DESCRIPTION: To introduce fundamental theory, basic design criteria and performance evaluation of different thermal engineering systems including heat exchangers, refrigeration systems and renewable energy systems, as well as heat transfer associated with building envelopes. To conduct and write an extensive term report encompassing a critical literature review and quantitative analysis of recent published academic research work on a selected topic in thermal systems engineering.

PREREQUISITES: Graduate student standing. At least one prior undergraduate course successfully passed separately in each of the following three subjects: fluid mechanics, thermodynamics and heat transfer.

ANTIREQUISITES: None

TOPICS: The topics to be covered will be selected from the following subjects:
1. Review of fundamental thermodynamics, fluid mechanics and heat transfer
2. Heat exchangers: Thermal and hydraulic design
3. Building heating systems (Boilers and Furnaces)
4. Refrigeration systems
5. Heat pumps
6. Solar thermal systems
7. Thermal storage
8. Heat transfer through the building envelope

LEARNING OUTCOMES: Students successfully completing this course will have:
- A well-established level of knowledge about various thermal energy systems.
- Improved skills to critically evaluate techniques/processes/devices currently used in these systems.
- The competency to apply the advanced knowledge gained through this course, in the critical analysis or design of various thermal energy systems.
- The ability to undertake and successfully complete engineering analyses independently.
- Improved ability to critically evaluate published research work, write/present ideas, issues and conclusions clearly and extensively and in a properly structured and consistent manner.
- Better awareness of the implementation of simplified assumptions to solve/analyze complex engineering problems.

CONTACT HOURS: 2 lecture hours per week (Tuesdays, 12.30 – 2.30 pm, SEB 2099, starting 7th January 2020)
1 laboratory hour (for each laboratory) during lecture time slot. Half course.

TEXTBOOK(S): None are needed for this course


EVALUATION: The final course grade will be determined as listed below:
Deadlines for assignments, lab reports and term project are according to the following schedule:

Laboratories (x2) 10%
Lab #1 Heat exchanger – 10th March 2020, report due in lab 1 week after (17th March 2020)
Lab #2 Refrigeration – 17th March 2020, report due in class 1 week after (24th March 2020)

Assignments (x2) 15%
Assignment #1 Due date (in department): 18th February 2020
Assignment #2 Due date (in department): 31st March 2020

Research project reports and presentation 75%
Progress Report, due (in class), 25th February 2020 [5%]
Final Report due date (in class): 7th April 2020 [50%]
Presentation Powerpoint file due: 5 pm, 6th April 2020
Presentation sessions: 7th April and 14th April 2020 [20%]
INSTRUCTOR: Professor E Savory
Office: SEB 3085, Tel. 519-661-2111, ext. 88256
Email: esavory@uwo.ca
Office Hours: To be determined

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/, and our own McIntosh Gallery http://www.mcintoshgallery.ca/. Information regarding health- and wellness-related services available to students may be found at 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

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. 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.

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.
## MME 9641 – Attributes and Learning Outcomes

<table>
<thead>
<tr>
<th>Attributes Degree Level Expectation</th>
<th>Weight</th>
<th>Assessment Tools</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth and breadth of knowledge</td>
<td>10%</td>
<td>Assignments, Laboratories, Project reports, Presentation</td>
<td>Understands advanced concepts and theories.</td>
</tr>
<tr>
<td>Research &amp; scholarship</td>
<td>50%</td>
<td>Project reports</td>
<td>Able to critically evaluate published research work. Able to conduct coherent and thorough analyses involving complex concepts using a range of techniques, principles and judgment.</td>
</tr>
<tr>
<td>Application of knowledge</td>
<td>10%</td>
<td>Assignments, Laboratories</td>
<td>Able to apply knowledge in a rational way to analyse a particular problem.</td>
</tr>
<tr>
<td>Professional capacity / autonomy</td>
<td>5%</td>
<td>Project reports, Laboratories, Presentation</td>
<td>Aware of academic integrity. Defends own ideas and conclusions. Integrates reflection into his/her learning process.</td>
</tr>
<tr>
<td>Communication skills</td>
<td>20%</td>
<td>Assignments, Laboratories, Project reports, Presentation</td>
<td>Writes and presents ideas, issues and conclusions clearly and in a properly structured and consistent manner.</td>
</tr>
<tr>
<td>Awareness of limits of knowledge</td>
<td>5%</td>
<td>Project reports</td>
<td>Aware of the need of assumptions in complex scientific analyses and their consequences. Understands the difference between theoretical and empirical approaches. Acknowledges analytical limitation due to complexity of practical problems.</td>
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</tbody>
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