Form 2B

City University of Hong Kong

Information on a Course
offered by Department of Mechanical and Biomedical Engineering
with effect from Semester B 2012/2013

Part I

Course Title: **Special Topics on Advanced Structural Materials**

Course Code: **MBE6102**

Course Duration: **One Semester**

Credit Units: **3**

Level: **P6**

Medium of Instruction: **English**

Prerequisites: **Background knowledge in related disciplines is required and course registration will be subject to the approval of the Course Examiner**

Precursors: **Nil**

Equivalent Courses: **MBE8101**

Exclusive Courses: **Nil**

Note: Students may repeat a course, or an equivalent course, to improve course grade only if the previous course grade obtained is C or below.

Part II

1. Course Aims

This course will be focused on the understanding scientific and metallurgical principles used for material processing and fabrication, microstructural control, composition adjustment, mechanical and metallurgical property evaluation, and development of structure-property correlation for advanced structural materials (with emphasis on metallic materials). The goal of this course is to achieve that senior and graduate students are able to select and design structural materials with superior properties as strength members used in advanced engineering systems. The materials topics intended to cover in this course will include phase diagram and microstructural control, hardening of structural materials, conventional and nanostructured steels with high strength, bulk metallic glasses (BMGs): Glass forming ability, atomic structures and mechanical properties, high-temperature superalloys, structural-gradient metallic materials, high-temperature refractory metals and alloys, and light-weight Ti-based alloys (including two-phase TiAl intermetallic alloys).

2. Course Intended Learning Outcomes (CILOs)

Upon successful completion of this course, students should be able to:

No.	CILOs	Weighting* (if applicable)
1.	Describe scientific and metallurgical principles used for alloy design and microstructural control	3
2.	Describe and apply advanced ferritic steels and nanostructured materials for structural applications	2
3.	Learn and apply light-weight and structural-gradient materials for structural applications	2
4.	Learn and apply bulk metallic glasses (BMGs) for structural applications	2
5.	Learn and apply high-temperature refractory alloys for structural applications	1
6.	Learn and apply Ni-based superalloys for structural applications	2

*Weighting ranging from 1,2,3 to indicate the relative level of importance in an ascending order.

3. Teaching and Learning Activities (TLAs)

(Indicative of likely activities and tasks designed to facilitate students' achievement of the CILOs. Final details will be provided to students in their first week of attendance in this course)

Activity Type:	Timetabled Activity (Hours per week)
Lecture	Lecture (3)

CILO No.	Large Class Activities (Lecture)	Total Hours
CILO 1	6	6
CILO 2	6	6
CILO 3	7	7
CILO 4	8	8
CILO 5	6	6
CILO 6	6	6
Total	**39**	**39**

4. Assessment Tasks/Activities

(Indicative of likely activities and tasks designed to assess how well the students achieve the CILOs. Final details will be provided to students in their first week of attendance in this course)

	Coursework		
CILO No.	**Quiz**	**Assessment of Term Report**	**Total (%)**
CILO 1	10	-	10
CILO 2	10	-	10
CILO 3	10	-	10
CILO 4	10	-	10
CILO 5	10	-	10
CILO 6	10	-	10
CILO 1-6	-	40	40
Total (%)	**60**	**40**	**100**

5. Grading of Student Achievement:

Grade Table

Letter Grade	Grade Point	Grade Definitions
A+	4.3	Excellent
A	4.0	
A-	3.7	
B+	3.3	Good
B	3.0	
B-	2.7	
C+	2.3	Adequate
C	2.0	
C-	1.7	
D	1.0	Marginal
F	0.0	Failure
P	-	Pass

Please refer to the SGS's website for details.

Part III

Keyword Syllabus:

Phase diagram and microstructural control, hardening of structural materials, conventional and nanostructured steels with high strength, bulk metallic glasses (BMGs): Glass forming ability, atomic structures and mechanical properties, high-temperature superalloys, structural-gradient metallic materials, high-temperature refractory metals and alloys, and light-weight Ti-based alloys (including two-phase TiAl intermetallic alloys).

Recommended Reading:

- Atomic structures of bulk metallic alloys (BMGs): Atomic-level structure and structure-property relationship in metallic glasses by Y.Q. Cheng and E. Ma, Progress in Materials Science (2010)
- Recent papers on bulk metallic Glasses by XJ Liu and CT Liu
- Bulk Metallic glasses by C. Suryanarayana and A. Inoue, CRC Publication, 2010
- Superplasticity in Metals and Ceramics by TG Nieh et al., Cambridge University Press, 1991
- Intermetallic compounds as new structural materials by M. Yamaguchi, Elsevier Publication, 1996
- Recent papers on nanostructured ferritic and austenitic steels by CT Liu, MW Chen, MK Miller, ME Fine.

- Recent papers on structural-gradient metallic materials and SMAT materials by Jian Lu
- The superalloys: fundamentals and applications by Rogers C. Reed, Cambridge University Press, 2006