MECH3300 Energy Conversion

Course Code: MECH3300	**Course Title:** Energy Conversion
Required Course Or Elective Course: elective	**Terms Offered (Credits):** Fall 2023-24 (3 credits)
Faculty In Charge: Qiye ZHENG	**Pre/Co-Requisites:** MECH2310
Course Structure: Lecture: 2 days per week, 1.5 hours; Tutorial: 1 day per week, 1 hour	
Textbook/Required Material: Thermodynamics-An Engineering Approach	

Bulletin Course Description:

(1) To deepen the students' understanding of the thermodynamic principles and concepts that govern the energy conversion processes in various engineering applications

(2) To enable the students to analyze and evaluate the practical power and refrigeration cycles used in different energy conversion systems

(3) To develop the students' skills and creativity in understanding and improving the energy conversion systems that meet the desired performance and efficiency criteria while minimizing the environmental impact

Course Topics:

1. Review of Thermodynamics
2. Exergy
3. Gas Power Cycles
4. Jet Propulsion Cycle
5. Thermodynamic property relations
6. Vapor and Combined Power Cycles
7. Refrigeration cycles
8. Heat pumps and advanced cooling techniques
9. Gas Mixtures
10. Gas–vapor mixtures and air-conditioning

Course Objectives: (correlated program objectives)	1. To deepen the students' understanding of the thermodynamic principles and concepts that govern the energy conversion processes in various engineering applications (P-O1, P-O3) 2. To enable the students to analyze and evaluate the practical power and refrigeration cycles used in different energy conversion systems (P-O3, P-O5) 3. To develop the students' skills and creativity in understanding and improving the energy conversion systems that meet the desired performance and efficiency criteria while minimizing the environmental impact (P-O1, P-O3, P-O5)
Course Outcomes: (correlated course objectives and program outcomes)	A. Explain and calculate the exergy or the maximum useful work that can be obtained from a given amount of energy at a specified state, and identify the sources of irreversibility and exergy destruction in energy conversion processes. (1) (POC1) B. Select and define the appropriate control volume for analyzing different energy systems, and determine the energy interactions across the control volume boundary in terms of heat, work, and mass flow. (1) (POC1, POC3) C. Apply and justify the assumptions and simplifications needed to formulate the thermodynamic models of classical power and

	refrigeration cycles. (2, 3) (POC3) D. Solve and interpret the thermodynamic performance of various energy conversion systems using the mass, energy, and entropy balances, and evaluate the effects of design parameters and operating conditions on the system efficiency and environmental impact. (2, 3) (POC1, POC3)
Assessment Tools: (correlated course outcomes)	Homework – 30% (10x3%), 0-100 Midterm examination – 30%, 0-100 Final examination – 40%, 0-100

BEng in Mechanical Engineering (4-year program)

Program Objectives:

P-O1. Be able to communicate and perform as an effective engineering professional in both individual and team-based project environments,

P-O2. Have an international outlook with clear perspectives on the Pearl river Delta and Greater China,

P-O3. Be able to research, design, develop, test, evaluate and implement engineering solutions to problems that are of complexity encountered in professional practice and leadership,

P-O4. Clearly Consider the ethical implications and societal impacts of engineering solutions,

P-O5. Continuously improve through lifelong learning.

Program Outcomes:

POC1. ability to identify and formulate problems in multidisciplinary environment with an understanding of engineering issues and constraints;

POC2. ability to design and conduct experiments as well as analyze and interpret data;

POC3. ability to apply knowledge of mathematics, science, and engineering for problem solving in mechanical engineering and related sectors or for further education in a research career;

POC4. ability to develop specification and to design system, component, or process to meet needs;

POC5. ability to understand the manufacturability, maintainability, and recyclability of engineering system and components;

POC6. ability to use modern engineering tools, techniques, and skills in engineering practice;

POC7. ability to communicate effectively;

POC8. ability to function in multi-disciplinary teams and provide leadership;

POC9. broadly educated with an understanding of the impact of engineering solutions on issues such as economics, business, politics, environment, health and safety, sustainability, and societal context;

POC10. clear understanding of professional and ethical responsibilities;

POC11. recognition of the need for life-long learning and continuing education;

POC12. international outlook with knowledge of contemporary issues.