

**City University of Hong Kong
Course Syllabus**

**offered by
Department of Biomedical Engineering /
Department of Mechanical Engineering
with effect from Semester A 2018 / 19**

Part I Course Overview

Course Title:	Material Analysis for Product Quality
Course Code:	MBE3063
Course Duration:	1 semester
Credit Units:	3 credits
Level:	B3
Medium of Instruction:	English
Medium of Assessment:	English
Prerequisites#: <i>(Course Code and Title)</i>	MBE2034 Engineering Materials and Processing or MBE2110 Engineering Materials or MBE2040 Basic Mechanical Engineering Principles or MBE2003 Mechanics or MBE2109 Engineering Mechanics
Precursors: <i>(Course Code and Title)</i>	Nil
Equivalent Courses: <i>(Course Code and Title)</i>	Nil
Exclusive Courses: <i>(Course Code and Title)</i>	Nil

#Prerequisites which are not part of the Major Requirement are waived for students admitted with Advanced Standing.

Part II Course Details

1. Abstract

(A 150-word description about the course)

This course aims to provide the basic concepts and principles in qualitative and quantitative analysis of physical, mechanical, and thermal properties of products made of metals, alloys, composites, glass or plastics. The students will receive training and guidance on some fundamental methods to test the reliability and safety of raw materials, components and products, and therefore they should be able to identify and specify appropriate analytic techniques required in given quality engineering problems, particularly in the manufacturing process, quality control, and product testing, and apply them to solve the problems.

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.	Recognize the importance of material analysis techniques for manufacturing process control, product reliability and quality assurance.			√	
2.	Identify the fundamental principles and techniques of material analysis of physical, mechanical, and thermal properties.			√	
3.	Design the appropriate testing and analysis process to test component/product performance in reliability, health, safety and environment aspects, with respect to manufacturing process requirements and product standards and regulations.			√	√
4.	Interpret the experimental results obtained through testing to evaluate the product risks and to solve quality engineering problems.			√	
		N.A.			

* If weighting is assigned to CILOs, they should add up to 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	This includes typical lectures on different topics of analysis techniques and applications accompanied by in-class activities. Office hours will be set aside during the semester to allow students/professor one-on-one consultation.	✓	✓	✓		2 hrs/week
Laboratory Work	Students are asked to work on laboratory exercises on different topics of testing techniques and applications. They have to do laboratory experiments on the measurement of raw materials, components and products with different instruments and techniques, and then summarize and discuss their testing results for the purpose of product assurance and compliance to meet the requirements of health, safety and environmental regulations. The main goal in this course is to encourage independent thinking and analytical reasoning to augment their problem solving skills, and consequently to install in students a mentality in the unity of theory and practice.		✓	✓	✓	3hrs/week for 5 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%						
Tests		✓	✓		20%	2 tests
Laboratory Work Reporting Assignments		✓	✓	✓	20%	Minimum of 3 reports to be developed
Examination: 60% (duration: 2 hours)						
					100%	

* The weightings should add up to 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	Ability to describe fundamental concepts and techniques of material analysis about product quality.	High	Significant	Moderate	Basic	Not even reaching marginal levels
2.Laboratory Work Reporting Assignments	Ability to explain the methodology and procedure and to analyse the lab data, as evidenced through the submitted reports.	High	Significant	Moderate	Basic	Not even reaching marginal levels
3.Examination	Ability to explain the fundamental concepts and techniques of material analysis about product quality.	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.)

- Product quality testing for reliability, health, safety and environment
- Material composition and structural analysis
Scanning electron microscopy (SEM), Atomic force microscopy (AFM), Transmission electron microscopy (TEM), Energy dispersive X-ray (EDX), Ultraviolet-visible (UV/Vis) spectroscopy, Mass spectrometry
- Mechanical testing
Mechanical properties, Tensile testing, Compression testing, Impact testing, Bend testing, Torsion testing, Hardness testing, Microhardness testing, Nanoindentation, Hydrostatic testing, Peel testing, Spark testing
- Thermal analysis
Thermal properties, Introduction to thermal analysis, Thermogravimetric analysis (TGA), Differential thermal analysis (DTA), Differential scanning calorimetry (DSC)

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.	Serope Kalpakjian, Steven R. Schmid, "Manufacturing processes for engineering materials", 5th ed, Prentice Hall/Pearson Education Int'l. (TS183.K34 2008).
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2.2 Additional Readings

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

1.	Douglas E. Adams, "Health monitoring of structural materials and components: methods with applications", John Wiley & Sons. (TA645 .A253 2007).
2.	Norman E. Dowling, "Mechanical behavior of materials: engineering methods for deformation, fracture, and fatigue", Prentice Hall. (TA404.8 .D68), latest edition.
3.	Michael E. Brown (ed.), "Introduction to thermal analysis: techniques and applications", 2nd ed, Kluwer Academic Publishers. (QD79.T38 B76 2001).
4.	Francis Rouessac and Annick Rouessac, "Chemical analysis: modern instrumentation methods and techniques", 2nd ed, Wiley. (QD79.I5 R6813 2007).
5.	J.P. Eberhart, "Structural and chemical analysis of materials: X-ray, electron and neutron diffraction; X-ray, electron and ion spectrometry; electron microscopy", Wiley. (TA417.23 .E2413), latest edition.

Online Resources

Online learning material is provided via University computer network.