Syllabus of Mathematics Courses

in

B. E. Programme

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
(S/M/W indicates strength of correlation) S – Strong, M – Medium, W – Weak

Cos	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	M	M	S	M	S	S	M	M
CO2	S	S	S	S	M	M	S	M	S	S	M	M
CO3	S	S	S	S	M	M	S	M	S	S	M	M
CO4	S	S	S	S	M	M	S	M	S	S	M	M

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 and volumes. 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
(S/M/W indicates strength of correlation) S – Strong, M – Medium, W – Weak

Cos	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	M	M	S	M	S	S	M	M
CO2	S	S	S	S	M	M	S	M	S	S	M	M
CO3	S	S	S	S	M	M	S	M	S	S	M	M
CO4	S	S	S	S	M	M	S	M	S	S	M	M

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

(S/M/W indicates strength of correlation) S – Strong, M – Medium, W – Weak

Cos	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	M	M	S	M	S	S	M	M
CO2	S	S	S	S	M	M	S	M	S	S	M	M
CO3	S	S	S	S	M	M	S	M	S	S	M	M
CO4	S	S	S	S	M	M	S	M	S	S	M	M

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 $1/3^{rd}$ rule
   iii) Simpson's $3/8^{th}$ rule
8. Solution of I^{st} 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 I^{st} 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.

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	0	0	0	0	0	1	0	2
CO2	3	3	2	1	0	0	0	0	0	1	0	2
CO3	3	3	2	1	0	0	0	0	0	1	0	2
CO4	3	3	2	1	0	0	0	0	0	1	0	2
CO5	3	3	2	1	0	0	0	0	0	1	0	2

Degree Programme

Title of the course : **Engineering Mathematics (only for LEET students)**
Subject Code : **OEMA-611**
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. Ordinary Differential Equations	Exact, linear and Bernoulli's differential equations, Second order linear differential equations with constant coefficients, Laplace transform and its properties, inverse Laplace transform, solution of ordinary differential equations using Laplace transform, Unit step function and unit impulse function.	6
	2. Sequences and Series	Convergence of sequences and series, tests for convergence: Integral Test, Comparison Test, Ratio Test, Root Test. Fourier series: Half range sine and cosine series.	8
	3. 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.	8
Unit-2	4.Multivariable Calculus (Differentiation)	Limit, continuity and partial derivative, total derivative. Tangent plane and normal line. Maxima, Minima and saddle points, Method of Lagrange's multiplier.	
	5.Multivariable Calculus (Integration)	Multiple Integration: Double integral (Cartesian and polar), Change in order of Integration in double integrals, Change of Variables (Cartesian and polar), Applications to area and volume, Triple Integral (Cartesian), Simple applications involving cubes, sphere and rectangular box.	8
	6. Complex Variable-Differentiation	Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithm) and their properties.	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. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2018.

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 effective mathematical tools for the solutions of differential equations that model physical processes.
2. The essential tool of matrices and linear algebra in comprehensive manner.
3. To deal with functions of several variables that are essential in most branches of engineering.
4. The mathematical tools needed in evaluating multiple integrals and their usage.

CO/PO Mapping

(S/M/W indicates strength of correlation) S – Strong, M – Medium, W – Weak

Cos	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	M	M	S	M	S	S	M	M
CO2	S	S	S	S	M	M	S	M	S	S	M	M
CO3	S	S	S	S	M	M	S	M	S	S	M	M
CO4	S	S	S	S	M	M	S	M	S	S	M	M

Degree Programme

Title of the course : **Operations Research**
Subject Code : **OEMA-612**
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. Introduction to LPP	Introduction to Optimization Techniques. Basic concept and notations. Formulation of Linear Programming Problem (LPP). Graphical Solution. Nature of the solution of LPP through graphical method. Spanning set, basis, replacing a vector in a basis, Basic solution and Basic Feasible Solutions (BFS) of system of linear equations, BFS by using rank method.	7
	2. Simplex Method I	Hyperplane, hypersurfaces, convex sets and their properties. Extreme points, adjacent point of a convex set. Standard Form of an LPP. Fundamental theorem of LPP. Slack, Surplus & Artificial variables Simplex method.	7
	3. Simplex Method II	Degeneracy. Nature of the solution of LPP through simplex method. Big M method. Two phase method.	10
Unit-2	4. Duality Theory	Primal and Dual problem. Duality theory, Complimentary Slackness Conditions (CSC), Solution of primal and Dual and vice versa.	9
	5. Transportation Problem	Basic concept & notations. Balanced & unbalanced TP. Initial BFS of TP by using North-West corner rule, Matrix minima method & Vogel's Approximation Method. Improving an initial BFS of a TP to optimal solution (or Modi method).	8
	6. Assignment Problem	Introduction to Assignment Problem. Hungarian method to solve Assignment Problem. Solution of some special type of AP.	4

