PROGRAMME NAME/S: COMMON TO ALL ENGINEERING PROGRAMS
SEMESTER : FIRST
COURSE TITLE : APPLIED MATHEMATICS-I
COURSE CODE :

I. RATIONALE:-

Applied Mathematics is the cornerstone of diploma programs, unlocking a world of critical thinking, problem-solving, and analytical skills essential for success. It sharpens students' ability to reason logically, think abstractly, and tackle real-world challenges with confidence. By mastering mathematical concepts, students not only build a strong foundation for higher education but also develop key skills—like problem-solving and analytical thinking—that empower them to excel in their careers and adapt to any situation. Mathematics isn't just about numbers; it's a dynamic tool for lifelong learning and professional growth.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME:-

Apply the concepts of Mathematics to solve industry-based technological problems.

III. COURSE LEVEL LEARNING OUTCOMES (COS):-

Students will be able to achieve & demonstrate the following COs on completion of course based learning
CO1: Apply algebra to solve systems of equations and engineering-related problems.
CO2: Analyze and solve real-world problems involving angles, distances and periodic phenomena through the principles of trigonometry.
CO3: Develop the skills to analyze and solve engineering problems involving straight lines and circles using coordinate geometry.
CO4: Apply differential calculus to analyze and solve problems involving rates of change, optimization, and geometry in engineering contexts.

IV. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT:

Sr. No.	Theory Learning Outcomes (TLOs)aligned to COs.	Learning content mapped with Theory Learning Outcomes (TLOs) and COs.	Suggested Learning Pedagogies.	No Of Lecture	CO

1	**TLO 1.1** Solve the given simple problem based on laws of logarithm. **TLO 1.2** Solve given system of simultaneous equations using Cramer's rule. **TLO 1.3** Obtain inverse of a matrix. **TLO 1.4** Obtain the proper and improper partial fraction for the given simple rational function.	**UNIT - I Algebra** 1.1 Logarithm: Concept and laws of logarithm. 1.2 Determinant: Definition, Properties of determinants, Expansion of determinants (of order 2 and 3), 1.3 Solutions of simultaneous equations using Cramer's rule (in 2 and 3 unknowns). 1.4 Matrices: Matrices, algebra of matrices, transpose, Inverse of matrix by adjoint method. 1.5 Partial Fractions: Types of partial fraction based on nature of factors and related Problems.	Improved Lecture Tutorial Assignment Flipped Classroom approach	10	CO1
2	**TLO 2.1** Apply the concept of Compound angle, allied angle and multiple angles to solve the given simple engineering problem(s). **TLO 2.2** Apply the concept of Sub- multiple angles to solve the given simple engineering related problem(s). **TLO 2.3** Apply concept of factorization and de-factorization formulae to solve the given simple engineering problem(s). **TLO 2.4** Investigate given simple problems by utilizing inverse trigonometric ratios. **TLO 2.5** Draw and understand the graphs of trigonometric functions.	**UNIT - II Trigonometry** 2.1 Trigonometric ratios of allied angles, compound angles, Sum, difference formulae multiple angles (2A, 3A), submultiples angles. (without proof) 2.2 Factorization and De-factorization Formulae (Without proof). 2.3 Inverse Trigonometric Ratios and related problems. 2.4 Principle values and relation between trigonometric and inverse trigonometric ratios. Graphs of trigonometric functions.	Improved Lecture Tutorial Assignment Demonstration Flipped Classroom approach	10	CO2
	TLO 3.1 Calculate angle between given two straight lines. **TLO 3.2** Formulate equation of straight lines	**UNIT - III Coordinate Geometry** 3.1 Straight line and slope of straight line:Angle between two lines, Condition of parallel and	Improved Lecture Tutorial Assignment Demonstration	10	CO3

