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 Thermal Fluids
Course Code:	MNE8111
Course Duration:	1 semester
Credit Units:	3 credits
Level:	R8
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 /MNE6113 Advanced Thermo -fluid
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. Abstract

Fluid flow and heat transfer are ubiquitous in nature and penetrated into almost every engineering process. The advances in nanotechnology, materials, instrumentation and visualization, as well as biomimetics lead to an exciting revival in the classical area of thermal-fluid. The course offers a cohesive and holistic introduction of important fundamentals and the latest progress in the general area of thermal-fluid, providing important foundation for discovery and innovation.

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	40%	✓	✓	✓
2.	**Familiarize** the scaling analysis	10%	✓	✓	✓
3.	**Understand** multiscale transport phenomena	30%	✓	✓	✓
4	**Demonstrate** the critical thinking in the design of novel thermal-fluid systems	20%	✓	✓	
** If weighting is assigned to CILOs, they should add up to 100%.*		100%			

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 consists of lectures on different topics.	✓	✓	✓	✓	2 hrs/week for 13 weeks
Tutorial	Take place in classroom setting which consists of tutorials and student activities on different topics.	✓	✓	✓	✓	1 hr/week for 13 weeks
Mid-term quiz	Take place in classroom to assess the learning outcome.	✓	✓	✓		

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/Assignment	✓	✓	✓	✓	10%	
Mid-term quiz	✓	✓	✓		30%	
Examination: 60% (duration: 2 hours)						
Examination	✓	✓	✓	✓	60%	
** The weightings should add up to 100%.*					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/Assignment	Ability to understand basic concepts related with the instrumentation and testing technologies.	High	Significant	Moderate	Not even reaching marginal levels
2. Mid-term quiz	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/Assignment	Ability to understand basic concepts related with the instrumentation and testing technologies.	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Mid-term quiz	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.)

- Fluid mechanics
- State of matter, phase diagram
- Viscosity, surface tension
- Boundary layer, transport equation, lubrication approximation
- Laminar flow, turbulent flow
- Conduction, convection, and radiation
- Phase change
- Scaling law
- Capillarity
- Wetting dynamics
- Interfacial hydrodynamics
- Thermal-fluid in biological systems

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.	Pierre-Gilles De Gennes., Francoise Brochard-Wyart, David Quere. Capillaity and wetting dynamcis, Springer, 2004. ISBN 0-387-00592-7.
3.	Collier, J. G., and J. R. Thome. Convective Boiling and Condensation. 3rd ed. New York, NY: Oxford University Press, 1996. ISBN: 9780198562962.

2.2 Additional Readings

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

Nil