Mechanical Vibrations

Course Description

The study of oscillatory behavior of bodies forms the principles of the vibration course.

Any body that has a mass and elasticity can vibrate and reshapes against energy, heat and etc. By resetting the vibrational agent, it returns to its original state. In this course, the behavior of these objects is examined.

SES	TOPICS	KEY DATES
1	FUNDAMENTALS OF VIBRATION Importance of the Study of Vibration Classification of Vibration Vibration Analysis Procedure	
2	Spring Elements Mass or Inertia Elements Damping Elements	
3	Harmonic Motion Harmonic Analysis	Homework 1 out
4	Free Vibration of an Undamped Translational System Free Vibration of an Undamped Torsional System Rayleigh s Energy Method	
5	Rayleigh s Energy Method Free Vibration with Viscous Damping	Homework 1 due, Homework 2 out
6	Free Vibration with Coulomb Damping Free Vibration with Hysteretic Damping Stability of Systems	
7	Harmonically Excited Vibration Equation of Motion Response of an Undamped System Under Harmonic Force Response of a Damped System Under Harmonic Force	Homework 2 due, Homework 3 out
8	Response of a Damped System Under $f(t) = F_0 e^{i\omega t}$ Response of a Damped System Under the Harmonic Motion of the Base	

SES	TOPICS	KEY DATES
	Response of a Damped System Under Rotating Unbalance	
9	Forced Vibration with Coulomb Damping Forced Vibration with Hysteresis Damping	Homework 3 due, Homework 4 out
10	Transfer-Function Approach Solutions Using Laplace Transforms Frequency Transfer Functions	Homework 4 due, Homework 5 out
11	Midterm 1	
12	Response Under a General Periodic Force First-Order Systems	Homework 5 due
13	Response Under a General Periodic Force Second-Order Systems	
14	Response to an Impulse Response to a General Forcing Condition Response to Base Excitation	Homework 6 out
15	Response Spectrum for Base Excitation Earthquake Response Spectra	
16	Midterm 2	Homework 6 due, Homework 7 out
17	Two-Degree-of-Freedom Systems Equations of Motion for Forced Vibration	
18	Free Vibration Analysis of an Undamped System Torsional System	
19	Forced-Vibration Analysis	Homework 7 due
20	Transfer-Function Approach	
21	Solutions Using Laplace Transform	

SES	TOPICS	KEY DATES
22	Solutions Using Frequency Transfer Functions	
23	Multi degree-of-Freedom Systems Using Newton s Second Law to Derive Equations of Motion	Homework 8 out
24	Potential and Kinetic Energy Expressions in Matrix Form Generalized Coordinates and Generalized Forces Using Lagrange s Equations to Derive Equations of Motion	
25	Equations of Motion of Undamped Systems in Matrix Form Eigenvalue Problem Solution of the Eigenvalue Problem	Homework 8 due
26	Free Vibration of Undamped Systems	
27	Forced Vibration of Undamped Systems Using Modal Analysis Forced Vibration of Viscously Damped Systems	Homework 9 out
28	Review	
29	Bug fix and workout resolution	Homework 9 due
30	Final Exam	

Grades

The student's course grade will be based on:

- Weekly homework 10%
- Term project 20%
- Midterm exam 30%
- Final exam 40%

Textbook

You will find readings and references to special topics in the textbook.

Singiresu S. Rao. Mechanical Vibrations. 5th ed.