Mechanical Vibrations

Course Code:

ME 445

Course Period:

Autumn

Course Type:

Core

Credits:

3

Theoric:

3

Practice:

0

Laboratory Hour:

0

ECTS:

5

Prerequisite Courses:

Differential Equations [1]
Dynamics [2]
Course Language:

English

Courses given by:

Mehmet A. Akgün [3]
Course Objectives:

The goal of this course is to teach preliminary concepts and problem solving methodologies related to mechanical vibrations.

Course Content:

Free and forced vibrations of single degree of freedom systems: undamped and damped vibrations, natural and resonance frequencies, harmonic and impulse responses, transient and end-state responses. Multi degree of freedom systems. Modal analysis. Vibration damping and control methods. Critical speeds. Vibration measurements.

Course Methodology:

1: Lecture, 3: Homework, 4: Project

Course Evaluation Methods:

A: Written exam, C: Homework, E: Presentation

Learning Outcomes	Program Outcomes	Teaching Methods	Assessment Methods
1) Ability to derive the equations of motion for vibratory systems and linearize nonlinear equations of motion.	1, 2	1, 3	A, C
2) Ability to solve for the overall response based on the initial conditions and the forcing, for one or multi degree-of-freedom mechanical systems.	1, 2	1, 3	A, C
3) Ability to design a passive vibration absorbing/suppressing device for a mechanical system experiencing harmonic excitation.	2, 3	1, 3	A, C
4) Ability to demonstrate knowledge in mechanical vibrations in an intra-disciplinary team project.	7	4	E

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	INTRODUCTION TO VIBRATION AND THE FREE RESPONSE	TEXTBOOK
2	INTRODUCTION TO VIBRATION AND THE FREE RESPONSE	TEXTBOOK
3	INTRODUCTION TO VIBRATION AND THE FREE RESPONSE	TEXTBOOK
4	INTRODUCTION TO VIBRATION AND THE FREE RESPONSE	TEXTBOOK

5	RESPONSE TO HARMONIC EXCITATION	TEXTBOOK
6	REVIEW AND EXAM 1	TEXTBOOK
7	RESPONSE TO HARMONIC EXCITATION	TEXTBOOK
8	RESPONSE TO HARMONIC EXCITATION	TEXTBOOK
9	GENERAL FORCED RESPONSE	TEXTBOOK
10	GENERAL FORCED RESPONSE	TEXTBOOK
11	REVIEW AND EXAM 2	TEXTBOOK
12	MULTIPLE DEGREE OF FREEDOM SYSTEMS	TEXTBOOK
13	DESIGN FOR VIBRATION SUPPRESSION	TEXTBOOK
14	DISTRIBUTED-PARAMETER SYSTEMS	TEXTBOOK

RECOMMENDED SOURCES	
Textbook	*Engineering Vibrations*, Daniel J. INMAN Pearson (Prentice Hall), 3rd ed., 2009, ISBN: 978-0-13-136311-3
Additional Resources	*Theory of Vibration with Applications,* W.T. Thomson, M. D. Dahleh Pearson, 5th ed., 1998, ISBN: 013 651 068X *Vibration Problems in Engineering,* W. Weaver Jr., S. P. Timoshenko, D. H. Young, Wiley, 3rd ed., 1990, ISBN: 0471 632 287

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	1	40
Homeworks	3	10
Project study	1	10
Attendance	14	5
Total		**65**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		35
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		65
Total		**100**

COURSE'S CONTRIBUTION TO PROGRAM								
No	Program Learning Outcomes		Contribution					
		NA	1	2	3	4	5	
1	Adequate knowledge in mathematics, science and engineering subjects pertaining to the relevant discipline; ability to use theoretical and applied knowledge in these areas in complex engineering problems.	**X**						
2	Ability to identify, formulate, and solve complex engineering problems; ability to select and apply proper analysis and modeling methods for this purpose.	**X**						
3	Ability to design a complex system, process, device or product under realistic constraints and conditions, in such a way as to meet the desired result; ability to apply modern design methods for this purpose.	**X**						
4	Ability to devise, select, and use modern techniques and tools needed for analyzing and solving complex problems encountered in engineering practice; ability to employ information technologies effectively.	**X**						
5	Ability to design and conduct experiments, gather data, analyze and interpret results for investigating complex engineering problems or discipline specific research questions.	**X**						
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability to work individually.	**X**						
7	Ability to communicate effectively in Turkish, both orally and in writing; knowledge of a minimum of one foreign language; ability to write effective reports and comprehend written reports, prepare design and production reports, make effective presentations, and give and receive clear and intelligible instructions.	**X**						
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.	**X**						
9	Consciousness to behave according to ethical principles and professional and ethical responsibility; knowledge on standards used in engineering practice.	**X**						

10	Knowledge about business life practices such as project management, risk management, and change management; awareness in entrepreneurship, innovation; knowledge about sustainable development.	**X**						
11	Knowledge about the global and social effects of engineering practices on health, environment, and safety, and contemporary issues of the century reflected into the field of engineering; awareness of the legal consequences of engineering solutions.	**X**						
12	Ability to work professionally in both thermal and mechanical systems areas, including design and realization.	**X**						
13	Ability to verify and validate numerical solutions to engineering problems.	**X**						

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Including the exam week: 14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	4	56
Mid-terms	2	5	10
Homework	3	4	12
Final examination	1	10	10
Total Work Load			130
Total Work Load / 25 (h)			5.20
ECTS Credit of the Course			5