**Western University**
***Department of Mechanical & Materials Engineering***

# MME 4485B/9515B - Fluid Machinery

**COURSE OUTLINE – 2024-2025**

***CALENDAR DESCRIPTION:*** Fluid turbo-machinery theory, performance characteristics of centrifugal and axial flow fans, compressors, pumps and turbines, fluid vibrations and sound, water hammer, introduction to fluid power controls and fluid amplifiers.

***COURSE INFORMATION:***

Instructor: Professor C. Zhang

Email: czhang@eng.uwo.ca

Lectures/tutorials/labs: See Draft My Schedule

***CONSULTATION HOURS:*** By appointment only.

***PREREQUISITES:*** MME 3303a/b.

***ANTIREQUISITES:*** None.

***ACCREDITATION UNITS:*** Science = 75%, Engineering Science = 25%

***TOPICS:***

1. Introduction, and dimensional analysis and similitude of turbomachines
2. Open turbomachines
3. Basic thermodynamics, fluid mechanics and definitions of efficiency
4. Axial flow turbines
5. Axial flow compressor, pumps and fans
6. Centrifugal compressors, pumps and fans
7. Radial flow turbines

***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:

1. Identify various types of turbomachines and their principal applications (KB4)
2. Perform a similarity analysis between a laboratory tested model and a full-scale turbomachine (KB3)
3. Apply basic conservation equations to predict the performance of different turbomachines (KB2, KB3, KB4)
4. Calculate efficiency of turbomachines (KB2, KB3, KB4)
5. Draw and use velocity triangle diagrams for axial and radial turbomachines (KB2, KB3, KB4)
6. Estimate losses for different stages (KB2, KB3, KB4)
7. Report experimental observations (I2, I3)
8. Interpret experimental outcomes in terms of the relevant theory (I2, I3)

***CONTACT HOURS:***

3 lecture hours, 1 tutorial hour, 0.17 laboratory hours/week (2 lab activities, 1 hour each), half course

***TEXTBOOK:***

S L Dixon and C. Hall, "Fluid Mechanics and Thermodynamics of Turbomachinery", 7th Ed, Butterworth-Heinemann, Boston. ISBN-13: 978-1-85617-793-1.

It is recommended to have the textbook, and the cost of the textbook is listed as $143.80 from the UWO Bookstore. https://bookstore.uwo.ca/textbook-search?campus=UWO&term=W2024B&courses%5B0%5D=001_UW/MME4485B

Students are welcome to purchase second-hand or earlier editions of this textbook.

***UNITS:***

SI and British Engineering

***EVALUATION:***

| | |
|---|---|
| Quiz #1 | 6% |
| Quiz #2 | 4% |
| Laboratories | 10% (5% for each lab) |
| Mid-term test | 25% |
| Final Examination | 55% |

Quizzes – 8:30 – 9:30 a.m. on Tuesday, Feb. 4 and Mar. 25, 2025
Mid-term test - 4:30 - 6:30 p.m. on Monday, Mar. 10, 2025.

***COURSE POLICIES:***

The following course-specific policies will be strictly enforced throughout the course:

**Assignments:**

- Each week starting from the 2nd week till the 12th week there will be an assignment (4-6 problems). These problems will indicate the level of student achievement expected. The students are not required to hand in the assigned problems for grading.

**Tutorials:**

- During the tutorial periods, the teaching assistants will be available to help students with solving the assignment problems, to answer questions and to provide additional explanation of the lecture material if needed. There will be 2 quizzes held during the tutorial period.

**Laboratories:**

- Laboratory attendance is compulsory.
- Each student will visit the lab twice for one hour during the lab period and conduct the two experiments **(1) Axial flow fan performance test and (2) Reaction (Francis) turbine performance test.** The laboratory will be conducted in groups of 3 students. Lab reports will be submitted as group reports for undergraduate students and individual reports for graduate students, and are due **one week** after the experiment is conducted.
- You should read the instruction sheet and section of the text dealing with the theory related to the experiment before you come to the laboratory. Laboratory attendance is compulsory. You will be required to record your experimental data neatly and have these signed by the laboratory instructor before you leave the lab.
- Passing the laboratory component of the course (i.e. at least 50% mark in the laboratory component) is necessary to pass the course
- Students who arrive 30 min after the scheduled lab time or miss the lab without academic consideration will be given one time only chance to conduct the lab (at a rescheduled time) with 50% penalty.
- 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
- Missing both labs without academic consideration will result in the course failure

**Quizzes**

- Closed book, two summary pages (8.5”x11”, both sides) and non-programmable calculator are allowed
- No make-up quiz options will be offered regardless of the circumstances for which the quiz was missed
- Missing quizzes with academic consideration will shift the weight of the missed quizzes into the final exam
- Missing a quiz without academic consideration will translate into a zero mark for that quiz

**Midterm exam (designated assessment)**

- Open book
- No make-up midterm options will be offered regardless of the circumstances for which the midterm was missed
- Missing the midterm with academic consideration will shift the weight of the missed midterm exam into the final exam, and documentations are required for missing the midterm (designated assessment)
- Missing the midterm exam without academic consideration will translate into a zero mark for the midterm

**Final exam**

- Open book
- If a minimum of 50% is not obtained on the final examination, the student will be assigned a grade of no greater than 48% for the course