MNE6113: ADVANCED THERMO-FLUID

Effective Term
Semester B 2024/25

Part I Course Overview

Course Title
Advanced Thermo-fluid

Subject Code
MNE - Mechanical Engineering
Course Number
6113

Academic Unit
Mechanical Engineering (MNE)

College/School
College of Engineering (EG)

Course Duration
One Semester

Credit Units
3

Level
P5, P6 - Postgraduate Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
MNE8111 Advanced Thermal Fluids

Exclusive Courses
Nil

Part II Course Details

Abstract
Fluid flow and heat transfer are widely occurred in the engineering processes, which can be in the multiscale forms, i.e. nano/micro or macro. As the technologies rapidly evolving, the advanced fluids such as nanofluids and supercritical fluids

are more and more widely applied in the different engineering areas. The course aims to polish the knowledge of multiscale fluid flow and heat transfer to the graduate students majoring in mechanical engineering, and encourage them to apply the principles and theories into the research and practices. The topics cover the fluid mechanics and heat transfer for different fluids types, which include: single-phase fluid, two-phase flow, supercritical fluid, and nanofluids.

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 for multiscale thermofluid.		x	x	
2	Identify multiscale thermofluid related mechanical engineering problems.			x	
3	Model and analyze multiscale thermofluid related mechanical engineering problems with theories.			x	x
4	Conduct literature survey to a multiscale thermofluid related applied problem, analysis the problem with critical thinking and demonstrate the idea with a mini-project.			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 consist of lectures on different topics of multiscale thermofluids	1, 2, 3, 4	2 hrs/week for 13 weeks
2	Tutorial	Take place in classroom setting which consist of tutorials and student activities on different topics of multiscale thermofluids	1, 2, 3, 4	1 hr/week for 13 weeks

3	Mini-project	Students are asked to conduct research on a topic related to multiscale thermofluid to practice the theories learned in the class and by themselves	1, 2, 3, 4	2 hr/week for 6 weeks

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Test/Assignments	1, 2, 3	20	
2	Mini-project	4	20	

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

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

Criterion

Ability to understand basic concepts related with 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

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

Criterion
Ability to understand basic concepts related with 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
Examination (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

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

Excellent
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Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching marginal levels

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

Criterion
Ability to understand basic concepts related with 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
Mini-project (for students admitted from Semester A 2022/23 to Summer Term 2024)

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

Excellent
(A+, A, A-) High

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

Criterion
Ability to understand basic concepts related with 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
- Supercritical fluid flow and heat transfer
- Nanofluids flow and heat transfer

Reading List

Compulsory Readings

	Title
1	Theodore L. Bergman, Adrienne S. Lavine, Frank P. Incropera David P. DeWitt. Fundamentals of Heat and Mass Transfer. 7th edition. New York, NY: John Wiley and Sons, 2011. ISBN: 978-0-470-50197-9.
2	Collier, J. G., and J. R. Thome. Convective Boiling and Condensation. 3rd ed. New York, NY: Oxford University Press, 1996. ISBN: 9780198562962.
3	Todreas N. E., and Kazimi M. S. Nuclear Systems I: Thermal Hydraulic Fundamentals. Taylor & Francis Group, LLC, Second Edition, 2011.
4	Bernard Zappoli, Daniel Beysens, and Yves Garrabos. Heat Transfers and Related Effects in Supercritical Fluids. Springer, 2015. ISBN: 9789401791878 (ebook).
5	Sarit K. Das, Stephen U. S. Choi, Wenhua Yu, T. Pradeep. Nanofluids: Science and Technology. John Wiley & Sons, Inc., 2008. Online ISBN: 9780470180693.

Additional Readings

	Title
1	Nil