Faculty of Engineering

Department of Mechanical Engineering

COURSE OUTLINE

MECH 330 – INTRODUCTION TO MECHANICAL VIBRATIONS

Term – Fall 2016 (201609)

Instructor	**Office Hours**
Dr. Daniela Constantinescu	Days: T
Phone: 250.721.6040	Time: 2:00 pm – 3:00 pm
E-mail: danielac@uvic.ca	Location: EOW 541

List all prerequisites and co-requisites: MECH 242; and MATH 110 or MATH 211; and MATH 201 or MATH 204.

LECTURE DATE(S)

Section: A01 /CRN12270	Days: MR	Time: 11:30 am – 12:50 pm	Location: ELL 167

TUTORIAL SECTIONS

Section: T01	Days: T	Time: 4:30 pm - 5:20 pm	Location: ECS 124
Section: T02	Days: W	Time: 5:30 pm - 6:20 pm	Location: ECS 124

LABORATORY SECTIONS

Section: B01	Days: T	Time: 8:30 am - 11:20 am	Location: ELW A243
Section: B02	Days: T	Time: 12:30 pm - 3:20 pm	Location: ELW A243
Section: B03	Days: F	Time: 12:30 pm - 3:20 pm	Location: ELW A243
Section: B04	Days: R	Time: 4:00 pm – 6:50 pm	Location: ELW A243
Section: B05	Days: M	Time: 5:00 pm – 7:50 pm	Location: ELW A243

TA Name	**E-mail**	**Office hours ECS 108**
Yuan Yang - Tutorials	yangyuan@uvic.ca	M, R 1:00pm – 2:00pm
Akram Saad - Laboratory	akrams@uvic.ca	
Hieu Phan - Marking	phanhieu@uvic.ca	

Required Text	**Optional Text**
Title: Fundamentals of Mechanical Vibrations	Any text on mechanical vibrations
Author: S. Graham Kelly	
Publisher/Year: McGraw Hill, 2000	
Reference Materials:	

COURSE OBJECTIVES: This course aims to develop students' fundamental knowledge and understanding of the oscillatory response of various mechanical systems, and to develop their knowledge and skills in vibrations testing and measurement.

Learning Outcomes next page

The MECH 330 topics build on rigid body dynamics concepts taught in MECH 242 and are related to topics studied in MECH 380. They also require knowledge of ordinary differential equations (MATH 201 or MATH 204) and linear algebra (MATH 100 and MATH 101).

The concepts learned in this course are precursor to topics that students will study in MECH 335 Theory of Mechanisms, MECH 421 Vibrations II, MECH 430 Robotics, MECH 485 Mechanism and Manipulator Synthesis. They will also be relied upon in MECH 400 Design Project, MECH 446 Introduction to Ocean Engineering, MECH 459 Fundamentals of Hybrid Vehicles, and MECH 475 Aircraft Design.

LEARNING OUTCOMES: Students who successfully complete this course will be able to:

1. Translate a physical problem in mechanical vibrations to an appropriate mathematical model.
2. Apply Newton's second law and energy methods to formulate the dynamic equations of motion of one- and multi-degree-of-freedom mechanical systems.
3. Solve the dynamic equations of motion of vibrating mechanical systems using university level mathematics (ordinary differential equations and linear algebra).
4. Calculate the natural frequencies, the mode shapes and the time response of one- and multi-degree-of-freedom mechanical systems under free and forced vibrations.
5. Analyze the risk of transmissibility and resonance.
6. Use vibration measurement techniques.
7. Carry out mechanical vibrations experiments.
8. Analyze experimental vibrations data.
9. Use vibration analysis in the design of mechanical systems to determine the operation frequency range.
10. Use Matlab to implement the numerical computations required to solve problems in free and forced vibrations of multi-degree of freedom mechanical systems, and to plot results.
11. Prepare assignment solutions and laboratory reports according to professional writing standards for engineering problem sets and for formal reports.
12. Uphold the APEGBC Code of Ethics in their interactions with other students, their team members, the TAs and the instructor.

Weight & Date(s) of Assessments:	**Weight**	**Date**
Assignments (5):	15%	09.29; 10.13; 10.27; 11:17; 12.01.
Labs (4):	16%	TBA on the News Forum on the Course Space site.
Mid-term	19%	Date: 6:30 pm – 8:30 pm on October 28 in ECS 123.
Final Exam	50%	TBA.

ASSIGNMENTS (Description & Method of Delivery)

1.Five problem sets will be distributed over the course of the term via the MECH 330 Course Space site. Assignment problems may require both hand calculations and Matlab/Simulink to complete.
2. The assignments must be handwritten on "Engineer's pad" paper using only the front side and the Matlab plots must be printed on US letter paper to be accepted. **Any other paper will be rejected**.
3. **30% of assignment grades will be allocated to presentation**. Full presentation grades will be awarded to assignments that comply with all requirements for the preparation of engineering problem sets outlined at http://web.mit.edu/me-ugoffice/communication/pset-format.pdf. If unclear about any requirements, please clarify them with the instructor in advance of the assignment due date.
4. The assignments must be submitted to the box marked "MECH 330" opposite ELW A144 and the Matlab/Simulink files used to solve the assignments must be uploaded to the MECH 330 Course Space site by 4:00pm on the day they are due. The Matlab/Simulink file names must follow the file naming rules detailed on the assignment handouts. **Late Assignments will not be accepted.**

