Del, Gradient, Divergence and Curl, their physical interpretations. Formulae involving Del applied to point function and their products, Directional derivative.	10
	6. Vector Integration	Line, surface and volume integrals. Theorems of Green (in plane), Gauss and Stoke (without proof) - their verification and applications.	10

Total=60

Course Outcomes (COs):
Upon completion of this course, the student will be able to:
CO1: Understand the concept of Laplace transform and apply it to solve differential equations.
CO2: Learn to obtain Fourier series expansion and its properties.
CO3: Understand the concept of partial differentiation and its applications.
CO4: Find the area and volume using multiple integral.
CO5: Understand the concept of vector differentiation and integration.

CO/PO Mapping: (Strong (3)/Medium (2)/Weak (1) indicates strength of correlation)															
COs	Programme Outcomes (POs)												Program Specific Outcome (PSO)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	0	0	0	0	0	1	0	2	2	3	2
CO2	3	3	2	1	0	0	0	0	0	1	0	2	2	3	2
CO3	3	3	2	1	0	0	0	0	0	1	0	2	2	3	2
CO4	3	3	2	1	0	0	0	0	0	1	0	2	2	3	2
CO5	3	3	2	1	0	0	0	0	0	1	0	2	2	3	2

Recommended Books:

1. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publishing House (2007).
2. G.B. Thomas and R.L. Finney, Calculus: Analytical Geometry, Addison Wesley (2006).
3. E. Kreyszig, Advanced Engineering Mathematics, Wiley Eastern (2010).
4. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill (2006).
5. Peter V.O'Neil, Advanced Engineering Mathematics, CENGAGE Learning (2011).

Title of the course	: **NUMERICAL ANALYSIS**
Subject Code	: **AMT – 611/AMT -621**
Weekly load	: 4 Hrs. LTP 3-1-0
Credit	: 4 (Lecture 3; Tutorial 1; Practical 0)

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Errors	Errors in arithmetic operations and functions. Round-off error, truncation error. Absolute error. Relative error. Percentage error. Principles of equal effect. Significant digits.	6
	2. Roots of equations	Intermediate value property. Bisection method. Method of false position. Secant Method. Newton-Raphson method. Iteration method. Convergence of these methods.	8
	3. Solution of linear equations and eigen value problems	Gauss Elimination method (with and without partial pivoting). Jacobi, Gauss-Seidel methods. Triangularization method. Rayleigh's power method for finding dominant eigenvalue.	8
Unit-2	6. Finite differences and Interpolation	Finite differences-forward, backward and central differences. Shift and averaging operators. Newton's forward, backward and divided difference interpolation formulae. Lagrange's formula. Gauss forward and backward difference interpolation formulae, cubic Spline interpolation.	8
	7. Numerical differentiation and integration	Numerical differentiation using Newton's forward and backward difference formulae. Numerical integration – Trapezoidal rule, Simpson's one third and three-eighth rules. Romberg's integration. Error in integration.	7
	8. Numerical solution of ODEs	Taylor series method. Picard's method. Euler method. Modified Euler's method. Runge-Kutta methods (up to fourth order) for solution of ODE of first order.	8

Total = 45

Course Outcomes(COs):

Upon completion of this course, the student will be able to:

CO1: Understand the concept of roots finding of nonlinear equations. Discuss its convergence and error analysis.
CO2: Solve the system of linear equations and understand eigen value problem numerically.
CO3: Understand different finite difference operators and the concept of interpolation.
CO4: Implement the idea of numerical differentiation and integration of different problems.
CO5: Solve first order ordinary differential equations numerically.

CO/PO Mapping: (Strong (3)/Medium (2)/Weak (1) indicates strength of correlation)															
COs	Programme Outcomes (POs)												Program Specific Outcome (PSO)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	0	0	0	0	0	1	0	2	2	3	2
CO2	3	3	2	1	0	0	0	0	0	1	0	2	2	3	2
CO3	3	3	2	1	0	0	0	0	0	1	0	2	2	3	2
CO4	3	3	2	1	0	0	0	0	0	1	0	2	2	3	2
CO5	3	3	2	1	0	0	0	0	0	1	0	2	2	3	2

Recommended Books:

1. S.S. Sastry, Introductory Method of Numerical Analysis, PHI (2005).
2. C. F. Gerald and P. O. Wheatley, Applied Numerical Analysis, Addison-Wesley (2004).
3. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computations, New Age International (2007).
4. J.H. Mathew, Numerical Methods for Mathematics, Science and Engineering, PHI (1966).

