MNE8111: ADVANCED THERMAL FLUIDS

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Advanced Thermal Fluids

Subject Code
MNE - Mechanical Engineering
Course Number
8111

Academic Unit
Mechanical Engineering (MNE)

College/School
College of Engineering (EG)

Course Duration
One Semester

Credit Units
3

Level
R8 - Research Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
MNE6113 Advanced Thermo-fluid

Exclusive Courses
Nil

Part II Course Details

Abstract
Fluid flow and heat transfer are ubiquitous in nature and penetrated into almost every engineering process. Advances in nanotechnology, materials, instrumentation, visualization, and biomimetics have led to an exciting revival in the classical

area of thermo-fluid. The course offers a cohesive and holistic introduction to important fundamentals and the latest progress in the general area of thermo-fluid, providing an essential foundation for discovery and innovation.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe and explain the basic principles and theories of fluid mechanics and heat transfer.	40	x	x	x
2	Familiarize the multiphase flow analysis.	10	x	x	x
3	Understand multiphase transport phenomena.	30	x	x	x
4	Demonstrate the critical thinking in the design of novel thermo-fluid systems.	20	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 a classroom setting, which consists of lectures on different topics.	1, 2, 3, 4	2 hrs/week for 13 weeks
2	Tutorial	Take place in a classroom setting, which consists of tutorials and student activities on different topics.	1, 2, 3, 4	1 hr/week for 13 weeks
3	Mid-term quiz	Take place in a classroom to assess the learning outcome.	1, 2, 3	

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Test/Assignment	1, 2, 3, 4	10	-	Yes
2	Mid-term quiz	1, 2, 3	30	-	No

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

2

Minimum Continuous Assessment Passing Requirement (%)

30

Minimum Examination Passing Requirement (%)

30

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

Test/Assignment (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Ability to understand basic concepts related to the instrumentation and testing technologies.

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

Mid-term quiz (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

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Examination (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

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Marginal
(D) Basic

Failure
(F) Not even reaching marginal levels

Assessment Task
Test/Assignment (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Ability to understand basic concepts related to the instrumentation and testing technologies.

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Moderate

Failure
(F) Not even reaching marginal levels

Assessment Task
Mid-term quiz (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Ability to understand basic concepts related to the instrumentation and testing technologies.

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Part III Other Information

Keyword Syllabus
- Single-phase fluid mechanics
- Single-phase heat transfer
- Two-phase flow dynamics
- Two-phase heat transfer

Reading List

Compulsory Readings

	Title
1	Fox, R. W., McDonald, A. T., Pritchard, P. J., Introduction to Fluid Mechanics, 6th Edition. John Wiley and Sons, 2006. ISBN: 0471735582.
2	Theodore L. Bergman, Adrienne S. Lavine, Frank P. Incropera, David P. DeWitt., Fundamentals of Heat and Mass Transfer, 7th edition. John Wiley and Sons, 2011. ISBN: 978-0-470-50197-9.
3	Yadigaroglu, G., Hewitt, G. F., Introduction to Multiphase Flow. Springer, 2018. ISBN 9783319587172.

Additional Readings

	Title
1	Ishii, M., Hibiki, T., Thermo-Fluid Dynamics of Two-Phase Flow, 2nd Edition. Springer, 2010. ISBN 9781441979858.
2	Todreas N. E., and Kazimi M. S. Nuclear Systems I: Thermal Hydraulic Fundamentals. Taylor & Francis Group, LLC, Second Edition. 2011. ISBN: 9781439808870.
3	Collier, J. G., and J. R. Thome. Convective Boiling and Condensation. 3rd ed. Oxford University Press, 1996. ISBN: 9780198562962.
4	Shah, M. M., Two-phase Heat Transfer. 2021, Wiley, ISBN 9781119618676.