

City University of Hong Kong
Course Syllabus

offered by College/School/Department of Electrical Engineering
with effect from Semester A in 2019/2020

Part I Course Overview

Course Title: Introduction to Human Bionics

Course Code: GE1322

Course Duration: One Semester (13 weeks)

Credit Units: 3

Level: B1

Proposed Area: Arts and Humanities
(for GE courses only) 2 Study of Societies, Social and Business Organisations
1 Science and Technology

Medium of Instruction: English

Medium of Assessment: English

Prerequisites: Nil
(Course Code and Title)

Precursors: Nil
(Course Code and Title)

Equivalent Courses: Nil
(Course Code and Title)

Exclusive Courses: Nil
(Course Code and Title)

Part II Course Details

1. Abstract

(about 150 words to describe the course content and types of learning activities)

Can we upload our consciousness to the internet? Are the tactics in Sci-Fi movies unimaginable? Does the pop culture inspire the front-end science, or vice versa? Today, human brain can control computer cursors and manipulate directions of wheelchairs. Conversely, a machine can feed data into human brain to enhance its performance. This course introduces brain-machine interfaces (BMIs) as a communication channel in the context of gaming industry, patient care, sports enhancement, military field, and also daily routines. The students enrol in this course will be able to understand the basic working principles behind a brain-machine interface, and be knowledgeable on operating a BMI device. Furthermore, the popular culture in shaping the public's perception of science, the regulation involved in technology transfer, and the ethical consideration on brain-machine interaction will be addressed in class. It is an introductory course to promote the awareness of realizing BMI in this era.

This course aims to encourage intellectual exchange between students in biology and engineering with students in humanities and social science in the context of brain-machine interface. This course enables students to gain insight of the impact on human health care through medicine and technology, and to translate abstract scientific knowledge into working systems. After taking this course, students will be able to place the understanding of basic principles in biology and engineering in the broader context of societal needs, i.e. pop culture, technology transfer and legal regulation.

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.	Explain basic neuroscience and the general technology enabling brain-machine interface	25%		✓	
2.	Evaluate the knowledge of brain-machine interface	25%	✓		
3.	Justify the use of brain-machine interface and related ethical issues	25%		✓	✓
4.	Describe the process of commercialization, clinical implementation and approval	25%		✓	
		100%			

* If weighting is assigned to CILOs, they should add up to 100%.

[#] Please specify the alignment of CILOs to the Gateway Education Programme Intended Learning outcomes (PILOs) in Section A of Annex.

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			
Lectures	Large group in-class activity involving the entire class	✓	✓					30hr
Group discussion	Project demonstration			✓	✓			3hr
Group presentation	Group project presentations in the middle of the semester and at the end of the semester	✓	✓	✓	✓			6hr

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: <u>70%</u>						
<p>Project 1- Technologies behind BMI:</p> <p>Students will submit a writing assignment to review the existing neural interface technology, and discuss the impact of technology involved.</p> <p>Students will also conduct laboratory activities related to neural interface. Each student is required to take quizzes after the lab and write a laboratory report to review on their topic of neural interface technology.</p>			√	√	35%	
<p>Project 2 - Infomercial:</p> <p>Students are required to work on a group project. The project requires student to present innovative ideas on designing new application for the brain-machine interface that will be beneficial to the society (health-care sector, entertainment sector etc). There will be a short presentation of their topic.</p>	√	√			35%	
<p>Final Exam: 30%</p> <p>(Duration: 1 hour)</p>						
<p>A final exam on the working principles of neural interface technologies, applications of brain computer interface, medical device regulatory and ethics will be conducted for non-technical individual.</p>	√	√	√	√		
					100%	

Remark: To pass the course, students are required to achieve at least 30% in continuous assessment i.e. projects and 30% of the examination. Also, 75% lecture attendance rate must be obtained.

Marks will be deducted for students fail to meet the attendance requirement. Cutoffs between letter grades will be set at the end of the semester. The grade distribution is not set in advance.

