MNE3121: HEAT TRANSFER

Effective Term
Semester A 2023/24

Part I Course Overview

Course Title
Heat Transfer

Subject Code
MNE - Mechanical Engineering
Course Number
3121

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
MNE2112 Thermodynamics and MNE3122 Fluid Mechanics

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

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 introduces the fundamental concepts and methods of heat transfer. The main objectives of this course are: (a) to develop the fundamental principles of heat transfer with three modes as conduction, convection, radiation and to explore the implications of these principles; (b) to study, analyze and design heat transfer systems through the application of these fundamental principles; (c) to develop the problem-solving skills essential to good engineering practice of heat transfer in real-world applications.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Develop the fundamental principles of heat transfer.			x	
2	Apply the fundamental principles of heat transfer to thermal systems.			x	
3	Analyze and design heat transfer systems through the application of the fundamental principles.			x	
4	Develop the problem-solving skills essential to good engineering practice of heat transfer in real-world applications.			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	Classroom lectures on the topics of the keyword syllabus.	1, 2, 3, 4	3 hrs for 13 weeks
2	Laboratory	Lab experiment projects.	1, 2, 3, 4	3 hrs for 2 weeks

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Mid-term Examination	1, 2, 3	30	Duration: 2 hours
2	Lab Experiment Project and Reports/Assignment	3, 4	30	Students will perform lab experiments and write lab reports, and attempt assignment.

Continuous Assessment (%)

60

Examination (%)

40

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

Mid-term Examination

Criterion

Ability to describe and apply the fundamental principles of heat transfer. Ability to analyze and design heat transfer systems through the application of fundamental principles.

Excellent (A+, A, A-)

Strong evidence of original thinking; good organization, capacity to analyze 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-)

Student is profiting from the university experience; understanding of heat transfer; ability to develop solutions to simple problems in the course.

Marginal (D)

Basic familiarity with the subject matter to enable the student 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 heat transfer.

Assessment Task

Lab Experiment Project and Reports/Assignment

Criterion

Ability to analyze and design heat transfer systems through the application of the fundamental principles.

Excellent (A+, A, A-)

Strong evidence of critical thinking; good organization, capacity to analyze 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 capacity and analytic ability; reasonable understanding of issues; evidence of familiarity with experiment.

Fair (C+, C, C-)

Student who is profiting from the laboratory class; understanding of the subject; ability to develop solutions to concerning the experiment.

Marginal (D)

Sufficient familiarity with the laboratory content to enable the student to move on to 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.

Assessment Task

Examination

Criterion

Ability to describe and apply the fundamental principles of heat transfer. Ability to analyze and design heat transfer systems through the application of fundamental principles.

Excellent (A+, A, A-)

Strong evidence of original thinking; good organization, capacity to analyze 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-)

Student is profiting from the university experience; understanding of heat transfer; ability to develop solutions to simple problems in the course.

Marginal (D)

Basic familiarity with the subject matter to enable the student 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 heat transfer.

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

Fourier’ s law, Conduction processes, Thermal resistance, Fins, Elementary convection including laminar and turbulent boundary layers, Thermal radiation including Stefan-Boltzmann law, Basic concepts of heat exchangers.

Reading List

Compulsory Readings

	Title
1	Frank P. Incropera, David P. DeWitt, Theodore L. Bergman, Adrienne S. Lavine, Incropera’ s Principles of Heat and Mass Transfer, 8th Edition, Global Edition, Wiley, 2017. ISBN: 978-1-119-38291-1.
2	Please note that old versions (or used books) of Incropera’ s textbooks are still fine. For example, · Theodore L. Bergman, Adrienne S. Lavine, Frank P. Incropera, David P. DeWitt. Introduction to Heat Transfer. Wiley, 2011. ISBN-13: 978-0470501962. · Frank P. Incropera, David P. DeWitt, Theodore L. Bergman, Adrienne S. Lavine, Fundamentals of Heat and Mass Transfer. Wiley, 2007. ISBN-13: 978-0471457282.

Additional Readings

	Title
1	John H., Lienhard. A Heat Transfer Textbook. Dover Publications, 2011. ISBN: 9780486479316.