

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



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COURSE TITLE:Mechanical Vibration 3 (3,0,0)COURSE NUMBER:DESIGNATION:CompulsoryPREREQUISITE(S):INSTRUCTOR:Mohammad A Gharaibeh, Office: E3101INSTRUCTOR'S E-MAIL:OFFICE HOURS:See posted HoursSee ton 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					
General Engineering Student Outcomes						
(a)	Ability to apply mathematics, science and engineering principles.	Н				
(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	М				
(d)	Ability to function on multidisciplinary teams.					
(e)	Ability to identify, formulate and solve engineering problems.	М				
(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
0	Midterm	30 points		2	
	Projects	-			
	Quizzes	30 points			
	Final Exam	40 points			
Prepared by:	Dr. Mohammad A Gharaíbeh		i		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
1.8 Stability 68 (Optional)
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 \dots 1

5.3 Vibration Absorbers 453} ... 1