Total=45

Recommended Books:

1. J. G. Chakravorty and P. R. Ghosh, Linear Programming and game Theory, Moulik Library (2009).
2. S. K. Gupta, Linear Programming & Network Models, Affiliated East-West Private Ltd. (1985).
3. Kanti Swarup, P.K. Gupta & Man Mohan, Operations Research, S. Chand & Sons.(1994).
4. H.A. Taha, Operations Research, PHI (2007).

Course Outcomes:

Operations research helps in solving real life problems in different environments that needs decisions. This module aims to introduce students to use quantitative methods and techniques for effective decisions-making; model formulation, like LPP, TP, AP and their applications.

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

1. Formulate some real life problems into LPP and find their solution by graphical method and rank method.
2. Use the simplex, Big M and two phase method to find an optimal BFS for the standard LPP.
3. Using Duality theory one can construct Dual Problem and check the optimal solution for primal LPP and Dual LPP by CSC.
4. Formulate and find the optimal solution of TP and AP.

CO/PO Mapping

(S/M/W indicates strength of correlation) S – Strong, M – Medium, W – Weak

Cos	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	M	M	S	M	S	S	M	M
CO2	S	S	S	S	M	M	S	M	S	S	M	M
CO3	S	S	S	S	M	M	S	M	S	S	M	M
CO4	S	S	S	S	M	M	S	M	S	S	M	M

Degree Programme

Title of the course : **Mathematical Methods**
Subject Code : **OEMA - 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. Series solution of Differential Equations	Power series solutions: Legendre polynomial, Bessel functions of the first kind and their properties, Recurrence formulae, Orthogonality of Bessel's function and Legendre Polynomials.	7
	2.Partial Differential Equation	Formation of PDE, Linear and non-linear equations of first order, Charpit's method, Homogeneous linear equation with constant coefficients, complementary function and particular integral.	7
	3. 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
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). Solution of first and second order difference equations with constant coefficients using Z-transform.	8

Total=45

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. Michael D Greenberg, Advanced Engg. Mathematics, Pearson (1998).
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2018.

Course Outcomes:

This course is intended to prepare the students with mathematical tools and techniques that are required in advanced applied mathematics. The objective of this course is to enable students to apply various transforms for solving differential equations and initial and boundary value problems and difference equations.

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

1. Understand how to solve differential equations and partial differential equations.
2. Learn to obtain Fourier series expansion of a function.

3. Learn Fourier transformation and its applications to solution of partial differential equations.
4. Learn to apply Z-transform to solve difference equation.

CO/PO Mapping (S/M/W indicates strength of correlation) S – Strong, M – Medium, W – Weak												
Cos	Programme Outcomes (Pos)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	M	M	S	M	S	S	M	M
CO2	S	S	S	S	M	M	S	M	S	S	M	M
CO3	S	S	S	S	M	M	S	M	S	S	M	M
CO4	S	S	S	S	M	M	S	M	S	S	M	M

