



UOW
MALAYSIA
KDU PENANG
UNIVERSITY COLLEGE

PART OF THE UNIVERSITY
OF WOLLONGONG AUSTRALIA
GLOBAL NETWORK

School of Engineering, Computing and Built Environment

Department of Computing

Bachelor of Computer Science (Hons)

AUTONOMOUS MOBILE ROBOTICS (CAI3034/N)

January 2023 Semester

Final Examination

Duration: 2 hours

Total Marks: 100

Instructions

1. This examination paper consists of **2 pages**, including this cover page.
2. There are **4 questions**: Question 1 (25 marks)
Question 2 (25 marks)
Question 3 (25 marks)
Question 4 (25 marks)
3. Read carefully the instructions printed at the beginning of each section.
4. All answers are to be written in the answer booklet(s) provided. Use black or blue ink only. Pencils may be used for sketches and diagrams.
5. Examination paper and answer booklet(s) are **not allowed** to be taken out from the examination room.

Question 1 (25 marks)**Answer all questions.**

- (a) Describe the components of a robot's control system and explain the role of each component in controlling the robot's movement. (10 marks)
- (b) State the purpose of a robotic end effector and describe two common types of end-effectors used in industrial robotics. (6 marks)
- (c) State the different types of robot actuators. Hence, describe the advantages and disadvantages of each type. (9 marks)

Question 2 (25 marks)**Answer all questions.**

- (a) Describe the Robotic Operating System (ROS) communication model and its advantages for building robotic systems. (6 marks)
- (b) Describe the role of the ROS Master in a distributed ROS system. (6 marks)
- (c) State the difference between a ROS launch file and a ROS node. (6 marks)
- (d) Explain the purpose of ROS messages and services in a robotic system, and give an example of each. (7 marks)

Question 3 (25 marks)**Answer all questions.**

- (a) Explain what is a robotic workspace? (3 marks)
- (b) Explain how the robotic workspace is determined? (4 marks)
- (c) Sketch the workspace and explain two characteristics of the following robots:
 - (i) Polar robot (6 marks)
 - (ii) Cylindrical robot (6 marks)
 - (iii) Cartesian robot (6 marks)

Question 4 (25 marks)**Answer all questions.**

- (a) Describe two differences between passive and active vision systems in robotics. (6 marks)
- (b) Describe two challenges involved in developing effective robotic vision systems (6 marks)
- (c) Describe two computer vision techniques used in robotics to recognize objects (6 marks)
- (d) Briefly explain what is visual servoing and how can robots use this approach to perform precise tasks. (7 marks)

THE END

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