Daffodil International University

Faculty of Science & Information Technology

Department of Software Engineering

Final Examination, Spring 2026

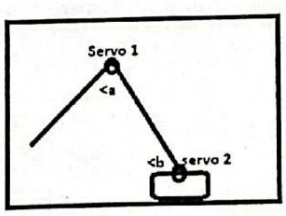
Course Code: SE532; Course Title: Introduction to Robotics

Sections & Teachers: 43 (All)

Time: 2:00 Hrs **Marks: 40**

Answer ALL Questions

[The figures in the right margin indicate the full marks and corresponding course outcomes. All portions of each question must be answered sequentially.]

1.	***a)***	In a robotic arm system, there are two servo motors labelled as servo 1 and servo 2. Initially, servo 1 = 90° and servo 2 = 45°. When the program starts, the robotic arm should perform the following sequence: Rotate servo 1 from 90° to 150°, Move servo 2 from 45° to 100°, Wait for 2 seconds, Rotate servo 1 to 30°, Move servo 2 to 20°, Finally, return both servos to their initial positions. **Build** the circuit and **code** the Arduino program for this servo motor action. 	[Marks-5]	**CLO-2** ***Level-3***
	b)	You are tasked with controlling a DC motor using an L298N motor driver and an Arduino microcontroller. The motor should perform the following sequence of actions when the program is run: a. Start the motor and run it in the forward direction at full speed for 3 seconds, b. Stop the motor for 2 seconds, then turn right c. Run the motor in the reverse direction at half speed for 5 seconds and turn left d. Stop the motor. **Draw** the circuit and **code** the arduino program for this motor action.	[Marks-5]	

	c)	You are tasked to design a robotic medicine dispensing system for use in a hospital. The robot must be able to pick up small medicine boxes from a storage rack and place them into specific trays accurately. To perform this task, the robot needs a motor that can provide precise angular movement and controlled positioning of its arm. Answer the following questions based on the given scenario **applying** concepts of motor: 1. From the DC motor, servo motor, and stepper motor, choose the most suitable motor for this robot and justify your answer. 2. Describe the control mechanism of the selected motor and explain how it helps the robot perform the required task accurately.	[Marks-5]	
	d)	i. A vector is described as P=32i-6j-7k. **Compute** its matrix form if it were to describe a direction as a unit vector. 0.26 -1.80 -0.210 0 ii. A frame, F is positioned in a 3D coordinate system. F_{old}= $\begin{bmatrix} 0.707 & -0.707 & 0 & 3 \\ 0.707 & 0.707 & 0 & 2 \\ 0 & 0 & 1 & 4 \\ 0 & 0 & 0 & 1 \end{bmatrix}$ The frame undergoes the following sequence of transformations: The frame is first rotated by 90∘ about the y-axis. Then, the resulting frame is rotated by 90∘ by x-axis, Finally, the frame is translated by [-9,5,-1], shifting its position in the space. **Determine** the final coordinates of the frame after applying all these transformations.	[Marks-3+7 =10]	
2.	a)	You are tasked to design and implement a "Smart Agricultural Monitoring Robot" for a crop field environment. The robot should be able to: • Move along a predefined path between crop rows, • Detect obstacles such as rocks or tools placed in the field, • Measure soil moisture to identify dry areas, • Detect rainfall to help decide whether irrigation is needed. **Decide** the answers to the following questions in order to design this robot: i. List the components required to design this robot. ii. Draw and label the circuit diagram for this robot. iii. Describe the programming logic or code needed to make the robot detect dry soil and rainfall while also avoiding obstacles.	[Marks-10]	CLO-3 *Level-5*
	b)	**Explain** your design choices, sensor integration, challenges faced while designing this robot.	[Marks-2]	
	c)	In ROS, different parts of a robot can communicate with each other using nodes, topics, and messages. **Explain** these concepts with a simple example of a robot system.	[Marks-3]	