City University of Hong Kong
Course Syllabus

offered by
Department of Biomedical Engineering
with effect from Semester A 2019 / 2020

Part I   Course Overview

Course Title: Robots in Our Life: How Applications of Robots Affect Our Life and Society

Course Code: GE2320

Course Duration: 1 semester

Credit Units: 3 credits

Level: B2

Proposed Area:
(for GE courses only)

	Arts and Humanities
2	Study of Societies, Social and Business Organisations
1	Science and Technology

Medium of Instruction: English

Medium of Assessment: English

Prerequisites:
(Course Code and Title) Nil

Precursors:
(Course Code and Title) Nil

Equivalent Courses:
(Course Code and Title) Nil

Exclusive Courses:
(Course Code and Title) Nil

Part II Course Details

1. **Abstract**
   (A 150-word description about the course)

   A robot is an automatic device that performs the functions ordinarily ascribed to human beings. The applications of robots have changed our life and society in one way or another. This course will introduce the basic knowledge for understanding how robots work and what they can do for us. The course will focus on applications of robots related to our life to see their impact on our society. To facilitate students' learning, a series of Problem Based Learning activities will be introduced including the design of Lego robots to tackle some given problems, and company visits to see real robots at work.

   This course aims to present an overview of the applications of robots as related to our life. The main objectives of the course are: to understand the breadth of the application of robots, to study the areas of robot applications that best suit students' interests and that can be found in our daily life, and to develop the skills in individual thinking and teamwork work through project work. An emphasis is placed on giving an opportunity to students to integrate what they have learnt to understand the impact of applications of robots to our modern society. Besides learning the concepts on robots, students would also have the chance to develop the valuable skills in teamwork and problem solving abilities.

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.	Describe the applications of robots, including domestic, service as well as industrial applications.		✓		
2.	Explain the principles and operations of the basic types of robots in applications as related to our life in a modern society.		✓	✓	
3.	Create some simple robots to perform given tasks.			✓	✓
4.	Demonstrate reflective practice in the design process including documentation and presentation.			✓	
5.	Demonstrate an ability to work effectively in a team			✓	

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

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	5	
Lecture on what robots are and what they can do in practical applications in modern society, with some real examples.	Introduce the basic concept of robot. Explain the application of robot in daily life with real examples.	✓	✓				6hrs (week 1 & 4)
Introduction on the architectures, operations, and applications of the basic types of robots. Watch a movie such as Blade Runner or iRobot.	Explain the robot kinematics with a real robot example.		✓				6hrs (week 2 & 3)
Introduction on the major components in a robot and illustrations on how they function in different applications including entertainment like movie industry. Read an Isaac Asimov's science fiction book on robots.	Explain the components of a robot, including the actuator, sensor, controller and so on.		✓				6hrs (week 5 & 7)
Conceptual design and planning for the development of a robotic system.	Introduce the main steps to develop a robot.			✓			3hrs (week 6)
Lecture on legality and ethicality of autonomous robots. Implementation of the design concepts in a robot design exercise.	Introduce the military robot and medical robot. Discuss the ethical issue of robot. Require student to develop the robot based on the concept learned in wk 6.			✓	✓		6hrs (week 9 & 12)
Participation in team competition exercise for the design project.	Require students to participate the robot contest.					✓	3hrs (week 10)
Background knowledge acquisition through reading of the reference books, lecture notes, and self-initiated work the technical knowledge related to the course content and the project, conduct the design.	Introduce the new techniques in robot. Require students to solve problems on robot by reading reference.				✓		6hrs (week 8 & 11)
Presentation of the design work through a written report and an oral presentation the results of a design project performed as part of a team.	Require students to demonstrate their robot, give a presentation and submit a report.				✓		3hrs (week 13)
Complementary out-of-class activities.	Company visits including those to Police Station for de-bomber robots and Hospitals for the surgical robots /directed readings/competitions.	✓	✓	✓	✓	✓	

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	5		
Continuous Assessment: 50%							
Report	✓	✓	✓	✓		20%	
Oral Presentation	✓	✓				5%	
Demonstration		✓	✓		✓	5%	
Contest		✓	✓		✓	20%	
Examination: 50% (duration: 2 hours)							

