City University of Hong Kong

Information on a Course
offered by Department of Mechanical and Biomedical Engineering
with effect from Semester A 2013 / 2014

Part I

Course Title: **Manufacturing of Biomedical Devices**

Course Code: **MBE8103**

Course Duration: **One Semester**

No. of Credit Units: **3**

Level: **R8**

Medium of Instruction: **English**

Prerequisites: **Nil**

Precursors: **Nil**

Equivalent Courses: **MBE6101 Manufacturing of Biomedical Devices**

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:

Biomedical manufacturing is currently a rapidly growing industry, brought by the globalization and the technology advancement. It can be viewed as the application of manufacturing technology to biomedical products, with the significant improvements in quality, safety and efficiency. However, the development process is often multidisciplinary and time-consuming.

This course aims to provide the essential knowledge in the biomedical product development (e.g. material properties, fabrication processes and design techniques for different applications) in order to provide ways to speed up the product development cycle. This course is multidisciplinary and covers the principles in mechanical, chemical, biological, and physiological aspects. Students can learn the techniques to apply the acquired knowledge for particular applications they are interested. Further, this course emphasizes also on inspiring

students to discover and convert newly reported technologies into products/services for the future development of biomedical applications.

2. Course Intended Learning Outcomes (CILOs)

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

No.	CILOs	Weighting* (if applicable)
1	**Describe** the mechanical and biochemical properties of bio-related materials, as well as their major applications as medical devices or other bio-products.	2
2	**Explain** the principles of the fabrication/manufacturing techniques for existing biomedical devices; and identify the manufacturing processes for the biomedical applications.	2
3	**Compare** the pros and cons of different bio-materials and their corresponding manufacturing processes.	1
4	**Select** the appropriate bio-related materials and manufacturing processes for specific applications; and **apply** basic design principles to specific bio-related products.	1
5	**Discover** and **elaborate** newly developed technologies related to biomedical manufacturing; and **propose** a selected technology on how it can be converted to the corresponding biomedical product/service.	2

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

3. Teaching and learning Activities (TLAs)

(designed to facilitate students' achievement of the CILOs)

Activity Type	Timetabled Activity (Hours per week)
Lecture/Tutorial Mix	Lecture (3)

CILO No.	Large class Activities	Group work Activities	Total Hours
CILO 1	6	2	8
CILO 2	8	2	10
CILO 3	6	2	8
CILO 4	6	2	8
CILO 5	0	5	5
Total	**26**	**13**	**39**

4. Assessment Tasks/Activities

	Coursework			
CILO No.	**Examination (3 hours)**	**Problem sets**	**Individual term project** (report + presentation)	**Total (%)**
CILO 1	10	5	5	20
CILO 2	10	5	5	20
CILO 3	5	5	5	15
CILO 4	5	5	5	15
CILO 5	20	0	10	30
Total (%)	**50**	**20**	**30**	**100**

Examination: 50 % of total marks
There is a 3-hour examination at the end of the semester. A part of the examination contains questions specifically designed for the MBE8103 students.

Problem sets: 20 % of total marks
Four problem sets are assigned in the course and each one focuses on each of the CILO 1 – 4.

Individual term project: 30 % of total marks
Grading of this term project is based on a presentation and a final report. This project emphasizes on discovering/proposing a new technology which has a high potential in the future biomedical manufacturing industries.

5. Grading of Student Achievement:

The grading is assigned based on students' performance in the assessment tasks/activities, including an examination (50 %), problem sets (20 %) and an individual term project (30 %).

Grade Table

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

Please refer the SGS's website for details.

Part III

Keyword Syllabus:

- **Materials:** metals, ceramics, polymers, adhesives.
- **Material properties:** biomaterials, biocompatibility, haemocompatibility, elastic modulus, surface roughness, porosity, nanostructures.
- **Fabrication:** scaffolds, nano/microparticles, rapid prototyping, electro-spinning, self-assembly, solid freeform fabrication, polymer coating, vapour deposition, biomodelling, 3D medical imaging, reverse engineering.
- **Considerations:** cell-material interaction, tissue attachment, bonding criteria, surface pretreatment, corrosion, degradation, ion release, implants, sterilization, surgery and infection.
- **Applications:** biosensors, drug delivery, tissue engineering, orthopaedic devices, internal fixation, joint prostheses, cartilage reconstruction.

Recommended Reading:

- Chu, P. K., Liu, X. (2008). *Biomaterials fabrication and processing handbook*. Northwest, Washington, D.C.: CRC Press.
- Davis, J. R. (2003). *Handbook of materials for medical devices*, Ohio: ASM International.
- Rakhorst, G., Ploeg R. (2008). *Biomaterials in modern medicine: the Groningen perspective*. Singapore: World Scientific Publishing.
- Gibson, I. (2005). *Advanced manufacturing technology for medical applications: reverse engineering, software conversion, and rapid prototyping*. England: John Wiley & Sons Ltd.