MNE2112: THERMODYNAMICS

Effective Term
Semester A 2022/23

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.

Teaching and Learning Activities (TLAs)

	TLAs	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

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Quizzes/ Mid-term Test	1, 2, 3, 4	15	
2	Mini-project	1, 2, 3, 4	10	Mini-project: Typical practical problem(s) related to the thermodynamics will be given to students to solve. The students are expected to work in teams to tackle the given problems. This learning activity will be mainly student-led but with some structural guidance from the teacher. At the end of the learning activity, a presentation session will be organised for all the students to present their solutions for the given problem.
3	Laboratory Report	1, 2, 3, 4	15	2-3 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/Mid-term Test

Criterion

Capacity to understand the key concepts, principles and theories related to thermodynamics, and to analyse and solve related engineering problems.

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. Mini-project

Criterion
Ability to apply the learned theories to conduct the research for a thermodynamics related topic.

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
3. Laboratory Report

Criterion
Capacity to conduct experiments, obtain and analyse the data, and have discussions and conclusions based on the concepts, principles and theories learned from the lectures, as evident from the reports.

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

4. Examination

Criterion

Capacity to understand the key concepts, principles and theories related to thermodynamics, and to analyse and solve related engineering problems @.

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

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

Additional Readings

	Title
1	Yunus A. Cengel and Michael A. Boles, Thermodynamics An Engineering Approach, The McGraw Hill Companies.
2	Moran M. J. & Shapiro H. N., Fundamentals of Engineering Thermodynamics, Wiley; 8 edition (April 18, 2014)