City University of Hong Kong
Course Syllabus

offered by
Department of Mechanical Engineering
with effect from Semester A 2022 / 23

Part I Course Overview

Course Title:	Advanced Thermo-fluid
Course Code:	MNE6113
Course Duration:	1 semester
Credit Units:	3 credits
Level:	P6
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites: *(Course Code and Title)*	Nil
Precursors: *(Course Code and Title)*	Nil
Equivalent Courses: *(Course Code and Title)*	MBE6113 Advanced Thermo-fluid **OR** MNE8111 Advanced Thermal Fluids
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. 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.

2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs	Weighting (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	Describe and explain the basic principles and theories of fluid mechanics and heat transfer for multiscale thermofluid.		✓	✓	
2.	Identify multiscale thermofluid related mechanical engineering problems.			✓	
3.	Model and analyze multiscale thermofluid related mechanical engineering problems with theories.			✓	✓
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.			✓	✓
		N.A.			

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 self-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.

3. Teaching and Learning Activities (TLAs)

(TLAs designed to facilitate students' achievement of the CILOs.)

TLA	Brief Description	CILO No.				Hours/week (if applicable)
		1	2	3	4	
Lecture	Take place in classroom setting which consist of lectures on different topics of multiscale thermofluids	✓	✓	✓	✓	2 hrs/week for 13 weeks
Tutorial	Take place in classroom setting which consist of tutorials and student activities on different topics of multiscale thermofluids	✓	✓	✓	✓	1 hr/week for 13 weeks
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	✓	✓	✓	✓	2 hr/week for 6 weeks

4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.				Weighting	Remarks
	1	2	3	4		
Continuous Assessment: 40%						
Test/Assignments	✓	✓	✓		20%	
Mini-project				✓	20%	
Examination: 60% (duration: 2 hours)						
Examination	✓	✓	✓	✓	60%	
					100%	

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

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Applicable to students admitted in Semester A 2022/23 and thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B)	Marginal (B-, C+, C)	Failure (F)
1.Test/Assignments	Ability to understand basic concepts related with the instrumentation and testing technologies	High	Significant	Moderate	Not even reaching marginal levels
2.Mini-project	Ability to understand basic concepts related with the instrumentation and testing technologies.	High	Significant	Moderate	Not even reaching marginal levels
3. Examination	Ability to understand basic concepts related with the instrumentation and testing technologies.	High	Significant	Moderate	Not even reaching marginal levels

Applicable to students admitted before Semester A 2022/23

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1.Test/Assignments	Ability to understand basic concepts related with the instrumentation and testing technologies	High	Significant	Moderate	Basic	Not even reaching marginal levels
2.Mini-project	Ability to understand basic concepts related with the instrumentation and testing technologies.	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Examination	Ability to understand basic concepts related with the instrumentation and testing technologies.	High	Significant	Moderate	Basic	Not even reaching marginal levels

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus

(An indication of the key topics of the course.)

- 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

2. Reading List

2.1 Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

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.

2.2 Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)

N.A.