Course: ENGR 290 – Materials & Thermodynamics, 2020
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Calendar Description

Topics covered in this course include description of point defects, diffusion in solids, dislocations, origin of Gibbs phase rule, phase diagrams, properties of non-ferrous materials, first law of thermodynamics, internal energy, second law of thermodynamics, entropy, availability and irreversible processes.

Intended Learning Outcomes

The primary purpose of this course is to prepare students for entry into a department of Mechanical Engineering at the University level. ENGR 290 reviews material already covered in their background, firming their understanding of the material to ease the transfer into the third year of Mechanical Engineering at the University level.

Upon successful completion of this course a student will be able to:

- Sketch a phase diagram for some common materials and alloys.
- Interpret the phase diagram of any material.
- Discuss the behavior of polymers.
- Explain the first and second laws of thermodynamics.
- Apply the first law of thermodynamics.
- Apply the second law of thermodynamics.
- Analyze problems in a systematic manner using diagrams in developing and evaluating thermodynamic processes, and applying concepts to steady and non-steady flow processes.
- Apply the concepts of irreversibility and availability.
- Explain and analyze air standard cycles.
- Analyze Rankine, Regeneration and Refrigeration Cycles.
- Analyze ideal and non-ideal gas vapor behavior.
- Use psychrometric charts as applied to humidification, dehumidification and air conditioning.

Text & References

No textbook is required for this course. However, you should own one of the following recommended texts (any edition is acceptable) to ensure you have what you need for University-level Thermodynamics:

- *Fundamentals of Engineering Thermodynamics* (Moran, Shapiro)
- *Fundamentals of Thermodynamics* (Borgnakke, Sonntag)
- *Fundamentals of Thermal-Fluid Sciences* (Çengel, Cimbala, Turner).

Course Content (subject to modification, if necessary)

Week	Quizzes	Assignments	Course Content
1	-	-	***Materials*** – Crystallization and diffusion in solids, polymers.
2	Quiz 1	-	***Materials*** – Equilibrium phase diagrams.
3	Quiz 2	-	***Materials*** – Use of phase diagrams, heat treatment, TTT diagrams.
4	Quiz 3	Assign. 1	***Thermodynamics*** – Review of thermodynamic properties, work, heat, development of the 1st Law of thermodynamics.
5	Quiz 4	-	***Thermodynamics*** – 1st Law examples, ideal gas law, idealized processes.
6	Quiz 5	-	***Thermodynamics*** – Carnot engine and the development of the 2nd Law of thermodynamics.
7	Quiz 6	Assign. 2	***Thermodynamics*** – 2nd Law examples, efficiencies of devices operating under irreversible processes.
8	Quiz 7	-	***Thermodynamics*** – Review/Catch up.
9	-	-	***Thermodynamics*** – Vapor power cycles.
10	Quiz 8	-	***Thermodynamics*** – Reheat and regeneration vapor power cycles, combined reheat-regen cycle.
11	Quiz 9	Assign. 3	***Thermodynamics*** – Vapor refrigeration and heat pump cycles.
12	Quiz 10	-	***Thermodynamics*** – Gas power cycles (air-standard analysis, cold air-standard analysis, Otto cycle, Diesel cycle).
13	Quiz 11	Assign. 4	***Thermodynamics*** – The Brayton cycle, combined Brayton-Rankine cycle, gas-refrigeration cycles.
14	Quiz 12	Assign. 5	***Thermodynamics*** – Psychrometrics, course review.

Lab Assignments & Evaluation

Assignments are due by 5:30 on the Friday of the weeks indicated in the above table. See http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.5.pdf for the Camosun grading policies. Instead of traditional term examinations, ENGR 290 will usually have weekly quizzes that will typically take about 15 minutes, based on the previous week's content. Theses quizzes are equally-weighted at 6% per quiz, and will be uploaded to D2L at a specified time, and completed by the student, with solutions emailed to the instructor.

Assignments	28%
12 Quizzes	72%

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