Western University
Department of Mechanical & Materials Engineering

MME 2234b – Heat Transfer and Dynamics

COURSE OUTLINE – FW2024-2025 (W2025)

This course has two parts: Dynamics (Part 1) and Heat transfer (Part 2)

CALENDAR DESCRIPTION:	To provide the student with an understanding of the basic concepts of heat transfer and dynamics of particles and rigid bodies.	
COURSE INFORMATION:	Instructor:	Roger E. Khayat, Ph. D. P. Eng Room: 3086 Email: rkhayat@uwo.ca
	Lectures:	See Draft My Schedule
PREREQUISITES:	ES 1022a/b/y	
COREQUISITES:	NMM 2270a/b	
ACCREDITATION UNITS:	Math = 10%, Engineering Science = 90%	

TOPICS:

Part 1 Dynamics

1. Kinematics of a particle
2. Kinetics of a particle: force and acceleration
3. Kinetics of a particle: work and energy
4. Vibration of single degree of freedom systems
5. Kinetics of a particle: impulse and momentum (optional)
6. Planar kinematics of a rigid body (optional)

Part 2 Heat Transfer

1. Introduction to conduction, convection and radiation
2. Conservation of energy applied to heat transfer
3. Three-dimensional heat diffusion equation
4. 1D steady-state conduction in Cartesian, Cylindrical and Spherical geometries
5. Conduction with thermal energy generation
6. Heat transfer from extended surfaces
7. Two-dimensional steady-state conduction
8. Conduction shape factors

OBJECTIVES AND 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.

Part 1: Dynamics

Objective 1: Develop a conceptual understanding of principles of engineering dynamics.
Learning Outcome (KB2):

- Students will demonstrate a conceptual understanding of engineering dynamics, including the force-acceleration and work-energy methods for analyzing particles and rigid bodies.

Objective 2: Develop the ability to create mathematical models of practical problems and obtain solutions.
Learning Outcomes (PA2):

- Students will develop the ability to construct mathematical models for dynamic systems involving particles and rigid bodies.
- Students will solve dynamic problems by applying mathematical models using force-acceleration and work-energy methods.
- Students will apply these models to analyze free and harmonic vibrations of single-degree-of-freedom systems.

Part 2: Heat Transfer

Objective 1: Develop a conceptual understanding of the fundamental elements of heat transfer.
Learning Outcome (KB2):

- Students will demonstrate a conceptual understanding of the fundamental principles of heat transfer, including conduction, convection, and radiation.

Objective 2: Gain a basic working knowledge of the various modes of heat transfer.
Learning Outcomes (PA2):

- Students will apply the principles of heat conduction and convection to analyze practical engineering problems.
- Students will identify and differentiate between the various modes of heat transfer in real-world applications.

Objective 3: Develop some methods of analysis for problems involving heat transfer.
Learning Outcomes (PA2):

- Students will develop methods for performing thermal analyses of composite walls, applying appropriate heat conduction equations.
- Students will apply methods for analyzing cooling fins, using principles of conduction and convection to assess their thermal performance.

CONTACT HOURS:	Three lecture hours, three tutorial hours, half course
TEXT:	No required textbooks. One can use the following as reference books (placed on reserve) Fundamentals of Heat and Mass Transfer, 7th edition, Theodore L. Bergman, Adrienne S. Lavine, Frank P. Incropera, David P. De Witt, John Wiley, 2011. Vector Mechanics for Engineers. Dynamics, Tenth Edition, F. Beer et al., McGraw-Hill, 2013.
EXAMINATIONS	Closed Book
UNITS:	SI
EVALUATION:	The final grade is computed as follows (schedule tentative):

Part 1. Dynamics

Attendance	**5%**
Test (4th week)	**10%**
Final exam (6th week)	**35%**

Part 2. Heat transfer

Attendance	**5%**
Test (11th week)	**10%**
Final exam	**35%**

(The HT final exam will be scheduled during the final exam period)

If a minimum mark of 50% is not obtained on EACH part, the student cannot receive a final mark greater than 48%.

USE OF GENERATIVE ARTIFICIAL INTELLIGENCE (AI)

The use of generative artificial intelligence (AI) tools/software/apps is not permitted.

The grade of a missed test in Part 1 or Part 2 with academic consideration will be reweighted towards the final exam of that part. Missed tests without academic consideration will have zero grade.