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. Coursework	Ability to explain the working principles, and evaluate the social impact of brain-machine interface technologies	Students not only show a thorough understanding on all of the CILOS, but also able to show independent thinking on other brain-machine interface not covered inside classroom	Students show a thorough understanding on all of the CILOS, able to explain the interconnection of the science behind the brain-machine interface with the popular culture, commerce and social communities.	Students show a general understanding on most of the CILOS, able to highlight a few examples covered in the classroom	Students show a limited understanding on some of the CILOS, incapable of completing the group project	Student fails to show a limited understanding on any of the CILOS, and fail to submit any group project
2 Final Exam	Ability to explain the working principles, and evaluate the social impact of neural interface technologies	Students not only show a thorough understanding on all of the CILOS, but also able to show independent thinking on other neural interface not covered inside classroom	Students show a thorough understanding on all of the CILOS, able to explain the interconnection of the science behind neural interface with the popular culture, commerce and social communities.	Students show a general understanding on most of the CILOS, able to highlight a few examples covered in the classroom	Students show a limited understanding on some of the CILOS, incapable of completing the group project	Student fails to show a limited understanding on any of the CILOS, and fail to submit any group project

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus

Brain-machine interface, brain-computer interface, neuro-prostheses, neuroscience, biomedical engineering, neural engineering, technology commercialization, popular culture

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.	Nil
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2.2 Additional Readings

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

1.	Miguel Nicolelis, "Beyond Boundaries: The New Neuroscience of Connecting Brains with Machines - and How It Will Change Our Lives" (New York : Times Books, 2011, 1st ed.) - MN
2.	Ray Kurzweil, "The Singularity is Near: When Humans Transcend Biology" (New York : Penguin, 2006) - RK
3.	Kenneth W. Horch (Editor), Gurpreet Dhillon (Editor), "Neuroprosthetics: Theory and Practice (Series on Bioengineering & Biomedical Engineering - Vol. 2)" (World Scientific Publishing Co. Inc., 2004) – KWH
4.	Peter Dayan and L. F. Abbott, "Theoretical Neuroscience: Computational and Mathematical Modeling of Neural Systems" (Massachusetts Institute of Technology Press, c2001) – PD
5.	Eric R. Kandel, James H. Schwartz, and Thomas M. Jessell, "Principles of Neural Science" (Appleton & Lange, c1991) – ERK
6.	Antonio R. Damasio, "Self Comes to Mind: Constructing the Conscious Brain" (Pantheon, 2010, 1st ed.) - ARD

A. Please specify the Gateway Education Programme Intended Learning Outcomes (PILOs) that the course is aligned to and relate them to the CILOs stated in Part II, Section 2 of this form:

GE PILO	Please indicate which CILO(s) is/are related to this PILO, if any (can be more than one CILOs in each PILO)
PILO 1: Demonstrate the capacity for self-directed learning	CILOs 1-4 Students will be given reading materials before each lecture. They need to acquire information that is not covered in the classroom to complete Project 1.
PILO 2: Explain the basic methodologies and techniques of inquiry of the arts and humanities, social sciences, business, and science and technology	N/A
PILO 3: Demonstrate critical thinking skills	CILOs 3-4 Students need to write literature review on current technologies and apply critical thinking on the impact of popular science on cultural, social, and business communities
PILO 4: Interpret information and numerical data	N/A
PILO 5: Produce structured, well-organised and fluent text	CILOs 1,3 Project 1 includes an essay based assignment that requires students to gather different views from current literatures to write a summarized review.
PILO 6: Demonstrate effective oral communication skills	CILO 2 Students are required to present their project results and express their critical views on the impact of popular science on cultural, social, and business communities.
PILO 7: Demonstrate an ability to work effectively in a team	CILO 2 Project 2 is team-based.
PILO 8: Recognise important characteristics of their own culture(s) and at least one other culture, and their impact on global issues	N/A

PILO 9: Value ethical and socially responsible actions	CILOs 3-4 In Project 1, students will reflect on the impact of neural interface on ethical issues and the influence of sci-fi technology on popular culture.
PILO 10: Demonstrate the attitude and/or ability to accomplish discovery and/or innovation	N/A

GE course leaders should cover the mandatory PILOs for the GE area (Area 1: Arts and Humanities; Area 2: Study of Societies, Social and Business Organisations; Area 3: Science and Technology) for which they have classified their course; for quality assurance purposes, they are advised to carefully consider if it is beneficial to claim any coverage of additional PILOs. General advice would be to restrict PILOs to only the essential ones. (Please refer to the curricular mapping of GE programme: http://www.cityu.edu.hk/edge/ge/faculty/curricular_mapping.htm.)

- B. Please select an assessment task for collecting evidence of student achievement for quality assurance purposes. Please retain at least one sample of student achievement across a period of three years.

Selected Assessment Task
<p>Project 1- Technologies behind BMI:</p> <p>Students are required to review the existing brain-machine interface technology and choose their favorite brain-machine interface, and discuss the impact of the popular culture on the technology involved. Students will also conduct laboratory activities related to brain-machine interface. Each student is required to write a review on their topic of brain-machine interface and submit a laboratory report.</p>