GE1314: IRONMAN: THE ART AND SCIENCE OF ROBOTS IN OUR SOCIETY

Effective Term
Semester A 2024/25

Part I Course Overview

Course Title
Ironman: The Art and Science of Robots in Our Society

Subject Code
GE - Gateway Education
Course Number
1314

Academic Unit
Electrical Engineering (EE)

College/School
College of Engineering (EG)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

GE Area (Primary)
Area 3 - Science and Technology

GE Area (Secondary)
Area 1 - Arts and Humanities

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses

Nil

Part II Course Details

Abstract

We can find Robots in many different places around us from the outer space walker, Amazon warehouse robot, diving rescue robot, house-keeping robot, to military autonomous robots. This course introduces robotic autonomous technology, from different perspectives, for example how do we design a robot, what is the science behind a robot, how does it receive and react, what is the social and ethical implications between man and Artificial intelligence (AI), in an elementary level treatment. Students who enrol this course will participate the building and demonstration of a creative imaginable robot using the LEGO MINDSTORM tool, and in-class discussions. Moreover, the basic engineering knowledge, the fundamental science theory of robot, and the ethical issues about using robot and AI will be all covered. Students will be assessed by assignments, tests, and project presentation to demonstrate their acquired knowledge. It is an introductory course to enrich students' creativity and personal development, and to provide students a brief understanding about the robotic AI technology.

This course aims to enhance the appreciation of the technology development and human applications on AI robots. The interactions available in the past, till today and tomorrow between human and robot will be discussed. On one hand, the technology enabling the movement, robotic vision, artificial intelligence and sense will be all covered in this course. On the other hand, the social implication of using robots and eventually replacing some tedious and dangerous human tasks will also be discussed. Students who enrol to this course will be able to give interdisciplinary comments on the impact of robots to mankind.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe traditional Robot and recent robotic technology		x	x	
2	Identify the general robotic and AI technology		x	x	
3	Evaluate the knowledge of Robotic and AI technology		x	x	x
4	Analyze and compare the differences of Human vs. Robot		x	x	

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 real-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.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures	Large group in-class activity	1, 2, 3, 4	3 hours
2	Demonstration	Robots/AI demonstration	1, 2, 3, 4	

| 3 | Group Presentation and discussion | Group project presentation/discussion near the end of the semester | 1, 2, 3, 4 | |

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Tests (min: 2)	1, 2, 3, 4	30	
2	Assignment (min: 3)	1, 2, 3, 4	10	
3	Presentation	1, 2, 3, 4	10	

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

Additional Information for ATs

Remark:

To pass the course, students are required to achieve at least 30% in the continuous assessment and 30% in the examination.

Other remarks:

a. A lecture is a large-class activity involving the whole class. The information of a particular topic is to be delivered by the instructor.
b. Group discussions include problem Q&A, case study discussion and reporting.
c. Demonstration is an in-class event to allow students understanding artificial intelligence/robotic applications.
d. Group presentation is a small-group activity to let students apply their knowledge on designated tasks. Students are required to submit a report, and also give the demonstration/presentation if appropriate.

Assessment Rubrics (AR)

Assessment Task

Coursework

Criterion

Achievements in CILOs

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task
Examination

Criterion
Achievements in CILOs

Excellent (A+, A, A-)
High

Good (B+, B, B-)
Significant

Fair (C+, C, C-)
Moderate

Marginal (D)
Basic

Failure (F)
Not even reaching marginal levels

Part III Other Information

Keyword Syllabus
Mechanical artificial agent, electro-mechanical machine, humanoid, fuzzy logic, home automation robot, unmanned combat air vehicle (UCAV), automated guided vehicles (AGV), artificial intelligent, machine learning, speech synthesizer, robotic vision, robotic AI applications.

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	Robot Technology Fundamentals J.G. Keramas, Delmar Publishers, ITP, 1999.
2	Introduction to robotics : analysis, control, applications Saeed Benjamin Niku., Saeed B. Hoboken, NJ : Wiley, Second Edition, 2011.
3	Artificial Intelligence: A Mdern Approach Stuart Russell, Peter Norvig, Prentice Hall, Second Edition, c2003.
4	The robotics primer Maja J. Matari# ; illustrations by Nathan Koenig. Cambridge : The MIT Press, c2007.
5	Introduction to Robotics, Mechanics and Control John J. Craig, Pearson Prentice Hall, Third Edition, 2005.
6	Definitive Guide to LEGO MINDSTORMS Dave Baum, A! Apress, Second Edition, 2003
7	Robotic Explorations – A Hands-on introduction to Engineering Fred G. Martin, Prentice Hall, 2001
8	Loving the Machine, The Art and Science of Japanese Robots Timothy N. Hornyak, 2006
9	Is Man a Robot? Geoff Simons, John Wiley & Sons, 1987

10	Ethics and Robotics Rafael Capurro, Michael Nagenborg, IOS Press, 2009
11	http://en.wikipedia.org/wiki/Robot
12	http://robots.net/
13	http://www.sciencedaily.com/news/computers_math/robotics/
14	http://www.aldebaran-robotics.com/en/naoeducation
15	http://www.robocup.org/

Annex (for GE courses only)

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:

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

2, 3

PILO 2: Explain the basic methodologies and techniques of inquiry of the arts and humanities, social sciences, business, and science and technology

1, 2, 3

PILO 3: Demonstrate critical thinking skills

3

PILO 4: Interpret information and numerical data

3

PILO 5: Produce structured, well-organised and fluent text

4

PILO 6: Demonstrate effective oral communication skills

4

PILO 7: Demonstrate an ability to work effectively in a team

4

PILO 10: Demonstrate the attitude and/or ability to accomplish discovery and/or innovation

4

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

Project Demo, Presentation and Project Report