Assignment #	Modules	Start	Due (4 pm)
1	Vibrations of single degree of freedom systems.	09.15	09.29
2	Vibrations of single degree of freedom systems.	09.29	10.13
3	Vibrations of multi degree of freedom systems.	10.13	10.27
4	Vibrations of multi degree of freedom systems.	10.27	11.17
5	Vibrations of multi degree of freedom systems.	11.17	12.01

LABORATORIES (Description & Method of Delivery)

1. Four laboratory experiments will be carried out during the term, according to the schedule posted to the MECH 330 Course Space site.
2. The laboratory reports will be due one week after the topics are covered in the lectures. The due dates will be posted to the News Forum of the MECH 330 Course Space site.
2. The laboratory reports must be prepared using text editing software and submitted as PDF files to the MECH 330 Course Space site by 4:00pm on the day they are due. **Late Laboratory reports will not be accepted.**
3. **40% of laboratory grades will be allocated to presentation**. Full presentation grades will be awarded to laboratory reports that implement the guidelines for the preparation of engineering laboratory reports outlined at http://www.me.umn.edu/education/undergraduate/writing/MESWG-Lab.1.5.pdf and http://ocw.mit.edu/courses/biological-engineering/20-109-laboratory-fundamentals-in-biological-engineering-fall-2007/assignments/guide_lab_report-htm/. If unclear about any requirements, please clarify them with the laboratory TA or the instructor in advance of the laboratory report due date.

Laboratory #	Modules	Schedule
1	Basic vibration measurement.	See the Course Space site
2	Frequency analysis of periodic signals.	See the Course Space site
3	Two-degree-of-freedom mechanical system.	See the Course Space site
4	Single-degree-of-freedom mechanical system.	See the Course Space site

NOTE:

Failure to complete all laboratory requirements will result in a grade of N being awarded for the course.

Failure to pass the final exam will result in a failing grade for the course.

The final grade obtained from the above marking scheme for the purpose of GPA calculation will be based on the percentage-to-grade point conversion table as listed in the current Undergraduate Calendar.

COURSE LECTURE NOTES

Unless otherwise noted, all course materials supplied to students in this course have been prepared by the instructor and are intended for use in this course only. These materials are NOT to be re-circulated digitally, whether by email or by uploading or copying to websites, or to others not enrolled in this course. Violation of this policy may in some cases constitute a breach of academic integrity as defined in the UVic Calendar.

Assignment of E grade and supplemental examination for this course will be at the discretion of the Course Instructor. The rules for supplemental examinations can be found in the current Undergraduate Calendar.

GENERAL INFORMATION

Note to Students:

Students who have issues with the conduct of the course should discuss them with the instructor first. If these discussions do not resolve the issue, then students should feel free to contact the Chair of the Department by email or the Chair's Secretary to set up an appointment.

"**Attendance**

Students are expected to attend all classes in which they are enrolled. An academic unit may require a student to withdraw from a course if the student is registered in another course that occurs at the same time….

An instructor may refuse a student admission to a lecture, laboratory, online course discussion or learning activity, tutorial or other learning activity set out in the course outline because of lateness, misconduct, inattention or failure to meet the responsibilities of the course set out in the course outline. Students who neglect their academic work may be assigned a final grade of N or debarred from final examinations.

Students who do not attend classes must not assume that they have been dropped from a course by an academic unit or an instructor. Courses that are not formally dropped will be given a failing grade, students may be required to withdraw and will be required to pay the tuition fee for the course." UVic Calendar, (2016) http://web.uvic.ca/calendar2016-09/undergrad/info/regulations/attendance.html

Accommodation of Religious Observance (AC1210)
http://web.uvic.ca/calendar2016-09/general/policies.html

Discrimination and Harassment Policy (GV0205)
http://web.uvic.ca/calendar2016-09/general/policies.html

Faculty of Engineering, University of Victoria Standards for Professional Behaviour

"It is the responsibility of all members of the Faculty of Engineering, students, staff and faculty, to adhere to and promote standards of professional behaviour that support an effective learning environment that prepares graduates for careers as professionals…."

You are advised to read the Faculty of Engineering document Standards for Professional Behaviour which contains important information regarding conduct in courses, labs, and in the general use of facilities.
http://www.uvic.ca/engineering/current/undergrad/index.php#section0-23

Cheating, plagiarism and other forms of academic fraud are taken very seriously by both the University and the Department. You should consult the Undergraduate Calendar for the UVic policy on academic integrity.

Policy on Academic Integrity
http://web.uvic.ca/calendar2016-09/undergrad/info/regulations/academic-integrity.html

Course Schedule (see the MECH 330 Course Plan for more details)

Module	Topics	Date/Week
1	Vibrations of single degree of freedom systems; free undamped and damped vibration characteristics, harmonic forcing, frequency response functions, Fourier series method for periodic forcing.	09.08 – 10.14
2	Multi degree of freedom systems; frequencies and modes analysis, matrix methods, and orthogonality of modes. Free and forced vibration characteristics of undamped and damped multi degree of freedom systems	10.14 – 11.10
3	Applications in vibration isolation and control.	11.10 – 12.01