City University of Hong Kong
Course Syllabus

offered by
Department of Biomedical Engineering
with effect from Semester A 2022 / 2023

Part I   Course Overview

Course Title: Advanced Automation Technology

Course Code: BME8126

Course Duration: 1 semester

Credit Units: 3

Level: R8

**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)   MBE6007/BME6007/MNE6007/MNE8118 Advanced Automation Technology

Exclusive Courses:
(Course Code and Title)   Nil

Part II   Course Details

1. **Abstract**

    The aim of the course is to provide the students with the understanding of the basic principles in some important technology in automation. This course will lay down the foundations of the engineering principles in such a way that the students can identify the appropriate concepts required in given engineering problems and apply them to formulate the suitable engineering solutions in automation and other applications.

2. **Course Intended Learning Outcomes (CILOs)**

No.	CILOs	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	To **give** an account of the basic theories of robotics and machine vision.		✓		
2.	To **develop** the ability to interpret basic vision problems.			✓	
3.	To **analyze** the principles in vision systems.			✓	
4.	To **design** robot systems for applications in automation.				✓
5.	To **apply** robots and sensing systems in automation and other applications.			✓	✓

* If weightings 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)

TLA	Brief Description	CILO No.					Hours/week (if applicable)
		1	2	3	4	5	
Lecture	On robot and vision systems	✓	✓	✓	✓		2 hours/week
Tutorial	To give some details on understanding the lectures'	✓	✓	✓	✓		1 hour/week
Laboratory	to give students opportunity to learn from practice	✓	✓	✓	✓	✓	3 hours/week, for 2 weeks

4. Assessment Tasks/Activities (ATs)

Assessment Tasks/Activities	CILO No.					Weighting*	Remarks
	1	2	3	4	5		
Continuous Assessment: 50%							
Project presentation and result	✓	✓	✓	✓	✓	35%	
Project Report	✓	✓	✓	✓	✓	15%	
Examination: 50%							
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

Applicable to students admitted in Semester A 2022/23 and thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B)	Marginal (B-, C+, C)	Failure (F)
1. Examination	Written exam at the end of the semester.	High	Significant	Basic	Not even reaching marginal levels
2. Project presentation and result	Include 3 parts on oral, lab demo and written report.	High	Significant	Basic	Not even reaching marginal levels
3. Project Report	Group reports but to include individual discussions	High	Significant	Basic	Not even reaching marginal levels

Applicable to students admitted before Semester A 2022/23

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Examination	Written exam at the end of the semester.	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Project presentation and result	Include 3 parts on oral, lab demo and written report.	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Project Report	Group reports but to include individual discussions	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**

   Robotics, Robot sensing, Robot vision, Machine vision systems, Image acquisition, Image pre-processing, Image filtering, Edge detection, Segmentation, Shape description and recognition, Camera calibration, Neural Network (NN) architectures, training and testing of NN, applications of NN in pattern recognition and automation.

2. **Reading List**
2.1 **Compulsory Readings**

   N.A.

2.2 **Additional Readings**

1.	K. S. Fu, R. C. Gonzalez and C. S. G. Lee, Robotics, Control, Sensing, Vision, and Intelligence, McGRAW-Hill Int.
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.	M. Sonka, et al, Image Processing, Analysis, and Machine Vision, Int. Thomson Pub., 1999.
5.	R. Jain, et al, Machine Vision, McGraw-Hill Inc., 1995.
6.	D. A. Forsyth and J. Ponce, Computer Vision, Person Education , Inc., 2003.
7.	Dinwiddie, Keith, Basic Robotics, Boston, MA : Cengage Learning, TJ211 .D569 2015
8.	Niku Saeed B, Introduction to Robotics : Analysis, Control, Applications, Hoboken : John Wiley Inc, 2015.