

Applied Mathematics-I (Mechanical Engg.)

Contact Hours/ Week:	3+2	Credits:	04
Total Lecture Hours:	40+20	CIE Marks:	50
Course Code:	AMM1	SEE Marks:	50

Course objectives:

This course will enable students to:

1.	Familiarize the importance of calculus associated with one variable and multivariable arising in engineering.
2.	Analyze and solve engineering problems by applying Ordinary Differential Equations.
3.	Demonstrate the use of analytical and numerical methods to solve the system of linear equations.
4.	Utilize a modern tool MATLAB for computation and visualization.

Module I- Polar Curves and Curvature

Polar coordinates, Polar curves, angle between the radius vector and the tangent, angle between two curves. Pedal equations. Curvature and radius of curvature - Cartesian, parametric, polar and pedal forms.

8 Hours Theory + 4 Hours Tutorial

Module II- Series Expansion, Indeterminate Forms and Multivariable Calculus

Statement and problems on Taylor's and Maclaurin's series expansion for one variable. Indeterminate forms-L'Hospital's rule. Partial differentiation, total derivative – differentiation of composite functions. Jacobian. Maxima and minima for the function of two variables.

8 Hours Theory + 4 Hours Tutorial

Module III- Ordinary Differential Equations of First Order

Linear and Bernoulli's differential equation. Exact and reducible to exact differential equations with integrating factor: $\frac{1}{N}\left(\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x}\right)$ and $\frac{1}{M}\left(\frac{\partial N}{\partial x} - \frac{\partial M}{\partial y}\right)$. Orthogonal trajectories, Law of natural growth and decay.

8 Hours Theory + 4 Hours Tutorial

Module IV- Ordinary Differential Equations of Higher Order

Higher-order linear ordinary differential equations with constant coefficients, homogeneous and non-homogeneous equations (e^{ax} , $\sin(ax+b)$, $\cos(ax+b)$, x^n only), Method of variation of parameters, Cauchy's and Legendre's homogeneous differential equations. Applications: Solving governing differential equations of Mass Spring.

8 Hours Theory + 4 Hours Tutorial

Module V- Linear Algebra

Elementary row transformation of a matrix, Echelon form, Rank of a matrix. Consistency and Solution of system of linear equations - Gauss-elimination method and approximate solution by Gauss-Seidel method. Eigenvalues and Eigenvectors, Rayleigh's power method to find the dominant Eigenvalue and Eigenvector. Applications: Traffic flow.

8 Hours Theory + 4 Hours Tutorial

TEXT BOOKS		
1.	B. S. Grewal,	Higher Engineering Mathematics, Khanna Publishers, 44 th Ed., 2021.
2.	E. Kreyszig	Advanced Engineering Mathematics, John Wiley & Sons, 10 th Ed., 2018.
3.	Gilbert Strang	Linear Algebra and its Applications, Cengage Publications, 4 th Ed., 2022.

REFERENCE BOOKS		
1.	B. V. Ramana	Higher Engineering Mathematics, McGraw-Hill Education, 11 th Ed., 2017.
2.	Srimanta Pal & Subodh C. Bhunia	Engineering Mathematics, Oxford University Press, 3 rd Ed., 2016.
3.	N. P. Balianand Manish Goyal	A Textbook of Engineering Mathematics, Laxmi Publications, 10 th Ed., 2022.
4.	H. K. Dassand Er. Rajnish Verma	Higher Engineering Mathematics, S. Chand Publication, 3 rd Ed., 2014.
5.	Ray Wylie, Louis C. Barrett	Advanced Engineering Mathematics, McGraw Hill Book Co., New York, 6 th Ed., 2017.
6.	David C Lay	Linear Algebra and its Applications, Pears on Publishers, 4 th Ed., 2018.
7.	Gareth Williams	Linear Algebra with Applications "Jones Bartlett Publishers Inc., 6 th Ed., 2017.

Course Outcomes:	
Upon completion of this course the student will be able to:	
CO1	Apply the knowledge of calculus to solve problems related to polar curves and implementation using MATLAB.
CO2	Apply the concept of partial differentiation to compute rate of change of multivariate functions and implementation using MATLAB.
CO3	Apply the analytical methods to solve first order and first-degree differential equations and implementation using MATLAB.
CO4	Apply the analytical methods to solve higher order differential equations and implementation using MATLAB.
CO5	Apply matrix theory for solving the system of linear equations, compute eigenvalues and eigenvectors and implementation using MATLAB.

Course Articulation Matrix														
		POs											PSOs	
		1	2	3	4	5	6	7	8	9	10	11	1	2
COs	CO1	3	1			1								
	CO2	3	1			1								
	CO3	3	1			1								
	CO4	3	1			1								
	CO5	3	1			1								