COURSE OUTLINE: MCH610 - APPLIED THERM & HEAT

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Approved: Corey Meunier, Dean, Technology, Trades, and Apprenticeship

Course Code: Title	MCH610: APPLIED THERMODYNAMICS AND HEAT TRANSFER
Program Number: Name	4043: MECH ENG. TECHNOLOGY
Department:	MECHANICAL TECHNIQUES PS
Academic Year:	2024-2025
Course Description:	In this course students build upon fundamentals from previous study in the application of thermodynamics and heat transfer. Concepts will include: phase-change processes, property diagrams (p-T, p-v and T-v diagrams), thermodynamic tables, work, heat and energy transfer, heat transfer mechanisms (conduction, convection, radiation), thermal resistance analogy, application of the 1st-Law of thermodynamics to (a) a process, (b) a cycle of a closed system, energy analysis of closed systems, applications of the 1st-law for steady-state-steady-flow processes and devices, and heat exchangers.
Total Credits:	2
Hours/Week:	2
Total Hours:	28
Prerequisites:	There are no pre-requisites for this course.
Corequisites:	There are no co-requisites for this course.
Vocational Learning Outcomes (VLO's) addressed in this course: **Please refer to program web page for a complete listing of program outcomes where applicable.**	**4043 - MECH ENG. TECHNOLOGY** VLO 6 Analyze and solve complex mechanical problems by applying mathematics and fundamentals of mechanical engineering. VLO 8 Design and analyze mechanical components, processes and systems by applying fundamentals of mechanical engineering.
Essential Employability Skills (EES) addressed in this course:	EES 1 Communicate clearly, concisely and correctly in the written, spoken, and visual form that fulfills the purpose and meets the needs of the audience. EES 2 Respond to written, spoken, or visual messages in a manner that ensures effective communication. EES 3 Execute mathematical operations accurately. EES 4 Apply a systematic approach to solve problems. EES 5 Use a variety of thinking skills to anticipate and solve problems. EES 6 Locate, select, organize, and document information using appropriate technology and information systems. EES 7 Analyze, evaluate, and apply relevant information from a variety of sources. EES 8 Show respect for the diverse opinions, values, belief systems, and contributions of others. EES 10 Manage the use of time and other resources to complete projects.

	EES 11 Take responsibility for ones own actions, decisions, and consequences.
Course Evaluation:	Passing Grade: 50%, A minimum program GPA of 2.0 or higher where program specific standards exist is required for graduation.
Other Course Evaluation & Assessment Requirements:	Grade Definition Grade Point Equivalent A+ 90 - 100% 4.00 A 80 - 89% B 70 - 79% 3.00 C 60 - 69% 2.00 D 50 - 59% 1.00 F (Fail) 49% and below 0.00 CR (Credit) Credit for diploma requirements has been awarded. S Satisfactory achievement in field /clinical placement or non-graded subject area. U Unsatisfactory achievement in field/clinical placement or non-graded subject area. X A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course. NR Grade not reported to Registrar`s office. W Student has withdrawn from the course without academic penalty.
Books and Required Resources:	Fundamentals of Thermal-Fluid Sciences by Yunus A. Cengel, John M. Cimbala, Afshin Ghajar Publisher: McGraw Hill Edition: 6th ISBN: 9781260716979

Course Outcomes and Learning Objectives:

Course Outcome 1	**Learning Objectives for Course Outcome 1**
1. Analyze systems using the First and Second Law of Thermodynamics.	1.1 Solve energy balance problems for solids and liquids. 1.2 Develop the conservation of mass and energy principles for steady flow processes. 1.3 Analyze the entropy change for thermodynamics processes. 1.4 Calculate the second-law efficiency of a system.
Course Outcome 2	**Learning Objectives for Course Outcome 2**
2. Perform efficiency calculations for heat engines including the Carnot cycle, Otto cycle, and Diesel cycle.	2.1 Explain the concept of a heat engine. 2.2 Draw the P-v diagram and list equipment related to each process. 2.3 Calculate cycle efficiency and the work ratio for the Carnot cycle. 2.4 Calculate maximum to minimum pressures in the Otto cycle. 2.5 Calculate cycle efficiency and mean effective pressure of diesel cycle.
Course Outcome 3	**Learning Objectives for Course Outcome 3**
3. Demonstrate an understanding of steam	3.1 Draw the Rankine cycle on a T-s diagram and a schematic of the equipment required in this cycle.

	cycles.	3.2 Explain each process of the Rankine cycle and list the equipment related to the process. 3.3 Use the formula for Rankine efficiencies in terms of enthalpies at various points in the cycle. 3.4 Calculate cycle efficiency, the work ratio, and specific steam consumption at various operating parameters. 3.5 Explain the reheat cycle. 3.6 Calculate new efficiencies with reheat cycle. 3.7 Draw the schematic of the equipment needed to run a regenerative cycle. 3.8 Draw the T-s diagram for Rankine cycle modified by regeneration. 3.9 Define and sketch back pressure turbines and pass-out pressure turbines
	Course Outcome 4	**Learning Objectives for Course Outcome 4**
	4. Calculate heat transfer in solids.	4.1 Define three methods by which heat transfer occurs. 4.2 Use Fourier`s law of conduction to compute steady-state heat transfer problems. 4.3 Use Newton`s law of cooling to compute heat transfer from a solid surface to a fluid. 4.4 Define thermal resistance in terms of the heat transfer coefficient. 4.5 Determine heat flow through a cylinder and a sphere.
	Course Outcome 5	**Learning Objectives for Course Outcome 5**
	5. Calculate heat transfer between a moving fluid and a solid surface.	5.1 Determine values for the heat transfer coefficient between a solid and a moving fluid. 5.2 Use empirical relations for pipe and tube flow. 5.3 Calculate free convection heat transfer on a vertical flat plate. 5.4 Calculate free convection heat transfer on a horizontal flat plate.

Evaluation Process and Grading System:

Evaluation Type	Evaluation Weight
Assignments	25%
Final Exam	25%
Test #1	25%
Test #2	25%

Date: November 12, 2024

Addendum: Please refer to the course outline addendum on the Learning Management System for further information.