Undergraduate Engineering Programmes

SCHEME & SYLLABUS

(From the Academic Year 2024-25 Onwards)

BOARD OF STUDY

DEPARTMENT OF MATHEMATICS

SANT LONGOWAL INSTITUTE OF ENGINEERING & TECHNOLOGY

(Deemed to be University under Ministry of Education, Govt. of India)

Longowal – 148106 (Punjab) INDIA

DEPARTMENT OF MATHEMATICS

VISION

The Department of Mathematics, SLIET, has always strived to be among the best Mathematics Departments in the country and has worked towards becoming a centre for advanced research in various areas of mathematics so that it can contribute to the development of the nation.

MISSION

- To work towards transformation of young people to competent and motivated professionals with sound theoretical and practical knowledge.
- To make students aware of technology to explore mathematical concepts through activities and experimentation.
- To produce post-graduate students with strong foundation to join research or to serve in industry.
- To create an atmosphere conducive to high class research and to produce researchers with clear thinking and determination who can, in future, become experts in relevant areas of mathematics.
- To inculcate in students the ability to apply mathematical and computational skills to model, formulate and solve real life applications.
- To make the students capable of discharging professional, social and economic responsibilities ethically.

UNDERGRADUATE ENGINEERING PROGRAMMES
(SEMESTER SYSTEM)

Mathematics is the backbone of science and engineering. Its utility in the emerging areas of science, engineering and technology is increasing day by day. After thorough deliberations and discussions and keeping syllabi of Indian universities in mind, the proposed syllabi contain various topics on pure, applied, and computational mathematics. The course would be beneficial to the engineering student community for their academic growth and employment.

PROGRAMME EDUCATIONAL OBJECTIVES:

- To provide students with knowledge and insight in mathematics so that they are able to work as mathematical professionals.
- To prepare them to pursue higher studies and conduct research.
- To train students to deal with the problems faced by industry through knowledge of mathematics and scientific computational techniques.
- To provide students with knowledge and capability in formulation and analysis of mathematical models in real life applications.
- To introduce the fundamentals of mathematics to students and strengthen their logical and analytical ability.
- To provide a holistic approach in learning through well designed courses involving fundamental concepts and state-of-the-art techniques in the respective fields.

PROGRAMME OUTCOMES:

The successful completion of this program will enable the students to:

1. Apply knowledge of mathematics to solve complex problems.
2. Identify the problems and formulate mathematical models.
3. Design the solutions for real life problems.
4. Analyse and interpret data to provide valid inferences.
5. Apply modern techniques to obtain solutions of mathematical problems.
6. Take the responsibility for mathematics practice.
7. Demonstrate the mathematics knowledge for sustainable development.
8. Apply ethical principles and commit to professional ethics.
9. Function effectively as an individual and as a member/leader in multidisciplinary groups.
10. Communicate mathematics effectively and make effective presentations.
11. Handle projects in mathematics independently or in multidisciplinary environments.
12. Recognise the need for society and engage in lifelong preparedness for technological advancement of the nation.

The board of studies for Undergraduate courses of Mathematics taught by the Department of Mathematics included the following members:

Chairman

- Dr. J.R. Sharma, Professor & Head, Department of Mathematics, SLIET Longowal

External Members

- Dr. Vinay Kanwar, Professor, Department of Applied Sciences, UIET, Panjab University
- Dr. Mahesh Kumar Sharma, Professor, School of Mathematics, Thapar University, Patiala

Members

- Dr. S.S. Dhaliwal, Professor
- Dr. Mandeep Singh, Professor
- Dr. Vinod Mishra, Professor
- Dr Sushma Gupta, Professor
- Dr. V.K. Kukreja, Professor
- Dr. R.K. Mishra, Professor
- Dr. R.K. Guha, Professor
- Dr. Yogesh Kapil, Assistant Professor
- Dr. Sudhir Kumar, Assistant Professor

Alumni Member

- Dr. Chinu Singla, Guest Faculty, Department of Mathematics, SLIET, Longowal

Parent Member

- Shri Jaspal Singh F/O Ms. Jatinder Kaur (M.Sc. Reg. No. 2262015)

UNDERGRADUATE STUDY SCHEME

MATHEMATICS COURSES FOR DIFFERENT UNDERGRADUATE ENGINEERING COURSES

SEMESTER - I (FOR ALL ENGINEERING GRADUATES)