* The weightings should add up to 100%.   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. Report	Ability to develop a robot by team work. Required to explain the techniques used in the robot development in details.	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Oral Presentation	Ability to introduce the robot functions in details. Ability to explain the working principle of the robot clearly.	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Demonstration	Ability to demonstrate the robot, including: 1. Be able to move following a given path. 2. Be able to identify the objects with different colours. 3. Be able to move the selected object.	High	Significant	Moderate	Basic	Not even reaching marginal levels
4. Contest	Ability to let the robot move following the given path as fast as possible.	High	Significant	Moderate	Basic	Not even reaching marginal levels
5. Examination	Ability to know and explain the working principles of robots clearly. Ability to solve the practical robotic problems by equations. Ability to introduce various types of robots in details, mainly including their working principles, characteristics, advantages and existing problems.	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.)

   - History of robots – Key events in robot history, fictional and real robots.
   - How does a robot work? – Why it can move, sense, and think like a human.
   - Loyal servants to our society – Industrial and Domestic robots, and the impacts of their applications on our society.
   - How does a robot feel? – Robot sensors. The legality and ethicality of autonomous robots.
   - Clever workers – Intelligent robots and their social impacts.
   - How do robots see? – Robot vision.
   - Supermen – Advanced applications of robots (in underwater, medical etc) and how they may change our life and society.
   - DIY – Project: design a simple robot yourself.

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.)

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

1.	John Long, Darwin's devices: what evolving robots can teach us about the history of life and the future of technology, 2012.
2.	S. K. Saha, Introduction to Robotics, McGRAW-Hill Int, 2008.
3.	G. Becky, et al, Robotics: State of the Art and Future Challenges, Imperial College Press, 2008.
4.	R. Dieter, Service robots: products, scenarios, visions, A K Peters, 2000.
5.	P. Neuburg, Medical robots, MediaMatters Co. Ltd., 2000.
6.	C. L. Nehaniv and K. Dautenhahn, Imitation and social learning in robots, humans and animals: behavioural, social and communicative dimensions, Cambridge University Press, 2007.
7.	J. P. Telotte, Replications: a robotic history of the science fiction film, University of Illinois Press, 1995.
8.	A. Krishnan, Killer robots: legality and ethicality of autonomous weapons, 2009.
9.	Philip K. Dick, Blade runner, Del Rey Mass Market Edition, 2007.

Online Resources:
The following is the website for
   1. Lego Mindstorms:
      http://mindstorms.lego.com/en-us/Default.aspx
      http://mindstorms.lego.com/en-us/products/default.aspx
   2. Robot Store Website for components
      http://www.robotstorehk.com/
      http://hk.farnell.com/jsp/home/homepage.jsp
      http://www.rshongkong.com/

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	It is related to our CILO 2 and 3 that encourage students through independent learning to extend the knowledge learnt in classroom for applications related to our daily life activities.
PILO 2: Explain the basic methodologies and techniques of inquiry of the arts and humanities, social sciences, business, and science and technology	It is related to CILO 1 and 2 that together help the students to develop an appreciation and also techniques for scientific inquiry, particularly on issues related to our daily life as well as potential impacts to our society.
PILO 3: Demonstrate critical thinking skills	It is related to CILO 3 and 4 that together help the students to develop critical thinking skill through design and development processes for creating simple robots for applications related to real-life activities.
PILO 4: Interpret information and numerical data	It is related to CILO 1 and 3 that encourage students to evaluate and analyse information comprehensively and critically.
PILO 5: Produce structured, well-organised and fluent text	
PILO 6: Demonstrate effective oral communication skills	
PILO 7: Demonstrate an ability to work effectively in a team	It is related to CILO 3, 4, and 5 that emphasize teamwork in order to create robots for applications related to real life activities.
PILO 8: Recognise important characteristics of their own culture(s) and at least one other culture, and their impact on global issues	
PILO 9: Value ethical and socially responsible actions	
PILO 10: Demonstrate the attitude and/or ability to accomplish discovery and/or innovation	It is related to CILO 2 and 3 which encourage students to develop an appreciation for scientific inquiry and critical reasoning in order to create robotic devices for solving real-life problems.

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
Group project and presentation: Student will be asked to design a robot with the following functions: 1. Be able to move following a given path. 2. Be able to identify the objects with different colours. 3. Be able to move the selected object.