Title of the course : **NUMERICAL ANALYSIS LAB**
Subject Code : **AMP – 611/AMP -621**
Weekly load : 2 Hrs. LTP 0-0-2
Credit : 1 (Lecture 0; Tutorial 0; Practical 1)

List of Programmes

1. Finding roots of the equation $f(x) = 0$ using
   i) Bisection Method ii) Secant Method iii) Method of false position

2. Finding roots of the equation $f(x) = 0$ using
   i) Iterative Method ii) Newton - Raphson's Method

3. To check consistency and finding Solution of a system of linear algebraic equations using
   i) Gauss elimination Method ii) Gauss - Seidal Method iii) Jacobi Method

4. Solution of a system of linear equations by triangularization method.

5. Finding dominating Eigen value and Eigen vector using Rayleigh's power Method.

6. Interpolation using
   i) Newton's forward difference formula ii) Newton's backward difference formula

7. Interpolation using
   i) Newton's divided difference formula ii) Lagrange's interpolation formula

8. Interpolation using
   i) Gauss's forward formula ii) Gauss's backward difference formula

9. Interpolation using Splines
   i) Linear ii) Quadratic iii) Cubic

10. Numerical differentiation using
    i) Newton's forward interpolation formula ii) Newton's backward interpolation formula

11. Numerical Integration using
    i) Trapezoidal rule ii) Simpson's 1/3rd rule
    iii) Simpson's 3/8th rule iv) Romberg's rule

12. Solution of Ist order ordinary differential equations using
    i) Taylor's series method ii) Picard's method
    iii) Euler's method iv) Euler's modified method

13. Solution of Ist order ordinary differential equations using
    i) Runge-Kutta method of IIIrd order ii) Runge-Kutta method of IVth order

Course Outcome: After the completion of this course, the student will be able to write a program in C/C++ and to:

CO1: Solve nonlinear equations using iterative methods.
CO2: Solve system of linear equations and find dominant eigen value.
CO3: Implement various interpolation formulae.
CO4: Obtain numerical differentiation and integration.
CO5: Solve first order ordinary differential equations numerically.

CO/PO Mapping: (Strong (3)/Medium (2)/Weak (1) indicates strength of correlation)															
COs	Programme Outcomes (POs)												Program Specific Outcome (PSO)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	0	0	0	0	0	1	0	2	2	3	2
CO2	3	3	2	1	0	0	0	0	0	1	0	2	2	3	2
CO3	3	3	2	1	0	0	0	0	0	1	0	2	2	3	2
CO4	3	3	2	1	0	0	0	0	0	1	0	2	2	3	2
CO5	3	3	2	1	0	0	0	0	0	1	0	2	2	3	2

Title of the course : **ADVANCED MATHEMATICS**
Subject Code : **AMO –** 621
Weekly load : 3 Hrs. LTP 3-0-0
Credit : 3 (Lecture 3; Tutorial 0; Practical 0)

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Complex Integration	Review of analytic function and its properties, Line integral, Cauchy's theorem (proof using Green's Theorem) Cauchy's integral formula. Morera's theorem, Cauchy's inequality, Poisson's integral formulae.	8
	2. Theory of Residues	Power series. Taylor's and Laurent's series, Singularities. Zeros. Residues. Cauchy's residue theorem.	6
	3.Application to Real Integrals	Integration around unit circle. Integration over semi-circular contours (with and without real poles). Integration over rectangular contours.	8
Unit-2	4. Fourier Transforms	Integral transforms. Fourier integral theorem. Fourier sine and cosine integrals. Fourier transforms. Properties of Fourier transforms. Convolution theorem for Fourier transforms.	8
	5. Z-Transforms	Z transforms and its properties. Z transform of polynomial functions, trigonometric functions and hyperbolic functions. Convolution theorem. Inverse Z-transform.	7
	6.Applications	Applications of Fourier transforms in solving partial differential equations (Laplace, Heat and Wave equations). Formation of difference equations and solution of first and second order difference equations with constant coefficients using Z-transform.	8

Total=45

Course Outcomes (COs):

Upon completion of this course, the student will be able to:

CO1: Evaluate complex contour integrals and apply the Cauchy integral theorem in its various versions, and the Cauchy integral formula.
CO2: Find the series expansions (Taylor's and Laurent's) of complex functions.
CO3: Apply the residue theory for the evaluation of real integrals.
CO4: Learn Fourier transforms and their application to solution of partial differential equations.
CO5: Have a thorough knowledge of Z-transform.

CO/PO Mapping: (Strong (3)/Medium (2)/Weak (1) indicates strength of correlation)															
COs	Programme Outcomes (POs)												Program Specific Outcome (PSO)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	0	0	0	0	0	1	0	2	2	3	2
CO2	3	3	2	1	0	0	0	0	0	1	0	2	2	3	2
CO3	3	3	2	1	0	0	0	0	0	1	0	2	2	3	2
CO4	3	3	2	1	0	0	0	0	0	1	0	2	2	3	2
CO5	3	3	2	1	0	0	0	0	0	1	0	2	2	3	2

Recommended Books:

1. R.K. Jain and S.R.K. lyengar, Advanced Engg. Mathematics, Narosa Publishing House (2007).
2. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill (2006).
3. R.V. Churchill and I.W. Brown, Complex Variables and applications, Tata McGraw Hill (2008).
4. Michael D Greenberg, Advanced Engg. Mathematics, Pearson (1998).