

MECH 463 - Sections 101 and 102

Mechanical Vibrations

4 Credits, 1st Semester 2016/17
Tuesdays and Thursdays, 8:00 – 9:30 am
Room: 182, Irving K Barber Learning Centre
Course Website: connect.ubc.ca

Instructor:

Dr. Mohammadreza Mallakzadeh
Office: TBA
Email: mallak@mech.ubc.ca
Office hours: By appointment on Tuesdays and Thursdays morning.

Teaching Assistants:

Name	Office	E-mail	Office hours
TBA			
TBA			
TBA			
TBA			
TBA			
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Textbook:

Mechanical Vibration by Singiresu S.Rao, 6th edition

Prerequisites:

MECH 221 and MECH 260; a sound working knowledge in kinematics, solid mechanics, differential equations, complex numbers, and matrix algebra is essential for this course.

Course Overview:

Mechanical vibration deals with observation, analysis, and modification of vibration in mechanical systems. Practical application and design consideration related to modifying the vibrational behavior of mechanical devices and structures will be studied in this course. It is important to know that there are both desirable and undesirable types of vibration like vibration used in industrial part feeders/sorters and on the seat of a vehicle, respectively.

Course Objectives:

The objectives of this course are as follows:

- i) Develop Lumped parameter models of mechanical systems
- ii) Formulate equations of motion using free-body-diagram and energy methods
- iii) Solve for vibration response
- iv) Design counter-vibration measures: absorbers, isolators, and system modification
- v) Comprehend working principles of vibration measurement devices

Course Outline:

Read the sections indicated below from the course text book before each lecture.

	Topic	Read	Objectives
	Introduction to Vibration	1.1 – 1.6	i
Single-Degree-of-Freedom Systems	Formulation of Equation of Motion	2.1; 2.2.1; 2.2.3	ii
	Equivalent Systems	1.7; 1.8	ii
	Undamped SDOF response	1.10; 2.2; 3.3	iii
	Viscously Damped SDOF response	2.6; 3.4	iii
	Vibration Isolation	9.10	iv
	Forced Vibration: General Excitation	4.2 – 4.5	iii
	Vibration Measuring Instruments	10.4; 10.5	v
Spectral Analysis	Introduction to Fourier Series & Fourier Transforms	1.11	v
	Frequency Response Functions and Coupled Systems		ii
Multi-Degree-of-Freedom Systems	Formulation of matrix Equations of Motion; Coupling and Principal Coordinates	5.1 – 5.6 6.1 – 6.8	i and ii
	Eigenvalue problems & Orthogonality Conditions	6.9 – 6.10	iii
	Free and Forced Vibration Response	6.13 – 6.15	iii
	Vibration Absorbers	9.11	iv
	Continues Systems	8.1 – 8.2	ii and iii

The coverage of the above proposed content depends on the pace of the class.

Course Load:

This is a 4 credit course and the course load is heavier compared to a normal credit course. It integrates concepts from Dynamics & Solid Mechanics. Students find this material challenging and rewarding. A 5 hours of study per week spent on this course outside the lectures, labs, and tutorials will keep you up to speed. Please keep up and do not leave things to the last moment.

Tutorial:

Tutorial attendance is compulsory. Tutorial problems are posted every Sunday on CONNECT. We will solve these problems together, in groups, on the following Monday, Wednesday and Friday in the tutorials. Please sign up in groups of 3. Your group will solve the tutorial problems and submit the finalized solution to the TA allocated for marking and feedback.

Section	Days	Time	Room
T1A	Mondays	13:00 – 14:00	Macleod 242
T1B	Wednesdays	12:00 – 13:00	Civil and Mechanical Engineering 1202
T1C	Fridays	10:00 – 11:00	Civil and Mechanical Engineering 1204

Homework:

One homework problem per week will be posted on every Wednesday; your hand-written answers should be submitted before 3pm on the following Wednesday in (...TBA...). Late submissions are not graded. Solving homework and assignment problems will help you prepare for the midterm and final examinations. Marked homework can be picked up from (...TBA...), approximately a week after you submit them.

Labs:

Please come prepared: read the handout carefully and complete the pre-lab exercise. You will be given a short quiz in the lab, the mark of which will count toward the pre-lab. The report should be submitted within two weeks (including holidays and weekends) in (...TBA...). Late submissions will incur mark deduction (5% per day). Grading scheme for the lab reports is posted on CONNECT along with the lab handout. Follow the report guidelines in the handout and ensure that your report addresses all points in the grading scheme. There would be two members per group and the lab is in ICICS X039 (opposite PACE lab). Time schedule would be announced after allocation of the lab groups members.

Course website:

All course related material including the lecture presentations, notes, announcements, e-mails, homework, solutions and exams will be posted at following website: connect.ubc.ca

Midterm exam:

The midterm exam will be held in the lecture times on October 25th. The date is final and non-negotiable. The exam is closed-book; your hand-written formula sheet (letter paper, both sides) is allowed. The exam is of 80 minutes' duration.

Final Exam

Typically, about 2 to 3 hrs long. The date, time, and place will be decided by the Registrar's Office.

Note: You must secure at least 50% overall and at least 50% in the final to pass the course. If you score below 50% in the final exam, your final mark will be your course mark.

Grading Scheme:

Homework	5%
Tutorials	5%
Midterm Examination	20%
Laboratory Reports	10%
Final Examination	<u>60%</u>
Total	<u>100%</u>

Academic Integrity

All students are expected to know, understand, and follow the code of conduct regarding academic integrity. At the most basic level, this means submitting only original work done by you and acknowledging all sources of information or ideas and attributing them to others as required. This also means you should not cheat, copy or mislead others about what is your work. Violations of academic integrity and harsh sanctions are imposed. For example, incidences of plagiarism or cheating may result in a mark of zero on the assignment or exam and more serious consequences may apply if the matter is referred to the President's Advisory Committee on Student Discipline. Careful records are kept in order to monitor and prevent recurrences. See:

<http://www.calendar.ubc.ca/vancouver/index.cfm?tree=3,286,0,0>