MNE2112: THERMODYNAMICS

Effective Term
Semester A 2024/25

Part I Course Overview

Course Title
Thermodynamics

Subject Code
MNE - Mechanical Engineering
Course Number
2112

Academic Unit
Mechanical Engineering (MNE)

College/School
College of Engineering (EG)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
PHY1201 General Physics I or
(PHY1101 Introductory Classical Mechanics or PHY1202 General Physics II)

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
MBE2101/MNE2101 Thermo and Fluid Dynamics

Additional Information
#Prerequisites which are not part of the Major Requirement are waived for students admitted with Advanced Standing.

Part II Course Details

Abstract

This course aims to provide students a holistic introduction to thermodynamics, which includes the fundamentals of thermodynamics and its engineering applications. At the end of the course, the students will not only be able to understand the thermodynamics theory but also can apply the theory to solve the practical engineering problems.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe the basic principles of thermodynamics.		x	x	x
2	Select relevant principles to obtain solutions for some common thermodynamics problems.		x	x	x
3	Integrate the principles of thermodynamics to analyse some real life problems.		x	x	x
4	Demonstrate reflective practice in an engineering context.		x	x	x

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Take place in classroom setting which consists of lectures on different topics related to key concepts, principles, theories, and their applications on thermodynamics.	1, 2, 3	3 hrs/week
2	Laboratory Work	Teach the students the basic experiments related to thermodynamics.	1, 2, 3, 4	3 hrs/week for 2 weeks

Additional Information for LTAs

Note: To reach excellent (A+, A, A-) in Laboratory Work acquires the capacity to extend the knowledge learned from lectures to the Report’ s discussion.

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Quizzes/Homework/Test	1, 2, 3, 4	25	Quizzes in individual lecture (5%). Homework assignment after lectures (5%). One mid-term test on week 7 (15%).
2	Laboratory Report	1, 2, 3, 4	15	2 reports to be submitted.

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

2

Additional Information for ATs

For a student to pass the course, at least 30% of the maximum mark for both coursework and examination should be obtained.

Assessment Rubrics (AR)

Assessment Task

1. Quizzes/Homeworks/Test

Criterion

Capacity to understand the key concepts, principles and theories related to thermodynamics, and to analyse and solve related engineering problems. A: 75-100%, B: 60-74%; C: 45-59%; D: 40-44%; <40% F.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task

2. Laboratory Report

Criterion

Ability to explain the methodology and procedure and analyse the experimental data and discuss the experimental findings.

Excellent (A+, A, A-)

Strong evidence of critical thinking; good organization, capacity to analyse and synthesize; superior grasp of subject matter; evidence of extensive knowledge of the experimental
matters concerned.

Good (B+, B, B-)

Evidence of grasp of subject, some evidence of critical thinking, capacity and analytic
ability; reasonable understanding of issues; evidence of familiarity with experiments.

Fair (C+, C, C-)

Evidence of being profited from the laboratory class; understanding of the subject; ability to develop solutions to concerning the experiments

Marginal (D)

Basic familiarity with the laboratory equipment; ability to move onto other laboratory materials.

Failure (F)

Little evidence of familiarity with the laboratory class materials; weakness in critical and analytic skills; limited, or irrelevant use of data

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Assessment Task

3. Examination

Criterion

Describe the fundamental concepts of thermodynamics and apply them to solve the engineering thermodynamics problems.

Excellent (A+, A, A-)

Strong evidence of original thinking; good organization, capacity to analyse and synthesize; superior grasp of subject matter; evidence of extensive knowledge base.

Good (B+, B, B-)

Significant evidence of grasp of subject, some evidence of critical capacity and analytic ability; reasonable understanding of issues; evidence of familiarity with course matter.

Fair (C+, C, C-)

Evidence of being profited from the university experience; understanding of the thermodynamics; ability to develop solutions to simple problems in the course.

Marginal (D)

Basic familiarity with the subject matter to progress without repeating the course.

Failure (F)

Little evidence of familiarity with the subject matter; weakness in critical and analytic skills; very limited demonstration of correct use knowledge in thermodynamics.

Additional Information for AR

Note: For a student to pass the course, at least 30% of the maximum mark for both coursework and examination should be obtained.

Part III Other Information

Keyword Syllabus

- Basic Definitions and Units - The Thermodynamic System and The Control Volume, Surroundings, Concept of Universe, Macroscopic and Microscopic Analysis, Definition of Substance, Properties of Substance, Thermodynamic Equilibrium, Concept of Quasi—Equilibrium, Process and Cycle, Fundamental Units, etc.
- Heat and Work - Definition of Thermodynamic Work, Units for Work, Forms of Work, Definition of Heat, Inter Convertibility of Heat/work into Work/heat, Governing Principles, Sign Convention.
- First Law of Thermodynamics
- The Second Law of Thermodynamics
- The Carnot Cycle
- Entropy
- Exergy Analysis
- Analysis of Power Generation Cycles
- Analysis of Refrigeration Cycles

Reading List

Compulsory Readings

	Title
1	Moran M. J. & Shapiro H. N., Fundamentals of Engineering Thermodynamics, Wiley; 8 edition (April 18, 2014)

Additional Readings

	Title
1	Sonntag R.E., Borgnakke C. & Van Wylen C. J., Fundamentals of Thermodynamics, Wiley, 6 edition (August 26, 2002)