3	related to given engineering problems. **TLO 3.3** Identify perpendicular distance from the given point to the line. **TLO 3.4** Calculate perpendicular distance between the given two parallel lines. **TLO 3.5** Formulate equation of circle related to given engineering problems.	perpendicular lines. 3.2 Various forms of straight lines: Slope point form, two-point form, Double intercept from, General form. 3.3 Perpendicular distance from a point on the line. 3.4 Perpendicular distance between two parallel lines. 3.5 Circle: Define a circle as a locus of a point. Exploring various forms of circle equations including standard, central, diameter and general forms.			
4	**TLO 4.1** Solve the given simple problems based on functions. **TLO 4.2** Solve the given simple problems based on rules of differentiation. **TLO 4.3** Obtain the derivatives of composite, implicit, parametric, inverse,logarithmic, exponential functions. **TLO 4.4** Apply the concept of differentiation to find equation of tangent and normal of a given curve. **TLO 4.5** Apply the concept of differentiation to calculate maxima, minima for given function. **TLO 4.6** Apply L'Hospital's rule in finding limit for Indeterminate form.	**UNIT - IV Differential Calculus** 4.1 Functions: Definition of variable, constant and function. Value of function at a given point. 4.2 Limit: Concept and definition of limit. Find limit (simple examples). 4.3 Derivatives: Define derivative as rate of change of quantities. Rules of derivatives such as sum, Product, Quotient of functions. Derivatives of function of a function, implicit and parametric functions. Derivatives of trigonometric inverse functions,logarithmic and exponential functions. 4.4 Successive derivative (up to third term only) 4.5 Applications of derivative: (a) Geometrical meaning of Derivative: Equation of tangent and normal (b) Maxima and minima of a function (c) L'Hospital's rule in Indeterminate form (0/0, ∞/∞).	Improved Lecture Tutorial Assignment Demonstration Simulation	18	CO4

V. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles /Tutorial Titles	Number of hrs.	Relevant Cos
LLO1:- Solve elementary problems on Algebra of matrices for branch specificengineering related applications.	Solve elementary problems on Algebra of matrices for branch specific engineering related applications.	1	CO1
LLO2:- Apply the concept of determinant to solve engineering problems.	Solve solution of Simultaneous Equation using Cramer's Rule.	1	CO1
LLO3:- Apply the concept of partial fraction to solve engineering problems.	Resolve into partial fraction using linear non-repeated, repeated, and irreducible quadratic factors.	1	CO1
LLO4:- Solve problems on Compound, Allied, multiple and sub multiple angles for related shapes.	Solve problems on Compound, Allied, multiple and sub multiple angles for related shapes.	1	CO2
LLO5:- Utilize the concept of trigonometry to solve engineering problems.	Practice problems on factorization and defactorization.	1	CO2
LLO6:- Utilize the concept of trigonometry to solve engineering problems.	Solve problems on inverse trigonometric ratios based on applications.	1	CO2
LLO7:- Solve branch specific engineering problems under given conditions of straight lines.	Practice problems on equation of straightlines using different forms.	1	CO3
LLO8:- Solve branch specific engineering problems under given conditions of straight lines.	Solve problems on perpendicular distance, distance between two parallel lines and angle between two lines.	2	CO3
LLO9:- Solve branch specific engineering problems under given conditions of straight lines.	Use given form of straight line to calculate the speed, distance and time of moving object.	2	CO3
LLO10:- Apply the concept of equation of tangent and normal to solve engineering problems.	Solve problems based on finding equation of tangent and normal for engineering applications.	2	CO4
LLO11:- Apply the concept of maxima, minima to solve engineering problems.	Solve problems based on finding maxima, minima of function of a given point for engineering applications.	1	CO4
LLO12:- Apply the concept of radius of curvature to solve engineering problems.	Use the concept of radius of curvature to solve given branch specific engineering problem.	2	CO4

VI. SUGGESTED ACTIVITIES/ ASSIGNMENT FOR SPECIFIC LEARNING /SKILLS DEVELOPMENT (SELF LEARNING)

ACTIVITIES:-

1- To sketch the graphs of a^x and $\log_a x$, $a>0$, $a \neq 1$ and to examine that they are mirror image of each other.
2- To establish a relationship between common logarithm (to the base 10) and natural logarithm (to the base e) of the number x.
3- To verify the relation between the degree measure and the radian measure of an angle.
4- To find the values of sine and cosine functions in second, third and fourth quadrants using their given values in first quadrant.
5- To plot the graphs of sin x, sin 2x, 2sin x and sin x/2, using same coordinate axes.
6- To draw the graph of $\sin^{-1}x$, using the graph of sin x and demonstrate the concept of mirror reflection (about the line y= x).
7- To explore the principal value of the function $\sin^{-1}x$ using a unit circle.
8- To prepare a model to illustrate the values of sine function and cosine function for different angles which are multiples of $\pi/2$ and π.
9- To find analytically the limit of a function f(x) at x=c and also to check the continuity of the function at that point.
10- To demonstrate a function which is not one –one but is onto.
11- To demonstrate a function which is one –one but not onto.

