

COMPUTATIONAL MECHANICAL ENGINEERING LABORATORY

IV Semester: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
AME106	Core	L	T	P	C	CIA	SEE	Total
		-	-	3	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 45			Total Classes: 45			
<p>OBJECTIVES: The course should enable the students to:</p> <ol style="list-style-type: none"> I. Develop MAT LAB programs for simple and complex engineering problems. II. Interpret the output graphical plots for the given governing equation. III. Apply the MATLAB programming to real time applications. <p>COURSE LEARNING OUTCOMES (CLOs): The students should enable to:</p> <ol style="list-style-type: none"> 1. Write simple program modules to implement single numerical methods and algorithms. 2. Calculate solutions to mechanical engineering problems using standard numerical methods. 3. Explore the vectors and scalars for writing MATLAB codes. 4. Test program output for accuracy using hand calculations and debugging techniques. 5. Analyze the applicability and accuracy of numerical solutions to diverse mechanical engineering problems. 6. Able to use MATLAB for interactive computations. 7. Familiar with memory and file management in MATLAB. 8. Able to generate plots and export this for use in reports and presentations. 9. Able to program scripts and functions using the MATLAB development environment. 10. Understand the subplots. 11. Able to use basic flow controls (if-else, for, while). 12. Familiar with strings and matrices and their use. 13. Determine the thermal stresses developed in a shaft. 14. Determine the thermal stresses developed in a pipe. 15. Able to plot the displacement versus time of a single degree of freedom system. 16. Able to plot the velocity versus time of a single degree of freedom system. 17. Able to plot the displacement versus time of a two degree of freedom system by Runga Kutta method. 18. Determine the frequency developed in a continuous system. 19. Able to plot the Acceleration versus time of a single degree of freedom system. 20. Study the variation of stress along the cross section of the beam under uniformly distributed load. 								
LIST OF EXPERIMENTS								
Week-1	FEATURES OF MATLAB							
Types of windows, Variables, logical operations, Assignment statements, Matrices, Vectors, Scalars, Transpose matrix, Product, summation and inverse matrices.								
Week-2	USES OF MATLAB.							
Algorithm development, Scientific and engineering graphics, Modeling, simulation, and prototyping, Application development, including Graphical User Interface building, Math and computation, Data analysis, exploration, and visualization.								
Week-3	MATHEMATICAL PROBLEMS IN MATLAB							
Plotting the graph for $\sin(x)$, $\cos(x)$, $\tan(x)$, $\csc(x)$, Hold on command application in drawing the multiple plots.								

Week-4	FORMULATION OF IDEAL AND REAL GAS PROBLEMS IN MATLAB PROGRAM
The gas law, for example, $P = f(n, T, V) = [nRT/V]$, plotting between P and T, P and V, analysis, interpretation of graphs.	
Week-5	DYNAMICS AND VIBRATION ANALYSIS-I IN MATLAB PROGRAM
The constant of the spring is $k = 3 \text{ kN/m}$ and the tension in the cable is 30 N. When the cable is cut, (a) derive an expression for the velocity of the block as a function of its displacement x, (b) determine the maximum displacement x_m and the maximum speed v_m , (c) plot the speed.	
Week-6	DYNAMICS AND VIBRATION ANALYSIS-II IN MATLAB PROGRAM
The constant of the spring is $k = 5 \text{ kN/m}$ and the tension in the cable is 50 N. When the cable is cut, (a) derive an expression for the velocity of the block as a function of its displacement x, (b) determine the maximum displacement x_m and the maximum speed v_m , (c) plot the speed.	
Week-7	THERMAL STRESS ANALYSIS OF PISTON-I IN MATLAB PROGRAM
The data is taken for the design of piston through which various geometries of the piston can be found out which are mentioned below. The material of the piston is Aluminum alloy 6061. Design of the Piston can be done by general programme in MATLAB Software.	
Week-8	THERMAL STRESS ANALYSIS OF PISTON-II IN MATLAB PROGRAM
The data is taken for the design of piston through which various geometries of the piston can be found out which are mentioned below. The material of the piston is Aluminum alloy 3003. Design of the Piston can be done by general programme in MATLAB Software.	
Week-9	ANALYSIS OF KINEMATICS IN FOUR BAR MECHANISM IN MATLAB PROGRAM
For a given geometry of four bar mechanism, drawing the plots of velocity, acceleration of the links at various angles.	
Week-10	ANALYSIS OF KINEMATICS IN FOUR BAR MECHANISM IN MATLAB PROGRAM
For a given geometry of slider crank mechanism, drawing the plots of velocity, acceleration of the links at various angles.	
Week-11	REVISION TO ALL MATLAB PROBLEMS
IF else, While else commands, 2D plots, frequency calculation of vibration systems.	
Week-12	REVISION TO ALL MATLAB PROBLEMS
Thermal analysis, Vibration analysis, preparation for semester end exam.	
Text Books:	
1. Agam Kumar Tyagi, "MATLAB and Simulink for Engineers", Oxford University Press 1st Edition, 2012. 2. S.S.Rao, Vibration Problems, CRC press, 4 th Edition, 2014.	
Reference Books:	
1. Delores M. Etter, David C. Kuncicky , Holly Moore, "Introduction to MATLAB 7", Pearson Education Inc, 1st Edition,, 2009. 2. Rao. V. Dukkipati , "MATLAB for ME Engineers" , New age Science, 1st Edition, 2008.	
Web References:	
1. http://www.tutorialspoint.com/matlab/ 2. http://in.mathworks.com/products/matlab/?requestedDomain=www.mathworks.com	