Lok Jagruti Kendra University
University with a Difference

Diploma in Automobile Engineering

LJ Polytechnic

Course Code: 025010101

Engineering Mathematics-I

Programme / Branch Name			Diploma in Automobile Engineering			
Course Name	Engineering Mathematics-I				**Course Code**	025010101
Course Type	HSSC	BSC	ESC	PCC	OEC	PEC

Legends: HSSC: Humanities and Social Sciences Courses BSC: Basic Science Courses
ESC: Engineering Science Courses PCC: Program Core Courses
OEC: Open Elective Courses PEC: Program Elective Courses

1. Teaching and Evaluation Scheme

Teaching Hours / Week					**Evaluation Scheme**				
L	**T**	**P**	**Total Teaching Hours**	**Total Credit**	**CA**	**CCE**	**SEE (TH)**	**SEE (PR)**	**TOTAL**
4	2	0	6	6	10	40	50	-	100

Legends:
L: Lectures T: Tutorial P: Practical
CA: Continuous Assessment (Attendance + Activity)
CCE: Continuous & Comprehensive Evaluation
SEE (Th): Semester End Evaluation (Theory)
SEE (Pr): Semester End Evaluation (Practical)

2. Prerequisites

- ✓ Number System ($\boldsymbol{N}, \boldsymbol{Z}, \boldsymbol{Q}, \boldsymbol{R}$)
- ✓ Set Notation
- ✓ Decimal Fraction (Addition, Subtraction, Multiplication, Division)
- ✓ L.C.M, H.C.F
- ✓ Factorization
- ✓ Indices and Surds
- ✓ Relation and Functions

3. Rationale

- ✓ The study of mathematics is an important requirement for the understanding and implementation of any branch of engineering. Mathematics curriculum provides students to learn the concept in-depth.
- ✓ The curriculum focuses on developing mathematical understanding, reasoning, and problem-solving skills. This will enable students for employing mathematical strategies to make precise decisions and solve familiar and unfamiliar problems efficiently.
- ✓ It helps students to become self-motivated, confident learners through active participation in challenging and engaging experiences in their day-to-day affairs.
- ✓ To develop versatility to work effectively and efficiently in a broad range of analytic, scientific, government, financial, health, technical, other positions.

4. Objectives

- ✓ To be familiar with approximate numbers using binomial expansions.
- ✓ Know to convert logarithmic equations to exponential equations and vice versa.

- ✓ Distinguish between matrices and determinants and are used as mathematical tools in solving simultaneous linear equations.
- ✓ Find the exact trigonometric function values for standard angles for sine, cosine, tangent, cotangent, cosecant, and secant using the unit circle.
- ✓ Understand inverse trigonometric functions.
- ✓ Analyze the equation of a sine or cosine and will able to plot the graphs.
- ✓ Solve Engineering problems using the graphical and algebraic representations of the vectors.
- ✓ Calculate the probability of events for more complex outcomes and solve applications involving probabilities.
- ✓ Demonstrate the ability to perform complex statistical data management and analysis.

5. Contents

Unit No.	Unit Name	Topics	Learning Outcomes	% Weightage	Hours
1.	**Binomial Theorem and Logarithm**	1.1. Factorial Notation and Basic Principle of Counting 1.2. Definition of Permutation and Combinations, Values of nP_r *and* nC_r 1.3. Binomial Theorem for Positive Integral Index and Finding its General Term, Constant Term, Middle Term and Coefficient of x^n, Approximate Value by Binomial Theorem 1.4. Concept and Relation between Exponential and Logarithmic Function 1.5. Types of Logarithm 1.6. Fundamental Laws & Properties and Related Examples	• Evaluate Expressions Involving Factorials and Binomial Coefficients • Expand Powers of Binomials Using the Binomial Theorem • Solve the Given Simple Problem Based on the Laws of the Logarithm	20	8
2.	**Determinants and Matrices**	2.1. Second-Order Determinants 2.2. Third-Order Determinants 2.3. Matrix 2.4. Different Types of Matrices 2.5. Properties of Matrices 2.6. Minor and Cofactor	• Solve the Given System of Linear Equations Using the Method of Inverse of Matrix Which can also be Useful in Various Fields of Technology	20	9