ASSIGNMENTS:-

1. Collect examples based on real world applications of logarithm and prepare a pdf file.
2.Solve the simultaneous system of equation in two variables by Determinant Method. Write down a Mathematical programming using any open-source software to verify the result.
3.Collect an example on coding theory using applications of matrices and prepare a pdf file.
4.Represent the Graph of Trigonometric function, Logarithmic function on algebra and interpret the nature of graph and make a pdf file.
5. Measure height of trees in surrounding locations using trigonometry and prepare presentation.
6. Find the derivative of y= x^sinx and visualize the graph of the function and its derivative using any open-source software geometrically.
7.Find height of room or distance between two pillars by using concept of straight line.
8.Collect at least 10 examples based on real world uses of applications of derivative.
9. To understand the concepts of local maxima, local minima and point of inflection.
10. To understand the concepts of absolute maximum and minimum values of a function in a given closed interval through its graph.
11. To construct an open box of maximum volume from a given rectangular sheet by cutting equal squares from each corner.

Attempt any 5-7 Assignment, out of the given list.

VII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED: -

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Open-source software like SageMaths, MATHS3D, GeoGebra, Graph, DPLOT, and Graphing Calculator (Graph Eq 2.13), ORANGE can be used for Algebra, Calculus,Trigonometry, and Statistics respectively.	All

VIII. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table):-

Sr. No.	Unit	Unit Title	Aligned COs	Learning Periods (L+T)	Weightage%
1	I	Algebra	CO1	10	21
2	II	Trigonometry	CO2	10	21
3	III	Coordinate Geometry	CO3	10	21
4	IV	Differential Calculus	CO4	18	37
Grand Total				**48**	**100**

IX. SUGGESTED COS - POS MATRIX FORM: -

Course Outcomes (COs)	Programme Outcomes (POs)						
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Lifelong Learning
CO1	3	2	-	-	-	-	2
CO2	3	2	-	-	-	-	2
CO3	3	2	-	-	-	-	2
CO4	3	2	-	-	-	-	2
Legends: - High:03, Medium:02, Low:01							

X. SUGGESTED LEARNING MATERIALS / BOOKS: -

Sr.No	Author	Title	Publisher with ISBN Number
1	Grewal B. S.	Higher Engineering Mathematics	Khanna publication New Delhi, 2013 ISBN: 8174091955
2	Dutta. D	A text book of Engineering Mathematics	New age publication New Delhi, 2006ISBN: 978-81-224-1689-3
3	Kreysizg, Ervin	Advance Engineering Mathematics	Wiley publication New Delhi 2016 ISBN: 978-81-265-5423-2
4	Das H.K.	Advance Engineering Mathematics	S Chand publication New Delhi 2008ISBN: 9788121903455

5	Marvin L. Bittinger David J.Ellenbogen Scott A. Surgent	Calculus and Its Applications	Addison-Wesley 10th Edition ISBN-13:978-0-321-69433-1
6	R. D. Sharma	Applied Mathematics	Dhanpat Rai Publications, New Delhi 110016. ISBN 978-93-80250-06-9
7	Hall & Knight	Higher Algebra	Arihant Publication. New Delhi. ISBN 978-9388127448
8	S. L. Loney	Plane Trigonometry	Arihant Publication. New Delhi. ISBN 978-9388127295
9	Jesus Martin, Michael Carr	Calculus for Engineering Students	Academic Press Inc ISBN-13: 9780128172100
10	Ewart S. Andrews, H. Bryon	The Calculus for Engineers	Creative Media Partners LLC ISBN-1346837309
11	Luther Pfahler Eisenhart	Coordinate Geometry	Dover Publication Inc ISBN-13: 978-0486442617

XIII. LEARNING WEBSITES & PORTALS: -

Sr. No.	Link / Portal	Description
1	http://nptel.ac.in/courses/106102064/1	Online Learning Initiatives by IITsand IISc
2	www.scilab.org/ -SCI Lab	Signal processing, statistical analysis, image enhancement.
3	www.mathworks.com/product/matlab/ -MATLAB	Applications of concepts of Mathematics to coding.
4	Spreadsheet Applications	Use of Microsoft Excel, Apple Numbers, Google Sheets.
5	https://ocw.mit.edu/	MIT Course ware
6	https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaddHo Pig	Concept of Mathematics through video lectures and notes
7	http://ocw.abu.edu.ng/courses/mathematics/	List of Mathematical Courses.
8	https://libguides.furman.edu/oer/subject/mathematics	Open Education Resources (OER) in Mathematics.
9	https://phet.colorado.edu/en/simulations/filter?subjects=mat h&type=html, prototype	Phet Simulation for Mathematics.
10	https://libguides.cmich.edu/OER/mathematics	Mathematics with OER.

Note:
Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before used by the students.