Western University
Faculty of Engineering

Department of Mechanical & Materials Engineering

MME 9614 – Applied Computational Fluid Mechanics and Heat Transfer

COURSE OUTLINE 2019-2020

DESCRIPTION: This course will introduce computational fluid dynamics (CFD) method and its applications. Students will develop the ability of using CFD method to predict fluid flow, heat transfer, and related processes.

PREREQUISITES: Graduate student standing or permission from the instructor

ANTIREQUISITES: None

TOPICS:
1. The finite volume method for discretization of partial differential equations
2. Types of error in numerical calculations
3. Mesh generation using Pointwise software
4. General usage of CFD software ANSYS Fluent and OpenFOAM
5. Turbulence modelling
6. Multiphase modelling
7. Heat transfer modelling

CONTACT HOURS: 2 lecture hours per week, 2 computer laboratory hours per week, half course

TEXTBOOK(S): None


COMPUTING: Software packages ANSYS Fluent, OpenFOAM, Pointwise

EVALUATION: The final course grade will be determined by the following distribution. Due dates for assignments, projects, presentations, and examinations are determined according to the tentative schedule as follows:

Assignments 35%
Assignment 1: Assigned week of September 23, 2019
   Due week of October 7, 2019
Assignment 2: Assigned week of October 14, 2019
   Due week of October 28, 2019
Assignment 3: Assigned week of November 4, 2019
   Due week of November 18, 2019
Assignment 4: Assigned week of November 18, 2019
   Due week of December 2, 2019

Project 30%
Report due on December 5, 2019

Final Examination 35%
Date and time will be announced before November 30, 2019

All examinations are closed book.
Only non-programmable calculators are allowed.

Office: SEB 3096, Tel. 519-661-2111, ext. 84455
Email: cdegroo5@uwo.ca
Office Hours: by appointment

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 Associate Dean (Graduate), after due warning has been given. On the recommendation of the Department concerned, and with the permission of the Associate Dean (Graduate), the student will be debarred from taking the regular examination in the course.

**HEALTH/WELLNESS:** As part of a successful graduate student experience at Western, we encourage students to make their health and wellness a priority. Western provides several on campus health-related services to help you achieve optimum health and engage in healthy living while pursuing your graduate degree. For example, to support physical activity, all students, as part of their registration, receive membership in Western’s Campus Recreation Centre. Numerous cultural events are offered throughout the year. Please check out the Faculty of Music web page [http://www.music.uwo.ca/](http://www.music.uwo.ca/) and our own McIntosh Gallery [http://www.mcintoshgallery.ca/](http://www.mcintoshgallery.ca/). Information regarding health- and wellness-related services available to students may be found at [http://www.health.uwo.ca/](http://www.health.uwo.ca/)

Students seeking help regarding mental health concerns are advised to speak to someone they feel comfortable confiding in, such as their faculty supervisor, their program director (graduate chair), or other relevant administrators in their unit. Campus mental health resources may be found at [http://www.health.uwo.ca/mental_health/resources.html](http://www.health.uwo.ca/mental_health/resources.html)

To help you learn more about mental health, Western has developed an interactive mental health learning module, found here: [http://www.health.uwo.ca/mental_health/module.html](http://www.health.uwo.ca/mental_health/module.html). This module is 30 minutes in length and provides participants with a basic understanding of mental health issues and of available campus and community resources. Topics include stress, anxiety, depression, suicide and eating disorders. After successful completion of the module, participants receive a certificate confirming their participation.

**CONDUCT:** Students are expected to arrive at lectures on time, and to conduct themselves during class in a professional and respectful manner that is not disruptive to others.

**SICKNESS:** Students should immediately consult with the instructor or Associate Chair (Graduate) if they have problems that could affect their performance in the course. The student should seek advice from the Instructor or Associate Chair (Graduate) regarding how best to deal with the problem. Failure to notify the Instructor or the Associate Chair (Graduate) immediately (or as soon as possible thereafter) will have a negative effect on any appeal.

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**ACCESSIBILITY:** 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.
 PLAGIARISM/

ACADEMIC OFFENCES: Students must write their essays and assignments in their own words. Whenever students take an idea, or a passage of text from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. Plagiarism is a major academic offence. Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence (see Western's scholastic discipline regulations for graduate students)

NOTICES: Students are responsible for regularly checking their Western email and notices posted on Instructors' doors.

NOTE: The above topics and outline are subject to adjustments and changes as needed.
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<tr>
<th>Degree Level Expectation</th>
<th>Weight</th>
<th>Assessment Tools</th>
<th>Outcomes</th>
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<tbody>
<tr>
<td>Depth and breadth of knowledge</td>
<td>30</td>
<td>• Assignments</td>
<td>• Understands advanced concepts and theories</td>
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<td></td>
<td></td>
<td>• Course project</td>
<td>• Aware of important current problems in the field of study</td>
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<td>• Understands computational and/or empirical methodologies to solve related problems</td>
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<td>Research &amp; scholarship</td>
<td>15</td>
<td>• Course project</td>
<td>• Able to conduct critical evaluation of current advancements in the field of specialization</td>
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<td>• Able to conduct coherent and thorough analyses of complex problems using established techniques/principles and judgment</td>
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<td>Application of knowledge</td>
<td>30</td>
<td>• Assignments</td>
<td>• Able to apply knowledge in a rational way to analyze a particular problem</td>
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<td></td>
<td>• Course project</td>
<td>• Able to use coherent approach to design a particular engineering system using existing design tools</td>
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<td>Professional capacity / autonomy</td>
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<td>• Aware of academic integrity</td>
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<td>• Implements established procedures and practices in the coursework</td>
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<td>• Defends own ideas and conclusions</td>
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<td>• Integrates reflection into his/her learning process</td>
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<td>Communication skills</td>
<td>15</td>
<td>• Assignments</td>
<td>• Communicates (oral and/or written) ideas, issues, results and conclusions clearly and effectively</td>
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<td>Awareness of limits of knowledge</td>
<td>10</td>
<td>• Assignments</td>
<td>• Aware of the need of assumptions in complex scientific analyses and their consequences</td>
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<td>• Course project</td>
<td>• Understands the difference between theoretical and empirical approaches</td>
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<td>• Acknowledges analytical limitation due to complexity of practical problems</td>
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