

## MME 4425b – Mechanical Vibrations

### COURSE OUTLINE – 2020-21

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<b>CALENDAR DESCRIPTION:</b>	Free and forced vibration of Single-degree-of-freedom systems; modelling of multi-degree-of-freedom systems via Lagrange's equations; modal summation method for response predictions; vibration isolation and vibration measuring instruments; tuned mass vibration absorber; viscous, coulomb and hysteresis damping; vibration of continuous systems; introduction to experimental modal analysis.
<b>COURSE INFORMATION</b>	Instructor: Dr. Liying Jiang Room CMLP 1306 Email: <a href="mailto:lyjiang@eng.uwo.ca">lyjiang@eng.uwo.ca</a> Lectures: Tu 1:30pm-2:30pm (AHB-1R40), Th 11:30am-12:30pm (AHB-1R40) F 1:30pm-2:30pm (NS-145) Tutorials/Labs: M 4:30pm-6:30pm (SH3345/SEB3101)
<b>PREREQUISITES:</b>	<b><i>Applied Mathematics 3413a/b or AM 3415a/b, and MME 3381a/b or MSE 3381a/b.</i></b> Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you will be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.
<b>ACCREDITATION UNITS:</b>	Engineering Science = 75%, Engineering Design = 25%
<b>TOPICS:</b>	Introduction to free and forced vibration, equations of motion, viscous and Coulomb damping, harmonic excitation, transient vibration, response of single- and multi-degree of freedom systems, design for vibration suppression, vibration measurement device and design, machine condition monitoring.
<b>LEARNING OUTCOMES:</b>	Upon successful completion of this course, students will be able to <ul style="list-style-type: none"><li>• describe a dynamic system by establishing mathematical models, deriving and solving governing equations, and interpreting results</li><li>• conduct vibration analysis for various systems (single degree, multi and infinite degrees of freedom) induced by various inputs (harmonic excitation, impulse excitation, base excitation, unbalance rotation) both analytically and numerically;</li><li>• make design recommendation for vibration suppression of mechanical systems to improve performance, including vibration isolators and vibration absorbers;</li><li>• conduct vibration measurements and design vibration measurement devices.</li></ul>
<b>CONTACT HOURS:</b>	3 lecture and 2 laboratory/tutorial hours per week (6 hours lab), half course
<b>TEXT:</b>	“Engineering Vibrations” by D. J. Inman, 4 <sup>th</sup> Edition, PEARSON. ISBN 0-13-287169-6
<b>REFERENCES:</b>	“Fundamentals of Mechanical Vibration” by S. Graham Kelly, McGraw-Hill, 2 <sup>nd</sup> Edition

“Mechanical Vibrations” by S. S. Rao, Addison Wesley, SI Edition, Prentice Hall

**TUTORIALS:**

“Shock and Vibration Handbook” by C. M. Harris, McGraw-Hill, 5<sup>th</sup> Edition  
Students are expected to attempt relevant questions from the text and discuss in the tutorial periods. The teaching assistant will present numerical solutions for some examples.

**EXAMINATIONS**

2 hour Closed Book midterm exam

3 hour Closed Book final exam

**UNITS:**

SI units will be used

**EVALUATION:**

The final grade is computed as follows:

Assignments	5%
Assignment 1: Due time 6:30 pm on Monday January 25	
Assignment 2: Due time 6:30 pm on Friday February 12	
Assignment 3: Due time 6:30 pm on Monday March 15	
Assignment 4: Due time 6:30 pm on Monday April 5	
Mid-term Test	20%
Date: Monday February 22	
Time: 4:30 pm-6:30 pm	
Location: SH-3345	
Hands-on Laboratory – Three group laboratory sessions for the semester	5%
Lab 1: Week of February 8-12; Lab 2: Week of March 8-12;	
Lab 3: Week of March 22-26.	
Location: SEB3101	
Course Project	15%
Due: 5:00 pm on April 9	
Final Examination	55%

**COURSE POLICY:**

Due to the nature and structure of evaluation in this course, it is exempt from the 15% policy. This means that you will not have received 15% of your grade prior to the course drop deadline. If you have any concerns about your progress in this course, at any point, I encourage you to speak with me directly.

Assignments

- Late submission of assignment will receive a grade no higher than 50% for that assignment.
- Missing an assignment without academic consideration will translate into a zero mark for that assignment.
- Missing an assignment with academic consideration will only account for the completed assignments for the assignment weighted mark.

Laboratory sessions

- Students who arrive 15 min after the scheduled lab time will receive a grade no higher than 50% for that lab session;
- Missing a lab without academic consideration will result in a zero mark for that lab;
- Late submission of lab report will receive a grade no higher than 50% for that lab session;

- Students who miss a lab with academic consideration are required to reschedule the lab by contacting the course instructor. Failure to do so will result in a zero mark for that lab.

#### Midterm exam

- No make-up midterm options will be offered regardless of the circumstances for which the midterm was missed;
- Missing the midterm exam without academic consideration will result in a zero mark for the midterm;
- Missing the midterm exam with academic consideration will automatically shift the weight of the missed midterm exam into the final exam;
- Examination will be CLOSED BOOK with only non-programmable calculators permitted.

#### Course project

- Missing the scheduled presentation without academic consideration will result in a zero mark for the presentation;
- Late submission of the project report without academic consideration will receive 50% penalty for the assigned mark of the written report;
- Students who miss the scheduled presentation or submit the project report late with academic consideration are required to make alternative arrangements by contacting the course instructor. Failure to do so will result in a zero mark for the project.

#### Final exam

- If a minimum of 50% is not obtained on the final examination, the student cannot receive a final mark greater than 48% for the course;
- Examination will be CLOSED BOOK with only non-programmable calculators permitted.

#### **ENGLISH:**

In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests and examinations for improper use of English. Additionally, poorly written work, with the exception of final examinations, may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.

#### **CONSULTATION:**

2:30-4:30pm (W)

#### **ATTENDANCE:**

Any student, who, in the opinion of the instructor, is absent too frequently from class or laboratory periods in any course, will be reported to the Dean (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Dean, the student will be debarred from taking the regular examination in the course.

#### **SSD:**

*Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.*

**CHEATING:**

University policy states that cheating, including plagiarism, is a scholastic offense. The commission of a scholastic offence is attended by academic penalties, which might include expulsion from the program. If you are caught cheating, there will be no second warning.

**NOTE:**

The above topics and outline are subject to adjustments and changes as needed. Students who have failed an Engineering course (ie.<50%) must repeat all components of the course. No special permissions will be granted enabling a student to retain laboratory, assignment or test marks from previous years. Previously completed assignments and laboratories cannot be resubmitted for grading by the student in subsequent years.