SN	SUB CODE	SUBJECT TITLE	L	T	P	CREDITS
1	BSMA – 401	ENGINEERING MATHEMATICS - I	3	1	0	4
		TOTAL				**4**

SEMESTER - II (FOR ALL ENGINEERING GRADUATES)

SN	SUB CODE	SUBJECT TITLE	L	T	P	CREDITS
1	BSMA – 402	ENGINEERING MATHEMATICS - II	3	1	0	4
		TOTAL				**4**

SEMESTER - III / IV

SN	SUB CODE	SUBJECT TITLE	L	T	P	CREDITS
1	BSMA – 501	NUMERICAL AND STATISTICAL METHODS	3	0	0	3
2	BSMA – 502	NUMERICAL AND STATISTICAL METHODS LAB	0	0	2	2
		TOTAL				**5**

ELECTIVE SUBJECTS FOR SEMESTER - V

SN	SUB CODE	SUBJECT TITLE	L	T	P	CREDITS
1	OEMA – 611	ENGINEERING MATHEMATICS (Only for LEET students)	3	0	0	3
2	OEMA – 612	OPERATIONS RESEARCH	3	0	0	3

ELECTIVE SUBJECTS FOR SEMESTER - VI

SN	SUB CODE	SUBJECT TITLE	L	T	P	CREDITS
1	OEMA – 621	MATHEMATICAL METHODS	3	0	0	3
2	OEMA – 622	DISCRETE MATHEMATICS	3	0	0	3

ELECTIVE SUBJECTS FOR SEMESTER - VII

SN	SUB CODE	SUBJECT TITLE	L	T	P	CREDITS
1	OEMA – 711	MATHEMATICAL STATISTICS	3	0	0	3

NOTE: *Elective courses shall be offered depending upon the availability of the faculty in the Department, as well as sufficient number of students in one course.*

SEMESTER - I

Title of the course : **Engineering Mathematics** - I
Subject Code : **BSMA – 401**
Weekly load : 4 Hrs. L T P 3-1-0
Credit : 4 (Lecture 3; Tutorial 1; Practical 0)

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, L'Hospital rule, Curve tracing.	9
	3. Integral Calculus	Evaluation of improper integrals. Beta and Gamma functions and their properties. Fourier series, Change of interval, odd even functions, Half range series.	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.	6
	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. B.V. Ramana., Higher Engineering Mathematics, Tata McGraw Hill, New Delhi, 11th Reprint, 2010.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2018.
5. Babu Ram, Engineering Mathematics, Pearson Education, 2009.

Course Outcomes: Upon completion of this course, students will be able to:

1. Learn essential concept of matrices and linear algebra in comprehensive manner.
2. Understand the differential - integral calculus, curve tracing and their real life applications.
3. Deal with functions of several variables and their applications in engineering.
4. Learn sequences and series, power series, Fourier series and their convergence analysis.
5. Apply vector calculus (differentiation only) in engineering and physical applications.

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
CO5	S	S	S	S	M	M	S	M	S	S	M	M

SEMESTER - II

Title of the course : **Engineering Mathematics - II**
Subject Code : **BSMA– 402**
Weekly load : 4 Hrs. L T P 3-1-0
Credit : 4 (Lecture 3; Tutorial 1; Practical 0)

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1.Multivariable Calculus (Integration)	Double integrals (cartesian and polar): Change in order of Integration, Change of Variables. Its applications to find area. Triple Integrals (Cartesian): Applications involving volumes of cube, sphere and rectangular parallelopiped.	7
	2. Ordinary Differential Equations	Exact, Linear and Bernoulli's differential equations, Higher 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, 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.	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 & 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 & R.C. DiPrima, Elementary Differential Equations & Boundary Value Problems. 9th Edn., Wiley, 2009.
4. J.W. Brown and R.V. Churchill, Complex Variables and Applications, McGraw-Hill, 7th Edn., 2011.
5. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2018.

Course Outcomes: Upon completion of this course, students will be able to:

1. Solve the multivariable integral calculus and its engineering applications.
2. Solve the ordinary differential equations by different methods and apply in applications.
3. Learn Laplace transform and its applications to solve engineering problems.
4. Learn differentiation and integration of functions of complex variable and their applications.
5. Apply vector calculus (integration only) in engineering and physical applications.