		2.7. Adjoint of a Matrix 2.8. Inverse of a Matrix 2.9. Solution of Simultaneous Linear Equations			
3.	**Trigonometry**	3.1. Unit Circle and Trigonometric Point 3.2. Trigonometric Identities and Relation between Cartesian and Polar Coordinate System 3.3. Measurement of an Angle (In Degree and Radian) 3.4. Trigonometric Ratios of $(-\theta)$ in Teams of those of θ 3.5. Allied Angles 3.6. Periodic Functions and Graphs 3.7. Graph of Sine and Cosine Function 3.8. Compound Angles 3.9. Product into Sums or Differences 3.10. Multiple and Submultiple Angles and Trigonometric Function of 18° and $22\frac{1}{2}^\circ$ 3.11. Inverse Trigonometric Functions 3.12. Inverse Trigonometric Functions of Negative Numbers and Reciprocal 3.13. Inverse Functions of Complementary Functions	• Apply the Concept of Compound Angle, Allied Angle, and Multiple Angles to Solve the Given Simple Engineering-Related Problems • Investigate Given Simple Problems Utilizing Inverse Trigonometric Ratios	25	9
4.	**Vectors in 2-D and 3-D**	4.1. Concept of Vector 4.2. Magnitude of Vector 4.3. Unit Vector 4.4. Addition, Subtraction and Scalar Multiplication 4.5. Direction Cosines 4.6. Product of Vectors (Dot Product, Cross	• Know the Difference between a Vector and a Scalar • Understand Multiplication of a Vector by a Scalar, Add/Subtract Algebraically	15	8

		Product, Box Product) 4.7. Angle between Two Vectors 4.8. Application of Vectors (Work Done & Moment of Force)	• Compute Dot Product, Cross Product, and Angle between Two Vectors • Determine Two Vectors are Perpendicular or Parallel to One Another • Solve Simple Problems of Work Done and Moment of Force		
5.	**Probability and Statistics**	5.1. Basic Concepts of Probability and Some Useful Terms 5.2. Types of Event 5.3. Probability - Definitions and Formulae 5.4. Measure of Central Tendency - Mean, Median, Mode 5.5. Measure of Dispersion - Mean Deviation from Mean and Median 5.6. Standard Deviation 5.7. Variance	• Be Familiar with Commonly Named Discrete and Continuous Random Variables and Basic Probability Axioms and Rules • Calculate Measures of Central Tendency and Dispersion for Grouped and Ungrouped Data	20	8
				Total Hours	**42**

6. List of Exercises /Tutorials

Tutorial is an important teaching-learning tool in mathematics. Small-group tutorials are an effective method to enhance student's confidence. It can help to improve their scores on tests and boost their academic performance in a class by One-on-one attention.

Sr. No	Exercises/Tutorials	Key Competency	Hours
1.	Binomial Theorem and Logarithm	• Evaluate Expressions Involving Factorials and Binomial Coefficients • Expand Powers of Binomials Using the Binomial Theorem • Solve the Given Simple Problem Based on the Laws of the Logarithm • Know to Draw the Graph of Logarithmic and Exponential Functions	4

2.	Determinants and Matrices	• Solve the Given System of Linear Equations Using the Method of Inverse of Matrix Which can also Useful in Various Fields of Technology	6
3.	Trigonometry	• Apply the Concept of Compound Angle, Allied angle, and Multiple Angles to Solve the Given Simple Engineering-Related Problems • Investigate Given Simple Problems Utilizing Inverse Trigonometric Ratios	8
4.	Vectors in 2-D and 3-D	• Differentiate between Vector and Scalar and Solve Simple Problems of Work Done and Moment of Force	4
5.	Probability and Statistics	• Express the Concept of Factorial and the Basic Principle of Counting • Solve the Simple Problems about Permutation and Combination • Calculate Mean and Standard Deviation of Discrete and Grouped Data Related to the Given Simple Engineering Problems • Determine the Variance and Coefficient of Variance of Given Grouped and Ungrouped Data • Develop an Analytical and Systematic Approach Towards Solving the Problem	6
		Total Hours	**28**

7. Suggested Specification Table for Evaluation Scheme

Unit No.	Chapter Name	Distribution of Topics According to Bloom's Taxonomy					
		R %	U %	App %	C %	E %	An %
1.	Binomial Theorem and Logarithm	20	20	30	10	10	10
2.	Determinants and Matrices	10	30	20	10	20	10
3.	Trigonometry	20	30	10	10	20	10
4.	Vectors in 2-D & 3-D	10	20	30	00	30	10
5.	Probability and Statistics	10	20	20	00	30	20

Legends: R: Remembering U: Understanding
App: Applying C: Creating
E: Evaluating An: Analyzing

8. Reference Books

1) Mathematics for Engineering Applications, Kuldip S. Rattan, Nathan W. Klingbeil, Wiley Publication
2) Engineering Mathematics, H. K. Das, S. Chand Publication
3) Calculus – Volume 1, Tom M Apostol, Wiley Publication
4) Engineering Mathematics-1, Reena Garg, Khanna Publication
5) Mathematics for Polytechnic Students, S. P. Deshpande, Pune Vidyarthi Gruh Prakashan
6) Plane Trigonometry, S. L. LONEY, Cambridge University Press

9. Open Sources (Website, Video, Movie)

1) https://tinyurl.com/ykddvzwu
2) https://tinyurl.com/238e2ep9