City University of Hong Kong

Information on a Course offered by Department of Electronic Engineering with effect from Summer Term 2013

Part I

Course Title:	Bioelectromagnetics - Theory and Topics in Engineering Applications
Course Code:	EE6616
Course Duration:	One Semester (13 weeks)
No. of credits:	3
Level:	6
Medium of Instruction:	English
Prerequisites:	Nil
Precursors:	EE2104 Introduction to Electromagnetics; or equivalent.
Equivalent Course:	Nil
Exclusive Courses:	Nil

Part II

Course Aims:

The aim of this course is to provide students with up-to-date knowledge on the theories, concepts in bioelectromagnetics. The course addresses selected topics in electromagnetics in human biology applications, and human safety in the field of bioelectromagnetics.

Course Intended Learning Outcomes (CILOs)
Upon successful completion of this course, students should be able to:

No.	CILOs
1.	Describe the fundamental theory of bioelectromagnetics in engineering.
2.	Recognise and address the issues relating to bioelectromagnetics applications in engineering.
3.	Recognise the human safety aspects in the field of bioelectromagnetics.
4.	Apply the principles of bioelectromagnetics in engineering analysis and in biological effects in human bodies.

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)

CILO 1-4	Lectures, laboratory experiments, in-class exercise, case studies
1,2,3	Lectures, and laboratory experiments
2,3,4	Lectures, laboratory experiments, in-class exercise, and case studies

Timetabling Information

Pattern	Hours
Lecture:	*39**
Tutorials:	*0*
Laboratory:	*0*
Other activities:	*0*

** Some of the lectures will be conducted in the laboratory as case studies, demonstrations and experiments*

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)

	Type of assessment tasks	Weighting (if applicable)
Continuous Assessment	Case Study, Group projects, Assignments & Lab experiments	50%
Examination	Written Exam	50% (2 hours)

Remark: To pass the course, students are required to achieve at least 35% in course work and 35% in the examination

Grading of Student Achievement:

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:

Constructive Alignment with Programme Outcomes

PILO	How the course contribute to the specific PILO(s)
1-4	Students are able to understand the principles theory in bioelectromagnetics and selected topics in the field.
2,3,4	Students are required to complete an assignment in related topics in biolectromagnetics

Part III

Keyword Syllabus:

Bioelectromagnetics theory
Interaction between electromagnetic and human body, energy absorption in human body effect cell viability and DNA integrity, electromagnetic dosimetry.

Effects and impacts in human body
Source of electromagnetic fields, electro stimulation, body current and field distribution, shocks and burns, heat absorption at high frequencies, DNA change, Evaluations of SAR (Specific Absorption Rate), Human model in SARs, Cole-Cole equation, human thermoregulatory systems, bio-heat equation, impedance methods.

Interaction of EM field and human body, and biological evidence
Electromagnetic coupling into biological systems, genotoxicity and non genotoxic cellular studies, animal studies, human and epidemiological studies.

Application and human safety standards/guidelines in the field of bioelectromagnetics
Diagnosis and treatment in bioelectromagnetics applications, harmful effects, standards/guidelines at low and high frequencies, International Commission on Non Ionizing Radiation Protection Guidelines.

Laboratory in bioelectromagnetics applications
The laboratory projects are designed to complement the lecture aspects of the course, and will provide hands-on experience on selected topics in electromagnetics in human biology applications, and human safety in the field of bioelectromagnetics. Typical laboratory sessions are:

- SAR evaluations and human body model by four-pole Cole-Cole equation,
- experiment of cell viability and DNA damages
- Case studies of electromagnetics devices in biomedical applications.
- Assessment of electromagnetic interference to ICNIRP recommendations.

Recommended Reading:

Basic Introduction to Bioelectromagnetics, Carl H. Durney, Douglas A. Christensen, CRC Press
Handbook of Biological Effects of Electromagnetic Fields, Second Edition, Charles Polk Polk, Elliot Postow CRC Press

Online Resources (if any)