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
CO5	S	S	S	S	M	M	S	M	S	S	M	M

SEMESTER - III / IV

Title of the course : **Numerical and Statistical Methods**
Subject Code : **BSMA– 501**
Weekly load : 3 Hrs. L T P 3-0-0
Credit : 3 (Lecture 3; Tutorial 0; Practical 0)

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Errors and Solution of Equations	Errors in arithmetic operations and functions: Round-off, truncation, absolute, relative, percentage errors. Intermediate value property, Bisection method, Method of false position, Secant Method, Newton-Raphson method, Iteration method and their convergence. Gauss elimination method (without 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 and Integration	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.	7
Unit-2	4. Numerical solution of ODEs	Solution of ODE of first order: Taylor series method, Picard's method, Euler method, Modified Euler's method and Runge-Kutta second and fourth order methods.	5
	5. Curve fitting, and Correlation	Curve fitting by the method of least squares: fitting of straight lines, second degree parabolas. Introduction to correlation coefficient, Karl Pearson coefficient and rank correlation.	8
	6. Probability and Its distributions	Definition and laws of probability, Baye's theorem, Random variable, Mathematical Expectation, 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 & R.K. Jain, Numerical Methods for Scientific & Engineering Computations, New Age Int. (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. S.P. Gupta, Statistical Methods, S. Chand & Co., 43rd Edition, 2017.

Course Outcomes: Upon successful completion of this course, students will be able to:

1. Identify and apply various numerical methods to solve problems involving error analysis. Master the use of numerical techniques to find roots of equations.
2. Apply finite difference methods for numerical differentiation and interpolation, and utilize Newton's divided difference and Lagrange's formulas effectively.
3. Execute numerical integration techniques and perform numerical differentiation. Solve ODEs using initial and boundary value techniques.
4. Implement least squares regression for fitting linear and polynomial equations to data sets and compute correlation coefficients to analyse.
5. Develop a deep understanding of probability laws, random variables, and their distributions, and apply these concepts to real-world data analysis and decision-making scenarios.

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
CO5	S	S	S	S	M	M	S	M	S	S	M	M

SEMESTER - III / IV

Title of the course : **Numerical and Statistical Methods Lab**
Subject Code : **BSMA– 502**
Weekly load : 2 Hrs. L T P 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) correlation coefficient.

SEMESTER - V (ELECTIVE COURSE)

Title of the course : **Engineering Mathematics (Only for LEET students)**
Subject Code : **OEMA-611**
Weekly load : 3 Hrs. L T P 3-0-0
Credit : 3 (Lecture 3; Tutorial 0; Practical 0)

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Ordinary Differential Equations and Laplace Transform	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.	8
	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, 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: Upon completion of this course, the student will be able to:

1. Solve ODEs, learn Laplace transform, its properties and their applications to solve engineering problems.
2. Sequences and Series, Fourier series and their convergence analysis.
3. The essential concept of matrices and linear algebra in comprehensive manner.
4. The multivariable differential and integral calculus and its engineering applications.
5. The differentiation and integration of functions of complex variable and their applications.

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
CO5	S	S	S	S	M	M	S	M	S	S	M	M

SEMESTER - V (ELECTIVE COURSE)

Title of the course : **Operations Research**
Subject Code : **OEMA-612**
Weekly load : 3 Hrs. L T P 3-0-0
Credit : 3 (Lecture 3; Tutorial 0; Practical 0)

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. Basic solution and Basic Feasible Solutions (BFS) of system of linear equations, Convex set, Extreme points, adjacent point of a convex set.	7
	2. Simplex Method-I	Standard Form of an LPP. Fundamental theorem of LPP. Slack, Surplus & Artificial variables Simplex method. Degeneracy. Nature of the solution of LPP through simplex method. Big M method. Two phase method.	9
	3. Simplex Method-II	Primal and Dual problem. Duality theory, Solution of primal and Dual and vice versa.	7
Unit-2	4. Duality Theory & Post Optimality Analysis	Complimentary Slackness Conditions. Dual Simplex method. Post Optimality Analysis for (i) Changes in cost vector and (ii) Changes in right hand side vector.	7
	5. Transportation and Assignment Problem	Basic concepts, notations. Balanced & unbalanced TP. Initial BFS of TP by using different methods. Improving an initial BFS of a TP to optimal solution. Introduction to Assignment Problem, Hungarian method.	8
	6. Game Theory	Introduction to game theory. The maximin & Minimax Criterion. Existence of saddle point. Game without saddle point. Mixed strategy. Solution of 2X2 game and rectangular game by mixed strategy (by Algebraic method). Dominance & its use to solve 2X2 game. 2XN & NX2 game. Graphical method, Solution of Game by LPP method and iterative method.	7

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:

Upon completion of this course, the student will be capable of:

1. Formulation of real-life problems into LPP and their solution by graphical and Gauss-Jordan method.
2. Solution of LPP by simplex, big M and two-phase methods.
3. Construction and solution of Dual Problem and using Duality theory to check the optimality of primal and Dual pair. Learn, how to tackle a changed problem by post optimality analysis.
4. Formulating and finding the optimal solution of transportation and assignment problem.
5. Learn applications of game theory in real life problem and their solution by various methods.

