Philadelphia University
Faculty of Engineering
Mechanical Engineering Department
2nd Semester 2012 / 2013

Course Outline

Course title:	Mechanical Vibration (620414)
Prerequisites:	Fundamentals of Engineering Analysis
Class Time:	Sunday, Tuesday and Thursday (8.10 : 9.10)
Instructor:	Eng. Laith R. Batarseh
Office hours	Monday – Wednesday (11.15 : 12.15)

Course Objective

The objective of this course is: for students to learn how to treat the vibration phenomena by transforming the physical model into a mathematical model and solve it by using the appropriate mathematical operations to find the response and analyze this response and bring it back to its physical concept.

Course Material

Textbook: Mechanical Vibration 5th edition in SI units, Singiresu S. Rao, Pearson, 2011.

Other References:

1. Elements of vibration analysis 2nd edition , Meirovitch,Leonard, McGraw-Hill Book Company, 1986.
2. An introduction to mechanical vibrations , Steidel,Robert F., John Wiley & Sons, 1989.
3. Fundamentals of mechanical vibrations 2nd edition , Kelly,Graham S., McGraw - Hill, 2000.

Classroom PowerPoint presentations

University library

Evaluation

- ❖ First Exam   = 20% (March, 31 – April,8 2013)
- ❖ Second Exam = 20% (5-13, May 2013)
- ❖ Final Exam   = 40 % (1-8, June 2013)
- ❖ Term Project = 10% (from the mid to the end of the semester)
- ❖ Quizzes   = 10% (on weekly base until the mid of the semester)

Course Contents

Week	Period	Topic	Chapter
1+2	24, Feb -7, Mar	**Fundamentals of vibration systems:** • Fundamental concepts • Vibration system elements • Mathematical molding • Harmonic analysis	Chapter 1
3+5	10-21, Mar	**Single DoF free vibrating system:** • Equation of motion derivation – un damped system • Equation of motion derivation –damped system • Torsional system • Logarithmic decrement method	Chapter 2
6+7	24,Mar-2,Apr	**Harmonically excited vibrating system:** • Damped and un-damped systems • Beating phenomena • Base-excitation • Unbalance as the main cause of vibration	Chapter 3
8+9	7-18,Apr	**Vibration under general forcing conditions:** • Periodic force • Convolution integral • Laplace transform	Chapter 4
10+11	21,Apr -2,May	**Two Degree of Freedom System:** • Equation of motion • Damped and undamped systems • Free and forced systems • Torsional system	Chapter 5
12+13	5-16, May	**Multi-degree of freedom systems:** • 3-degree of freedom • Molding continues system as multi DoF system • Natural frequencies and mode shapes • Dunkerley's Formula	Chapter 6+7
14+15	19-30,May	**Vibration measurements and control** • Balancing of rotating machinery • Whirling of shafts • Vibration isolation and absorbers • Introduction to vibration measurements in field	Chapter 9+10
16		**MATLAB applications on vibration problems**	------

Expected Outcomes

It is expected from the student that he/she comes out with the following knowledge at the end of this course:

- ❖ Can classify the systems of vibrations.
- ❖ Understood the parameters and variables of a vibrating system.
- ❖ Can represent the vibration phenomena as a mathematical model and solve it to obtain the response
- ❖ Understood the concept of natural frequency and how to find it for a vibrating system.
- ❖ Understood the concept of Degree of Freedom in vibrating system.
- ❖ Learn how to analyze the free and forced vibrating system
- ❖ Learn the process of vibration measurements and control
- ❖ Have an introduction about continues systems

Attentions

1- *Absence:-* six absences are allowed with accepted excuses. Any exceeding for the permitted absences, student will be restricted from taking the final exam
2- *The late on the class time:-* the student is allowed to enter the class after **10 minutes** from the starting of the class only.
3- *Discipline:-* it is expected from the student as engineer candidate to have good manners and be disciplined in the class room. So, any student make any disturbance in the class will be dismissed immediately
4- *Dismissing:-* no student is allowed to dismiss from the class until the lab is finished for any excuse.
5- *Quizzes:-* one quiz will be given at the end of each week. Any absence from any quiz without excuse will graded **zero.**

Software Aid

Through this course, student has to use the computer aiding either to accomplish his/her project (internet and MATLAB) or to solve book questions using MATLAB.

The given textbook is rich of examples solved by MATLAB subroutines and student is expected to try these subroutines by him/her self.

Term Project

- The project subject will be announced to the students at the mid of the semester (March,28th) to insure that he/she has enough knowledge in vibration analysis.
- When the project is given, student is allowed to submit his/her document before May,19th.
- The students are allowed to work in groups and individually but the assessment will be individually after a discussion.
- A single title cannot be repeated.
- The project must be printed on *A4* papers with appropriate cover page, table of contents,…, etc. (number of pages between: 10 – 30 Pages)
- Student must prepare a power point presentation (number of slides between 5 – 15 slides)