

# Course Syllabus for Mechanical Vibrations

EMEC4315 Fall 2018-2019

## Instructor

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## Course Description

This course deals with the study of vibration in mechanical systems which is concerned with the oscillatory motions of bodies and the forces associated with them. This course aims to provide you with an understanding of the nature and behaviour of dynamic engineering systems and the capability of applying the knowledge of mathematics, science, and engineering to solve engineering vibration problems.

One and multi-degree-of-freedom systems. Natural frequencies and modes of vibrations, resonance, beat phenomenon, effect of damping, applications to practical problems, and methods to avoid excessive vibrations.

## Learning Outcomes

- i. Become proficient in the modeling and analysis of one-DoF systems - free vibrations, transient and steady-state forced vibrations, viscous and hysteric damping. (A, E, L)
- ii. Become proficient in the modeling and analysis of multi-Dof systems - Lagrange's equations, reduction to one-DoF systems for proportionally damped systems, modal analysis, vibration absorbers, vibration transmission, Fourier transforms. Use of Matlab for matrix computations.

## Prerequisite

Engineering Dynamics, Theory of machines

## Lect ures

- Lectures are held in **C010** on Saturday, Mondays and Wednesdays from 12:00 a.m.-13:00 p.m.
- You are strongly encouraged to ask questions during lecture and to offer answers to questions asked by the professor, even if you are not sure they are correct.
- Attendance will be taken at these lectures and used as one indicator of your level of effort.
- Ringers on cell phones should be turned off during lecture.

## Course Materials

- Required Textbook: **Mechanical Vibrations, Fifth Edition, Singiresu S.Rao.**
- Supplementary Textbook: Mechanical and Structural Vibrations, First Edition, Jerry H. Ginsberg, ISBN 0-471-12808-2.

week	period	Topic
1+2+3	15 <sup>th</sup> Sep. - 30 <sup>th</sup> Sep.	.Fundamentals of vibration systems .Fundamental concepts .Vibration system elements .Mathematical modeling .Harmonic analysis
4+5+6	1 <sup>st</sup> Oct.. – 27 <sup>th</sup> Oct.	.Single DoF free vibrating system . Equation of motion derivation _ derivation_damped system .Tensional system .Logarithmic decrement method
7+8+9	29 <sup>th</sup> Oct. – 13 <sup>th</sup> Nov.	.Harmonically excited vibrating system .Damped and un-damped system .beating phenomena .base – excitation .Unbalance as the main cause of vibration
10+11+12	14 <sup>th</sup> Nov. – 30 <sup>th</sup> Nov.	.Vibration under general forcing conditions . periodic force .Convolution .Laplace transform
13+14+15	1 <sup>st</sup> Dec. – 25 <sup>th</sup> Dec.	.Multi-degree of Freedom system .2-degree of freedom system .mode shape .3-degree of freedom .Modeling continuous system as multi DoF system .mode shape

### Grading

Your final course grade is calculated according to the following distribution:

- H.W. and Quizzes: 10%
- ANSYS Project: 15%
- Midterm Examination: 35%
- Final Examination: 40%

### Quizzes

Quizzes will be given roughly once a week. The lowest quiz grade will be dropped.

### Examinations

**The midterm examination** will be given in class on Wednesday, October 29<sup>th</sup>.

**The final examination** is tentatively scheduled for Saturday, January 13<sup>th</sup>

Early examinations will not be given.

### **Missed Quizzes and Examinations**

Here is the policy regarding a missed quiz or examination:

- If you know ahead of time that you will miss the event, you must notify the instructor in writing and describe your reason for missing the event.
- If you do not know ahead of time that you will miss the event, you must notify the instructor in writing as soon as possible after the event and describe your reason for missing the event.
- If the instructor determines that the reason is appropriate, you will be excused from the event and the grade will not count in determining your course grade. If the instructor determines that the reason is not appropriate, you will receive a zero for that event.
- The following reasons are not appropriate: oversleeping, working on an assignment for another course, travel for pleasure.