City University of Hong Kong
Course Syllabus

offered by
Department of Mechanical Engineering
with effect from Semester A 2019 / 2020

Part I Course Overview

Course Title:	Engineering Materials and Processing
Course Code:	MNE2034
Course Duration:	1 semester
Credit Units:	3 credits
Level:	B2
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites : *(Course Code and Title)*	Nil
Precursors: *(Course Code and Title)*	High School Physics or Science & Technology is desirable
Equivalent Courses: *(Course Code and Title)*	MBE2034 Engineering Materials and Processing
Exclusive Courses: *(Course Code and Title)*	MBE2106/MNE2106 Basic Engineering Materials and Processing or MBE2110/MNE2110 Engineering Materials

Part II Course Details

1. Abstract

(A 150-word description about the course)

The aims of this course are to equip students:

- with knowledge of the properties and structures of engineering metals and alloys used in engineering applications; and
- with ability to identify the common range of processes and operations for conversion and shaping of materials into discrete components.

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** the basic structure and behaviour for engineering materials.			✓	
2.	**Apply** basic knowledge of materials to the selection of engineering materials for mechanical products.			✓	✓
3.	**Outline** the features and operational principles of manufacturing processes for making mechanical products, and some of the mechanisms that cause defects during processing.			✓	
4.	**Select** manufacturing processes for producing a designed mechanical product.		✓		✓
** If weighting is assigned to CILOs, they should add up to 100%.*		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	Explain fundamental concepts involved with: (i) material structures, their influence on material properties and behaviours, how they can be processed and applied as engineering materials; and (ii) the components and operational features of different manufacturing processes, the cause of defects due to incorrect setting and processing, and incorrect designs of components; (iii) etc.	✓	✓	✓	✓	2.5 hrs/week
Small Group and Individual Activities	Home works and group discussions on some critical issues associated with material structures, behaviours, processing and design.	✓	✓	✓	✓	0.5 hr/week
Laboratory Work	Visualizing and familiarizing some processes available in laboratories, and understanding safety and quality issues associated with different processes, encouraging self-learning and self-information searching in writing laboratory reports.	✓		✓	✓	3 hrs/week for 2 weeks
Consultation	Students meet course teaching staff on individual or small group basis in staff's office for clearing doubts associated with lectures, home works, tutorials, and laboratory works.					1 hr/week[@]

Note: @1 hour per week will be scheduled as "consultation hour" for clearing doubts of students who can meet the teaching staff on an individual or small group basis in his/her office. When the class size exceeds 50 students, an additional consultation hour will be provided and the students will be divided into two groups.

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%						
Tests	✓	✓	✓	✓	20%	2 tests
Laboratory Reports	✓		✓	✓	20%	2 reports to be submitted
Examination: 60% (duration: 2.5 hours)						
** 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.)

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Tests	1.1 Capability to describe basic structure and behaviour of engineering materials, and to select the materials for mechanical products. 1.2 Capability to outline features and operational principles of manufacturing processes, and to select processes for producing a designed mechanical product.	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Laboratory Reports	2.1 Evidence of understanding the manufacturing processes demonstrated in lab., their safety and processing issues. 2.2 Evidence of self-learning and self-information searching. 2.3 Ability to appreciate the features and working principles of various manufacturing processes.	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Examination	3.1 Ability to describe basic structure and behaviour of engineering materials. 3.2 Ability to apply knowledge of materials to the selection of engineering materials for mechanical products. 3.3 Ability to outline the features and operational principles of manufacturing processes for making mechanical products, and some of the mechanisms that cause defects during processing. 3.4 Ability to select manufacturing processes for producing a designed mechanical product.	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.)

1) Introduction to Engineering Materials

- Structure and Properties of Metals: Crystal structure of metals, deformation, imperfections, strain hardening, grains and grain boundaries, anisotropy, recovery, recrystallization and grain growth, cold, warm and hot working.
- Mechanical Behaviour: Stress-strain curves, ductility, failure, ductile and brittle fracture.
- Metal Alloys: Physical properties, phase diagrams, heat-treatment techniques, common metals and alloys for engineering applications.

2) Introduction to Manufacturing Processes

- Metal Casting Processes: Solidification, cast structures, defects, common casting processes.
- Bulk Forming: Flat and shape rolling, forging, extrusion, drawing processes.
- Sheet Metal Forming: Blanking and shearing, bending, deep drawing processes.
- Processing of metal powders and ceramics.
- Plastics Processing: Types of engineering plastics, extrusion, injection molding, blow molding, thermoforming, vacuum forming, compression molding, composite making.
- Material Removal: Machining processes for different shapes, turning, milling, drilling, grinding, unconventional processes such as electro-discharge machining and laser cutting.

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.	"Manufacturing Processes for Engineering Materials", Serope Kalpakjian, Addison Wesley Publishing Co., 3rd Edition, 1997, ISBN 0-20182370-5 (TS183.K34 1997). (Chapters 3, 5, 6 & 7).
2.	"Materials Science and Engineering: An Introduction", William D. Callister, Jr., 6th or 7th Edition, 2007 (or 8th edition 2010), John Wiley & Sons, Inc.

2.2 Additional Readings

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

1.	"Introduction to Manufacturing Processes", John A. Schey, McGraw-Hill International Edition, ISBN 0-07-055279-1 (TS183.S33). (Chapters 2, 3, 4 & 5).
2.	"Introduction to Materials Science for Engineers", James F. Shackelford, 5th – 7th Edition, Prentice Hall.