Degree Programme

Title of the course : **Discrete Mathematics**
Subject Code : **OEMA – 622**
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. Logic	Mathematical Logic: Statement and notations, proposition and logic operations, connectives (conjunction, disjunction, negation), statement formulae and truth tables, propositions generated by set, equivalence of formulae and implication laws of logic, propositions over a universe, variables, quantifiers.	9
	2. Relations and Functions	Relation and Function: Binary relations, Properties of binary relation in set, Equivalence relations, Composition of binary relations. Partial Order set, principal of mathematical induction and Pigeon-hole Principle.	8
	3. Recurrence Relations	Recurrence relations, Difference equations as recurrence relations and their solutions, generating functions and their solutions.	5
Unit-2	4. Lattice	Lattice and Algebraic systems, Principle of duality, Basic properties of Algebraic systems, Distributed and Complemented Lattices, Boolean Lattices	7
	5. Boolean Algebra	Boolean algebra, Boolean functions and Boolean expressions, simplifications of Boolean expressions, Basic circuits and theorems, Logical gates and relations of Boolean functions.	6
	6. Graph Theory	Basic terminology of graph theory, degree Paths, Circuits, Graph connectivity, Weighted graphs. Trees, Spanning trees, Properties of tree, planar graphs. Eulerian graphs (Eulerian paths and circuit), Hamiltonian graphs and their properties, Kruskal's algorithm and Prim's algorithm for finding minimum spanning tree.	10

Total=45

Recommended Books:

1. J. P. Trembley and R. Manohar, A First Course in Discrete Structure with applications to Computer Science, Tata McGraw-Hill (1999).
2. M. K. Das, Discrete Mathematical Structures, Narosa Publishing House (2007).
3. Babu Ram, Discrete Mathematics, Vinayak Publications (2004).
4. Narsingh Deo, Graph Theory, with applications to Engineering and Computer science. Prentice Hall of India Pvt. Ltd. (1987).

Course Outcomes :

The objective of this course is to prepare students to develop mathematical logic and mathematical arguments which are required in learning many courses involving mathematics and computer sciences. To motivate students how to solve practical problems using discrete mathematics.

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

1. Construct mathematical arguments using logical connectives and quantifiers.
2. Validate the correctness of an argument using statement and predicate calculus.
3. Understand how lattices and Boolean algebra are used as tools and how they help in the study of computer networks.
4. Learn how to work with some of the discrete structures which include sets, relations, functions, graphs and recurrence relations.

CO/PO Mapping

(S/M/W indicates strength of correlation) S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	M	S	S	M	S	S	M	M
CO2	S	S	S	S	M	S	S	M	S	S	M	M
CO3	S	S	S	S	M	S	S	M	S	S	M	M
CO4	S	S	S	S	M	S	S	M	S	S	M	M

Title of the course : **Mathematical Statistics**
Subject Code : **OEMA – 711**
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.Correlation and Regression	Partial and multiple correlation (three variables case only), Regression analysis up to three variables.	6
	2.Probability	Definition of probability using different approaches, Discrete and continuous random variables, Probability mass function, Probability density function, Probability distribution function, Functions of a random variable.	9
	3. Distributions	Exponential distribution, Gamma distribution, Chi-square distribution, Student's t distribution and F distribution.	7
Unit-2	4.Moment Generating and Characteristic Functions	Moments, Moment generating functions, Characteristic function, Joint distribution function, Marginal and conditional distributions, Bi-variate normal distribution.	7
	5.Testing of hypothesis	Fundamental notions, Tests based on Normal, t, Chi-square and F distributions.	8
	6.ANOVA technique	Analysis of variance: Completely Randomized Design and Randomized Block Design.	8

Total=45

Recommended Books:

1. P. L. Meyer, Introduction to Probability and Statistical Applications, Oxford & IBH (2007).
2. A. M. Goon, M. K. Gupta and B. Dasgupta, An Outline of Statistical Theory, Vol. I , World Press Pvt. Ltd (2013).
3. T. W. Anderson, An Introduction to Multivariate Statistical Analysis, John Wiley (2003).
4. S. P. Gupta, Statistical Methods, S. Chand & Co., 43rd Edition, 2017.
5. S.C. Gupta & V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons(2014).

Course Objectives: 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.

After the completion of this course, the student will be able to:
1. Analyse the correlated data and fit the linear regression model
2. Compute the probability of composite events
3. Understand the random variable, expectation, moments and distributions
4. Understand the concept of sampling distribution and its importance.

CO/PO Mapping (S/M/W indicates strength of correlation) S – Strong, M – Medium, W – Weak												
Cos	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S	S	S	S	M	M	S	M	S	S	M	M
CO2	S	S	S	S	M	M	S	M	S	S	M	M
CO3	S	S	S	S	M	M	S	M	S	S	M	M
CO4	S	S	S	S	M	M	S	M	S	S	M	M