



**Philadelphia University**  
Faculty of Engineering and Technology  
Department of Mechanical Engineering

**Course Information:**

<b>Course Title:</b>	<b>Mechanical Vibrations (620414)</b>
<b>Prerequisite:</b>	Engineering Analysis 1 (650260) + Dynamics (620212)
<b>Credit Hours:</b>	3 credit hours (16 weeks per semester, approximately 44 contact hours)
<b>Textbook:</b>	Mechanical Vibrations by S. S. Rao, 5 <sup>th</sup> edition, 2011
<b>References:</b>	Theory of vibration with applications by W. T. Thomson, 3 <sup>rd</sup> edition, 1988 Mechanical vibrations by Rao V. Dukkipati ,2010

**Course Description:** Study of oscillatory motion, derivation of governing equations of motion for undamped and damped vibratory systems in free and forced motions, basics of vibration isolation, free and forced vibrations of multi degrees of freedom systems, vibration absorbers, and vibration of one dimensional continuous systems.

**Course requirements:** Computer, internet connection, webcam, and Matlab software

**Instructor:** **Prof. Adnan D. Mohammed**  
**Office:** Mechanical Engineering building, room E61206 , ext. : 2543

**Course Topics:**

Week	Topic
1	Fundamentals of vibrations:
2,3,4	Free vibration of single degree of freedom system
5,6,7	Forced vibration of single degree of freedom system
8,9,10	Two Degrees of Freedom System:
11,12,13	Multi-degree of freedom System
14,15	Vibration of one dimensional continuous systems
16	General review and Final exam..

## **ABET Student Outcomes (SOs)**

1	An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
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
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

## **Course Learning Outcomes and Relation to ABET Student Outcomes:**

Upon successful completion of this course, a student should be able to:

1.	Classify the motion of different vibrating systems and understand the concept of Degrees of Freedom of vibrating systems. Also, understand the terminologies of vibrations.	[1]
2	Derive and solve the differential equation of motion of free and forced vibration of damped and un-damped single degree of freedom system by the two well-known methods; Newton's 2 <sup>nd</sup> law method and Energy method.	[1]
3	Derive and solve the differential equations of motion and find the natural frequencies and the corresponding mode shapes (Eigenvalues and Eigenvectors) of vibrating having more than one degree of freedom.	[1]
4	Design a passive vibration absorber	[1 , 2]
5	Analyze vibration problems of one dimensional continuous systems	[1]

**Teaching methodology:** Online, Blended or both

**Electronic platform:** Microsoft-teams

### **Evaluation methods:**

Evaluation of student's performance (final grade) will be based on the following categories:

**Mid-term exam:** Shall be given at the end of the seventh week of the course in the form of multiple choice questions and (or) specific problems to be solved and uploaded by the student using the University electronic platform.

**Quizzes:** A number of short exams of 10-minute quizzes in the form of multiple choice questions or an assignment using the University electronic platform will be given to the students during the semester. These quizzes will cover material discussed during the previous lecture(s).

**Homework:** Problem sets will be given to students in the form of assignments using the University Electronic platform. Homework should be solved by each student individually and submitted using the platform before the due date.

**Copying homework is forbidden, any student caught copying the**

**homework or any part of the homework will receive zero mark for that homework**

**Participation:** Questions will be asked during the online session (lecture) and the student is assessed based on his/her response

**Final Exam:** The final exam will cover all the class material.

**Grading policy:**

Mid-term Exam.	30%
Home works, Quizzes and participation	30%
Final Exam	40%
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Total:	100%

**Attendance policy:**

Absence from classes and/or tutorials shall not exceed 15%. Students who exceed the 15% limit without a medical or emergency excuse, acceptable to and approved by the Dean of the relevant college/faculty, shall not be allowed to take the final examination and shall receive a mark of zero for the course. If the excuse is approved by the Dean, the student shall be considered to have withdrawn from the course.