Western University
Department of Mechanical & Materials Engineering

MME 3325a – Mechanical Vibrations

COURSE OUTLINE – 2025-2026

CALENDAR DESCRIPTION: Free and forced vibration of single-degree-of-freedom systems; viscous and coulomb damping; vibration isolation and vibration measuring instruments; modelling of multi-degree-of-freedom systems via Newton's second law; modal analysis and modal summation method for response predictions of multi-degree-of-freedom systems; tuned mass vibration absorber; introduction to vibration of continuous systems; introduction to spectrum analysis for machinery diagnostics.

COURSE INFORMATION:

Instructor: Haojie Mao, Ph.D.
TEB 365

Email: hmao8@uwo.ca

Lectures/tutorials/labs: See Draft My Schedule

PREREQUISITES: NMM2270a and MME 2213b

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.

ANTIREQUISITES: None

ACCREDITATION UNITS: Engineering Science = 85%, Engineering Design = 15%

TOPICS:

- Free/forced vibration of single-degree-of-freedom systems
- Viscous and Coulomb damping
- Harmonic excitation and transient vibration
- Vibration measurement device and design
- Motion equations and response prediction for multiple-degree-of-freedom systems and continuous systems
- Design for vibration suppression
- Spectrum analysis for vibration

LEARNING OUTCOMES:

The Mechanical and Materials Engineering Program has been accredited by Canadian Engineering Accreditation Board (CEAB) of Engineers Canada. Accredited programs provide the academic requirements for licensure as a professional engineer in Canada. Western Engineering has defined indicators of the 12 Graduate Attributes (GAs) that the CEAB expects graduating engineering students to demonstrate. The connections between course learning outcomes and Western Engineering's GA Indicators are identified below.

Upon successful completion of this course, students will be able to:

- Describe a dynamic system by establishing mathematical models, deriving and solving governing equations, and interpreting results. (KB2, KB3, PA1, ET2)
- Conduct vibration analysis for a variety of discrete and continuous systems induced by various inputs (harmonic excitation, impulse excitation, base excitation, unbalance rotation) both analytically and numerically. (PA1, ET2)
- Make design recommendation for vibration suppression of mechanical systems to improve performance via vibration isolators and vibration absorbers. (KB4, PA1, IESE1, DE3, DE4)
- Conduct vibration measurements and perform spectrum analysis. (PA1, ET2)

CONTACT HOURS:

3 lecture hours, 2 tutorial hours, 0.5 laboratory hour, half course

Laboratory: 3 lab sessions, 3 hours/session, with a total of 9 hours per semester

TEXTBOOK:

"Engineering Vibrations" by D. J. Inman, 5th Edition, PEARSON. ISBN 978- 0-13-680985-2. Available from publisher https://www.pearson.com/en-us/subject-catalog/p/engineering-vibration/P200000003490/9780136809852

4th Edition is also acceptable. Available from Aamzon.ca https://www.amazon.ca/Engineering-Vibration-D-J-Inman/dp/9332518483

REFERENCES:

"Fundamentals of Mechanical Vibration" by S. Graham Kelly, McGraw-Hill, 2nd Edition.

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

"Shock and Vibration Handbook" by C. M. Harris, McGraw-Hill, 5th Edition.

UNITS:

SI will be used; however, English units may be introduced through examples as required.

TUTORIALS:

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

Two 1-hour closed book quizzes

One 2-hour closed book midterm exam

3-hour closed book final exam

EVALUATION:

The final grade is computed as follows:
Assignments 9%
Quizzes 12%
Midterm exam 20%
Hands-on Laboratory – Three group laboratory sessions 9%
Final Examination 50%

COURSE POLICIES:

Assignments

- Late submission of assignment will translate into a zero mark for that assignment.
- Assignments are due on Friday at noon as specified by each posted assignment, but you can submit as late as the following Monday at noon without penalty.
- Since flexibility in the submission deadline has been provided, any request for academic consideration for assignments will be denied.

Laboratory sessions

- Students who arrive 15 min after the scheduled lab time will receive a grade with 50% deduction of the mark received 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 with 50% deduction of the mark received for that lab session;
- Students who miss a lab with academic consideration are required to reschedule the lab by contacting the course instructor no later than 2 days after that lab. Failure to do so will result in a zero mark for that lab.

Quizzes and Midterm exam

- No make-up options for quizzes and midterm exam will be offered regardless of the circumstances for which the quiz or midterm exam was missed;
- Missing a quiz without academic consideration will result in a zero mark for that quiz or midterm exam;
- Missing a quiz with academic consideration will automatically shift the weight of the missed quiz into the midterm exam;
- Missing the midterm exam will result in a zero mark for the midterm exam;
- Missing the midterm exam with academic consideration (**designated assessment**, therefore students are required to provide formal supporting documentation) will automatically shift the weight of the midterm exam into the final exam;
- Quizzes and examinations will be CLOSED BOOK with only non-programmable calculators permitted.

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.

General Faculty / University Policies

The Faculty of Engineering and Western University have overarching policies that prescribe how undergraduate courses should run. The course-specific policies described above should be considered *in addition to* those overarching policies, or as course-specific interpretations of them. In the event of contradictions or confusion between course-specific policies above and general Faculty / University policies, please contact your course instructor for clarification.

Western Engineering's undergraduate polices can be found by navigating to:
https://www.eng.uwo.ca/undergraduate/academic-support-and-accommodations/policies.html

and then clicking the "*Engineering Undergraduate Policies framework*" link.