Degree Programme

Title of the course : **Engineering Mathematics** - I
Subject Code : **BSMA – 401**
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. Matrices	Rank of a matrix, System of linear equations, Symmetric, skew-symmetric and orthogonal matrices, Orthogonal transformation, Eigenvalues and eigenvectors. Diagonalization of matrices, Cayley – Hamilton theorem, Complex matrices: Hermitian, skew-Hermitian and unitary matrices and their properties.	8
	2.Differential Calculus	Mean-value theorem, Taylor's and Maclaurin's theorems with remainder. Indeterminate forms and L'Hospital's Rule.	7
	3. Integral Calculus	Evaluation of definite and improper integrals. Beta and Gamma functions and their properties. Application of definite integral to evaluate surface area and volume of revolution.	7
Unit-2	4.Calculus of Several Variables	Limit, continuity and partial derivatives, total derivative. Tangent plane and normal line, Maxima, Minima and saddle points, Method of Lagrange's multiplier.	8
	5. Sequences and Series	Convergence of sequences and series, tests for convergence: Comparison Test, Integral Test, Ratio Test, Root Test. Power series, Taylor's series, series for exponential, trigonometric and logarithm functions. Fourier series, Half-range series.	8
	6. Vector Differentiation	Scalar and vector fields, differentiation of vectors, vector differential operators: Del, Gradient, Divergence and Curl, their physical interpretations. Formulae involving Del applied to vector point function and their products, Directional derivatives.	7
			Total=45

Recommended Books:

1. G.B. Thomas and R.L.Finney, Calculus and Analytic Geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. T. Veerarajan, Engineering Mathematics for first year, Tata Mc Graw-Hill, New Delhi, 2008.
4. B.V. Ramana., Higher Engineering Mathematics, Tata McGraw Hill, New Delhi, 11th Reprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2018.
7. Babu Ram, Engineering Mathematics, Pearson Education, 2009.

Course Outcomes:

The objective of this course is to familiarize engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of Mathematics and applications that they would find useful in their disciplines.

Upon completion of this course, students will learn:

1. The essential concept of matrices and linear algebra in comprehensive manner.
2. The differential - integral calculus and their real life applications.

3. To deal with functions of several variables and their applications in engineering.
4. Convergence analysis of power series and Fourier series.
5. Applications of vector calculus (differentiation).

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

Degree Programme

Title of the course : **Engineering Mathematics - II**
Subject Code : **BSMA– 402**
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.Multivariable Calculus (Integration)	Multiple Integration: Double integrals (Cartesian and polar), Change in order of Integration in double integrals, Change of Variables (Cartesian and polar). Applications: area Triple Integrals (Cartesian), Simple applications involving cube, sphere and rectangular parallelopiped.	7
	2. Ordinary Differential Equations	Exact, Linear and Bernoulli's differential equations, Second order linear differential equations with constant coefficients, method of variation of parameters, Cauchy-Euler equation.	6
	3. Laplace Transform	Laplace transform of elementary functions, properties of Laplace transform, transform of derivatives and integrals, inverse Laplace transform, Convolution theorem, Solution of ordinary differential equations using Laplace transform, Unit step function and unit impulse function, their Laplace transforms.	8
Unit-2	4 Complex Variable-Differentiation	Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate. Elementary analytic functions (exponential, trigonometric, logarithm) and their properties. Conformal mapping.	8
	5. Complex Variable-Integration	Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and maximum-modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series. Cauchy residue theorem (without proof), Residue theorem and its applications to real integrals: Integration around unit circle, Integration over semi-circular contours.	9
	6. Vector Integration	Line, surface and volume integrals. Theorems of Green (in plane), Gauss and Stoke (without proof) - their verification and applications.	7
			Total=45

Recommended Books:

1. G.B. Thomas and R.L.Finney, Calculus and Analytic Geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. W.E.Boyce and R.C. DiPrima, Elementary Differential Equations and Boundary Value Problems. 9th Edn., Wiley India, 2009.
4. S.L. Ross, Differential Equations, 3 Ed. Wiley India, 1984.
5. E.A Coddington, An Introduction to Ordinary Differential Equations, Prentice hall India, 1995.
6. E.L. Ince. Ordinary Differential Equations, Dover Publications, 1958.
7. J.W. Brown and R.V. Churchill, Complex Variables and Applications, McGraw-Hill, 7th Edn., 2011.
8. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2018.

