City University of Hong Kong
Course Syllabus

offered by
Department of Mechanical Engineering
with effect from Semester A 2024 / 25

Part I Course Overview

Course Title:	Thermodynamics and Kinetics
Course Code:	MNE8109
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)*	Nil
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. Abstract

This course aims to cover the fundamental and advanced topics related to thermodynamics and kinetics of materials for our research postgraduate students, from the statistics mechanics, the thermodynamics laws (first and second laws), phase transition, surfaces and interface, instability to defects in materials.

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.	Understand the principles and fundamentals of thermodynamics and kinetics.			√	
2.	Able to study the literatures related to thermodynamics and kinetics of materials.		√	√	
3.	Formulate an engineering problem with the principles of thermodynamics and kinetics.			√	
4.	Apply the principles of thermodynamics and kinetics to solve an engineering problem.			√	√
		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 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.

3. Learning and Teaching Activities (LTAs)

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

LTA	Brief Description	CILO No.				Hours/week (if applicable)
		1	2	3	4	
Lectures	This includes typical lectures on different topics of thermodynamics and kinetics.	√	√	√	√	39 hours

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%						
In-class quiz and tests		√	√	√	20%	At least one mid-term or in-class quiz to be arranged
Homework	√	√	√	√	20%	3-4 assignments to be submitted
Examination: 60% (duration: 3 hours)						
Examination	√		√	√	60%	Final Exam
					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 before Semester A 2022/23 and in Semester A 2024/25 & thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. In-class quiz and tests	Understand the principles and fundamentals of thermodynamics and kinetics, formulate the engineering problems with the above mentioned principles.	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Homework	Able to study the literatures related to thermodynamics and kinetics of materials, Understand the principles and fundamentals of thermodynamics and kinetics, formulate and solve the engineering problems with the above mentioned principles.	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Examination	formulate and solve the engineering problems with the given principles of thermodynamics and kinetics.	High	Significant	Moderate	Basic	Not even reaching marginal levels

Applicable to students admitted from Semester A 2022/23 to Summer Term 2024

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B)	Marginal (B-, C+, C)	Failure (F)
1. In-class quiz and tests	Understand the principles and fundamentals of thermodynamics and kinetics, formulate the engineering problems with the above mentioned principles.	High	Significant	Moderate	Not even reaching marginal levels
2. Homework	Able to study the literatures related to thermodynamics and kinetics of materials, Understand the principles and fundamentals of thermodynamics and kinetics, formulate and solve the engineering problems with the above mentioned principles.	High	Significant	Moderate	Not even reaching marginal levels
3. Examination	formulate and solve the engineering problems with the given principles of thermodynamics and kinetics.	High	Significant	Moderate	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.)

The zeroth, first, second and third laws of thermodynamics; internal energy; entropy; enthalpy; free energy
Statistic mechanics; probability; temperature; partition function; diffusion
Transition state theory;
Phase transition; phase diagrams; phase stability; crystal and glass; solid solution and metallic compounds
Defects; vacancy; dislocation; surface and interface; fracture

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.)

N.A.

2.2 Additional Readings

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

1.	Gerald H. Meier, Thermodynamics of surfaces and interfaces: Concepts in inorganic materials; Cambridge University Press.
2.	R.K. Pathria and Paul D. Beale, Statistical mechanics; the 3rd Edition; Elsevier.
3.	Svein Stolen, Tor Grande and Neil L Allan, Chemical Thermodynamics of Materials: Macroscopic and Microscopic Aspects, John Wiley & Sons, Ltd.
4.	U.F. Kocks, A.S. Argon and M.F. Ashby, Thermodynamics and kinetics of slip, Pergamon Press Ltd.
5.	Y. Austin Chang, W. Alan Oates, Materials Thermodynamics, Johns Wiley & Sons, Inc.
6.	Taiji Nishizawa, Thermodynamics of microstructures, 2008 ASM International®