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
CO5	S	S	S	S	M	M	S	M	S	S	M	M

SEMESTER - VI (ELECTIVE COURSE)

Title of the course : **Mathematical Methods**
Subject Code : **OEMA - 621**
Weekly load : 3 Hrs. L T P 3-0-0
Credit : 3 (Lecture 3; Tutorial 0; Practical 0)

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 Equations	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. Applications	Applications of Fourier transforms in solving partial differential equations (Laplace, Heat and Wave equations).	8
	6. Z-Transforms	Z transforms and its properties, Z transform of polynomial functions, trigonometric functions and hyperbolic functions. Convolution theorem, inverse Z-transform. Solution of difference equations with constant coefficients using Z-transform.	7
			Total=45

Recommended Books:

1. R.K. Jain and S.R.K. Iyengar, 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: Upon completion of this course, the student will be able to

1. Understand series solution of differential equations.
2. Formation and solution of first order linear and non-linear partial differential equations.
3. Learn to obtain Fourier series expansion of a function.
4. Learn Fourier transformation and its applications to solution of partial differential equations.
5. 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
CO5	S	S	S	S	M	M	S	M	S	S	M	M

SEMESTER - VI (ELECTIVE COURSE)

Title of the course : **Discrete Mathematics**
Subject Code : **OEMA – 622**
Weekly load : 3 Hrs. L T P 3-0-0
Credit : 3 (Lecture 3; Tutorial 0; Practical 0)

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 and their validation.	7
	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.	7
Unit-2	4. Lattice	Lattice and Algebraic systems, Principle of duality, Basic properties of Algebraic systems, Distributed & Complemented Lattices, Boolean Lattices	7
	5. Boolean Algebra	Boolean algebra, Boolean functions and Boolean expressions, simplifications of Boolean expressions,	7
	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.	9

Total=45

Recommended Books:

1. J. P. Trembley and R. Manohar, A First Course in Discrete Structure, Tata McGraw-Hill (1999).
2. M. K. Das, Discrete Mathematical Structures, Narosa Publishing House (2007).
3. Babu Ram, Discrete Mathematics, Vinayak Publications (2004).
4. N. Deo, Graph Theory, Prentice Hall of India Pvt. Ltd. (1987).
5. K.H. Rosen, Discrete Mathematics and Its Applications, Tata Mc-Graw Hill (2017).

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

1. Construct mathematical arguments using logical connectives.
2. Validate the correctness of an argument using statement and predicate calculus.
3. Work with some of the discrete structures which include sets, relations, functions and recurrence relations.
4. Understand how lattices and Boolean algebra can be used as tools in the study of computer networks.
5. Understand various fundamental concepts of graph theory, its properties and applications in real life problems.

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
CO5	S	S	S	S	M	M	S	M	S	S	M	M

SEMESTER - VII (ELECTIVE COURSE)

Title of the course : **Mathematical Statistics**
Subject Code : **OEMA – 711**
Weekly load : 3 Hrs. L T P 3-0-0
Credit : 3 (Lecture 3; Tutorial 0; Practical 0)

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1.Probability	Review of probability, Moments, Skewness and Kurtosis. Discrete and continuous random variables. Distribution function. Joint and marginal distribution function. Mathematical expectation. Variance and Covariance. Moment generating functions. Characteristic function.	8
	2.Correlation and Regression	Partial and multiple correlation (three variables case only), Regression analysis up to three variables.	6
	3. Distributions	Discrete and continuous univariate distributions - Binomial, Poisson, and Normal distributions. Their properties and fitting of distributions.	8
Unit-2	4.Sampling distribution	Types of sampling. Standard error. Hypothesis. Critical values. Tests of significance for large samples. Sampling of attributes and variables.	7
	5.Testing of hypothesis	Properties and applications of exact sampling distributions: Chi-square, Student's 't' and F distributions.	9
	6.ANOVA technique	Analysis of variance: One-way and two-way classification.	7
			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: 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.
5. Perform the testing of hypothesis.

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
CO5	S	S	S	S	M	M	S	M	S	S	M	M