Course Outcomes:

The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

Upon completion of this course, students will learn:

1. The multivariable integral calculus and its engineering applications.
2. The solution procedure of ordinary differential equations.
3. Laplace transform and its applications to solve engineering problems.
4. The differentiation and integration of functions of complex variable and their applications.
5. Engineering and physical applications of vector calculus (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

Degree Programme

Title of the course : **Numerical and Statistical Methods**
Subject Code : **BSMA– 501**
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. Errors and Solution of Equations	Errors in arithmetic operations and functions: Round-off error, truncation error, absolute error, relative error, percentage error. Intermediate value property, Descartes Rule of signs. Bisection method, Method of false position, Secant Method, Newton-Raphson method, Iteration method. Convergence of these methods. Gauss Elimination method (with and without partial pivoting). Jacobi, Gauss-Seidel methods.	10
	2.Finite Difference 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.	6
	3.Numerical differentiation, integration and solution of ODEs	Numerical differentiation using Newton's forward and backward difference formulae. Numerical integration : Trapezoidal rule, Simpson's one third and three-eighth rules. Error in integration. Solution of ODE of first order: Taylor series method, Picard's method, Euler method, Modified Euler's method and Runge-Kutta methods.	7
Unit-2	4.Curve fitting	Curve fitting by the method of least squares: fitting of straight lines, second degree parabolas and more general curves.	5
	5.Statistics	Measures of central tendency, measures of dispersion, coefficient of variation, relation between measures of dispersion, moments, skewness, kurtosis, Karl Pearson coefficient of correlation.	8
	6.Probability	Definition of probability, laws of probability, Baye's theorem, Random variable, Mathematical Expectation, Moment generating function, Probability distributions: Binomial, Poisson and Normal.	9

Total = 45

Recommended Books:

1. S.S. Sastry, Introductory Method of Numerical Analysis, PHI (2005).
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computations, New Age International (2007).
3. B. S. Grewal, Numerical Methods in Engineering & Science, Khanna Publishers, 2011.
4. S.C. Gupta & V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons(2014).
5. A. M. Goon, M. K. Gupta and B. Dasgupta, An Outline of Statistical Theory, Vol. I , World Press Pvt. Ltd (2013).
6. S. P. Gupta, Statistical Methods, S. Chand & Co., 43rd Edition, 2017.

Course Outcomes:

The course aims to shape the attitudes of learners regarding the field of statistics. Specifically, the course aims to motivate in students an intrinsic interest in statistical thinking and Instil the belief that statistics is important for scientific research.

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

1. Finding the roots of nonlinear equations, system of linear equations and error analysis.
2. Understand the concept of different operators and their applications in solving numerical differentiation and integration.
3. Solve ordinary differential equations of first order numerically.
4. Understand the concept of data handling using curve fitting, central tendency, dispersion and correlation.
5. Understand the concept of probability and its implementation in discrete and continuous distributions.

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

Degree Programme

Title of the course : **Numerical and Statistical Methods Lab**
Subject Code : **BSMA– 502**
Weekly load : 2 Hrs. LTP 0-0-2
Credit : 1 (Lecture 0; Tutorial 0; Practical 2)

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

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

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

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

9. Solution of Ist order ordinary differential equations using Runge-Kutta methods.

10. Fitting a curve using given data.
    i) linear curve ii) quadratic curve
    iii) cubic curve iv) any other

11. Finding the following, using given data:
    i) mean, median and mode.
    ii) standard deviation and mean deviation.
    iii) moments, skewness and kurtosis of various order.
    iv) rank correlation.

Course Outcomes:

The course aims to implement C/C++ programming concepts to the topics discussed in BSMA-501.

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

1. Solve nonlinear equations using iterative methods.
2. Solve system of linear equations and find dominant eigen value.
3. Implement various interpolation formulae.
4. Obtain numerical differentiation and integration.
5. 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