



MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

UNIVERSITY ORDINARY EXAMINATION

2023/2024 ACADEMIC YEAR

**SECOND YEAR SECOND SEMESTER EXAMINATION FOR BACHELOR
OF SCIENCE IN ELECTRICAL AND ELECTRONICS ENGINEERING**

EET418: ROBOTICS AND AUTOMATION

DURATION: 2 HOURS

INSTRUCTIONS TO CANDIDATES:

1. Answer Question one and any other two questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE (30 MARKS)

- a) What is a robot? (2marks)
- b) Explain the following types of robots
- i. Android robot
 - ii. NC robot
 - iii. Intelligent robot
 - iv. Fixed sequence robot (4marks)
- c) Describe the classification of robot vision system based on dimensional model of scenes and light intensity level. (4marks)
- d) Find the equation of motion of the spring-mass system shown below using Newtonan approach and langragian approach. (2marks)
- _____
- e) Explain the following common robot terminologies
- i. Limited sequence
 - ii. Acuracy
 - iii. Payload
 - iv. Yaw (4marks)
- f) Robots are structured in four coordinate systems. Name and describe any two of such coordinate systems (4marks)
- g) Describe the following sensors used in robotics (4marks)
- h) Mention any two uses of sensors in robotics (2marks)

SECTION TWO: ANSWER ANY TWO QUESTIONS

QUESTION TWO (20 MARKS)

- a) Differentiate between power and manual lead through programming. (4marks)
- b) Explain the five generation of robots controllers. (5marks)
- c) What is a controller? Mention the basic types of controllers and their purpose (4marks)

- d) Consider the following electrical system shown in the figure below (7marks)

QUESTION THREE (20 MARKS)

- a) Explain the following terms used in robot vision (4marks)
- i. Thresholding
 - ii. Object recognition
 - iii. Feature extraction
 - iv. Windowing
- b) Find the transfer function PID controller and draw its block diagram (4marks)
- c) Show that the equation of a pendulum is given by; (8marks)

$$\theta + \frac{g}{l} \sin \theta = 0$$

- d) With the help of a diagram explain the operation of the vidicon tube. (4marks)

QUESTION FOUR (20 MARKS)

- a) Differentiate between robot –oriented and object-oriented programming. (4marks)
- b) The position of an end effector P(5,8,10) is rotated 60° about the z-axis, followed by 30° about x- axis and then 45° about the y-axis. Find the final position of the end effector. (6marks)
- c) The figure below shows a 2-DOF link manipulator whose joints are both revolute and link lengths 11 and 12 as shown. Given the exact position and orientation find the possible joint angles. (10marks)