



The Hashemite University
Faculty of Engineering
Department of Mechanical Engineering
Course Syllabus
Spring 2020



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: See posted Hours
LECTURE TIME AND LOCATION **Section 1:** Sun, Tues and Thurs. 08:00-09:00

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	7	7
Design for Vibration Suppression	4	4
Exams (First and Second)	2	2
Total	38	38

After completing the course, the student will be able to:

1. Derive mathematically the equation of motion for a SDOF and MDOF systems (a)
2. Analysis of a vibrating system in terms of: amplitude, natural frequency and damping
3. Applying Linear algebra, Langrangian method in solving problems for MDOF systems
4. Design vibration isolator, and vibration absorber

Student Outcomes (SO) Addressed by the Course:

#	Outcome Description	Contribution
General Engineering Student Outcomes		
(a)	Ability to apply mathematics, science and engineering principles.	H
(b)	Ability to design and conduct experiments, analyze and interpret data.	
(c)	an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	M
(d)	Ability to function on multidisciplinary teams.	
(e)	Ability to identify, formulate and solve engineering problems.	M
(f)	Understanding of professional and ethical responsibility.	
(g)	Ability to communicate effectively.	
(h)	The broad education necessary to understand the impact of engineering solutions in a global and societal context.	
(i)	Recognition of the need for and an ability to engage in life-long learning.	
(j)	Knowledge of contemporary issues.	
(k)	Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.	L
H=High, M= Medium, L=Low		

Grading Plan:

	Date	Day	Time
Midterm	30 points		
Projects	-		
Quizzes	30 points		
Final Exam	40 points		

Prepared by: Dr. Mohammad A Gharaibeh

Date: 11 Oct, 2020

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
- 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
- 5.3 Vibration Absorbers 453} ... 1