The Hashemite University
Faculty of Engineering
Department of Mechanical Engineering
Course Syllabus
Fall 2025

COURSE TITLE:	Mechanical Vibration 3 (3,0, 0)	**COURSE NUMBER:**	110402433
DESIGNATION:	Compulsory	**PREREQUISITE(S):**	110402231
INSTRUCTOR:	Mohammad A Gharaibeh, **Office**: E3101	**INSTRUCTOR'S E-MAIL:**	mohammada_fa@hu.edu.jo
OFFICE HOURS:	Mon/Wednesday 10:00am-11:30am		
LECTURE TIME AND LOCATION	***Section 2:*** Mon/Wed 08:30am-10:00am		

Course Description (catalog):
Free and forced vibrations of damped and undamped single degree of freedom systems. Multi-degree of freedom systems: natural frequencies, mode shapes, modal analysis. Design of vibration isolator and Shock absorber

Textbook(s) and/or Other Supplementary Materials:
Engineering Vibrations, by D. Inman, 4th Edition, Prentice Hall, 2001.

Major Topics Covered:

Topic (Refer to Course Content for detailed Subjects)	# Lectures	Contact hours
Introduction To Vibration and the Free Response	8	8
Response To Harmonic Excitation	8	8
General Forced Response **	5	5
Multiple-Degree-of-Freedom Systems	9	9
Design for Vibration Suppression	4	4
Exams (First and Second)	**2**	**2**
Total	**40**	**40**

After completing the course, the student will be able to:
1. Derive mathematically the equation of motion for a SDOF and MDOF systems (**1,2**)
2. Analysis of a vibrating system in terms of amplitude, natural frequency and damping (1,2)
3. Applying Linear algebra, Lagrange method in solving problems for MDOF systems (1,2)
4. Design vibration isolator, and vibration absorber (4)

Student Outcomes (SO) Addressed by the Course:

#	Outcome Description	Contribution
	General Engineering Student Outcomes	
(1)	an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.	H
(2)	an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.	M
(3)	an ability to communicate effectively with a range of audiences	
(4)	an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	
(5)	an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	
(6)	an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	
(7)	an ability to acquire and apply new knowledge as needed, using appropriate learning strategies	
	H=High, **M**= Medium, **L**=Low	

Grading Plan:

		Date	Day	Time
First Exam	30 points			
Second Exam	30 points			
Quizzes	-			
Final Exam	40 points			

Prepared by: *Dr. Mohammad A Gharaibeh* **Date:** 15 Feb, 2026

Course Content: (Based on Book Table of contents)

1 Introduction to Vibration and the Free Response (8)

1.1 Introduction to Free Vibration 2} … 1
1.2 Harmonic Motion 13} … 2
1.3 Viscous Damping 21} … 1
1.4 Modeling and Energy Methods 31} … 1.5
1.5 Stiffness 46} … 1
1.7 Design Considerations 63
1.8 Stability 68 (Optional) } … 1
1.10 Coulomb Friction and the Pendulum 81 (Optional)} … 0.5

2 Response to Harmonic Excitation (8)

2.1 Harmonic Excitation of Undamped Systems 118} … 0.5
2.2 Harmonic Excitation of Damped Systems 130} … 1.5
2.3 Alternative Representations 144} … 0.5
2.4 Base Excitation 151} … 1.5
2.5 Rotating Unbalance 160} … 1.5
2.6 Measurement Devices 166} … 1
2.7 Other Forms of Damping 170} … 1.5

4 Multiple-Degree-of-Freedom Systems 303 (7)

4.1 Two − Degree − of − Freedom Model (Undamped) 304} … 1
4.2 Eigenvalues and Natural Frequencies 317} … 1
4.3 Modal Analysis 331} … 2.5
4.4 More Than Two Degrees of Freedom 339} … 0.5
4.5 Systems with Viscous Damping 355} … 1
4.6 Modal Analysis of the Forced Response 361} … 1
4.8 Examples 376

5 Design for Vibration Suppression 433 (4)

5.1 Acceptable Levels of Vibration 434 … . . 1
5.2 Vibration Isolators 443} … 1
5.3 Vibration Absorbers 453} … 1