

COURSE TITLE	MATLAB FOR MECHANICAL ENGINEERING
COURSE CODE	01ME1707
COURSE CREDITS	1

Objective:

- 1 This course is designed to provide basic understanding of MATLAB and coding for design and application of mechanical system. Programming in MATLAB for solving different problems in the field of mechanical engineering.

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

- 1 Apply MATLAB programming techniques to solve real-world mechanical engineering problems involving optimization and simulation.
- 2 Analyze the performance of various meta-heuristic algorithms for solving engineering design problems.
- 3 Evaluate different optimization results using MATLAB to identify the most efficient mechanical design solutions.
- 4 Design and implement higher-order solutions for the analysis and design of mechanical components using hybrid optimization methods.
- 5 Develop MATLAB scripts to model and optimize complex truss and mechanical structures using evolutionary algorithms.
- 6 Interpret and assess multi-objective optimization outcomes through Pareto front analysis to make data-driven design decisions.

Pre-requisite of course:NA

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
0	0	2	0	0	0	50	50
Contents : Unit	Topics						Contact Hours
Total Hours							

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	MATLAB Introduction Introduction, Arithmetic Operations,, Display Formats, Elementary Math Built-in Functions, Variable Names, Predefined Variables, Commands for Managing Variables, General Commands, Arrays, Operations with Arrays.	6

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
2	Optimization with Metaheuristics Metaphors Associated with Metaheuristic Optimization Methods, Details of Representative Metaheuristic Algorithms,, Crow Search Algorithm, Firefly Optimization Algorithm (FA), Harmony Search Algorithm,, Teaching-Learning-Based Optimization (TLBO),, Honey Bee Swarm Optimization Algorithm.	6
3	Programming with MATLAB script file. Programming with MATLAB script file.	2
4	Topology Optimization of a 72-Bar Truss with Hybrid Metaheuristics Topology Optimization of a 72-Bar Truss with Hybrid Metaheuristics	2
5	Comparative Evaluation of Metaheuristic Algorithms on a Real-Life Mechanical Component Comparative Evaluation of Metaheuristic Algorithms on a Real-Life Mechanical Component	2
6	Design and Optimization of a Lightweight Truss Bridge using PSO Design and Optimization of a Lightweight Truss Bridge using PSO	2
7	Plotting Pareto Fronts and Design Spaces for Multi-Objective Problems Plotting Pareto Fronts and Design Spaces for Multi-Objective Problems	2
8	Design of Gears and Bearings using Moth Flame Optimization (MFO) Design of Gears and Bearings using Moth Flame Optimization (MFO)	2
9	Metaheuristic-Based Topology Optimization of 25-Bar Truss Structures Metaheuristic-Based Topology Optimization of 25-Bar Truss Structures	2
10	Applying GA to Minimize Weight of a 10-Bar Truss in MATLAB Applying GA to Minimize Weight of a 10-Bar Truss in MATLAB	2
11	Multi-Objective Optimization of Trusses using NSGA-II in MATLAB Multi-Objective Optimization of Trusses using NSGA-II in MATLAB	2
12	Formulating Objective Functions for Truss Optimization Formulating Objective Functions for Truss Optimization	2
Total Hours		32

Textbook :

- 1 MATLAB for mechanical engineers,, Rao V. Dukkipati,, New Age Science, 2010

Textbook :

- 2 Getting started with MATLAB for mechanical engineers, Dr K Viswanath Allam Raju, Paperback, Mahi publication, 2015

References:

- 1 Solving Mechanical Engineering Problems with MATLAB, Solving Mechanical Engineering Problems with MATLAB, Simin Nasser, MCH, 2019
- 2 MATLAB for Mechanical Engineering: Beginner and Intermediate Level, MATLAB for Mechanical Engineering: Beginner and Intermediate Level, Enass H. Flaiech, Al-Khafaji Ali J. Dawood, Laith Jaafer Habeeb, LAP Lambert, Academic Pub, 2016
- 3 An Engineer's Guide to MATLAB With Applications from Mechanical, Aerospace, Electrical, Civil, and Biological Systems Engineering An Engineer's Guide to MATLAB With Applications from Mechanical, Aerospace, Electrical, Civil, and Biological Systems Engineering, An Engineer's Guide to MATLAB With Applications from Mechanical, Aerospace, Electrical, Civil, and Biological Systems Engineering An Engineer's Guide to MATLAB With Applications from Mechanical, Aerospace, Electrical, Civil, and Biological Systems Engineering, Edward B. Magrab, Prentice Hall publication, 2018
- 4 MATLAB for Engineers,, MATLAB for Engineers,, Holly Moore, , Pearson,, 2021
- 5 MATLAB for Engineering Applications, MATLAB for Engineering Applications, William J. Palm III, McGraw-Hill Education, 2018

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
0.00	0.00	50.00	20.00	20.00	10.00

Instructional Method:

- 1 Power Point Presentation
- 2 Videos

Supplementary Resources:

- 1 <https://matlabacademy.mathworks.com/details/matlab-onramp/gettingstarted>
- 2 <https://matlabacademy.mathworks.com/details/matlab-fundamentals/mlbe>