



Daffodil International University
Faculty of Science & Information Technology
Department of Software Engineering
Final Examination, Summer 2026

Course Code: SE 532; Course Title: Introduction to Robotics

Sections & Teachers: MTE (A, B), HI (C, D, J), SCS (E, F, G, H), FF(I)

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)	A point $p(5,5,5)^T$ is attached to a rotating frame. The frame rotates 90° about the z-axis of the reference frame. Compute the coordinates of the point relative to the reference frame after the rotation, and sketch the result graphically.	[Marks-5]	CLO-2 Level-3
	b)	A frame F_{noa} is located in the position P. After the following transformation the frame position has changed to $Q[2,5,7]^T$. A rotation along Z axis by anti-clock 30 degree but before that a translation along all axis by $[2,3,5]$. After those two, another rotation along Y axis by 45 degrees followed by a translation along all axis by $[3,-5,3]$. Calculate the position P with respect to Q.	[Marks-10]	
	c)	An H-bridge is an electronic circuit made of four switches that lets a motor driver run a DC motor forward, backwards, and stop quickly. Sketch the H-bridge circuit and the truth table to describe its functionality.	[Marks-5]	
	d)	In a robotic arm system, there is one servo motor labelled as servo-1. Initially, servo-1 = 90° . When the program starts, the robotic arm should perform the following sequence: Rotate servo-1 by 30° , Wait for 2 seconds, Rotate servo-1 by 45° , Wait for 2 seconds, Finally, return the servo motor to its initial positions. Build the circuit and code the Arduino program for this servo motor action.	[Marks-5]	
2.	a)	An agro-tech startup is deploying an Autonomous Crop Monitoring Rover to optimize large-scale farming efficiency. The rover operates independently in outdoor crop fields to navigate rows, monitor environmental conditions, and transmit data without human intervention. Rover Specifications & Features are: Field Navigation: Moves through uneven crop rows using a motorized chassis.	[Marks-10]	CLO-3 Level-5

	• Obstacle Avoidance: Detects and bypasses obstacles like rocks, animals, or fences. • Soil Monitoring: Identifies dry soil patches requiring immediate irrigation. • Weather Detection: Senses sudden rainfall to protect its electronics or alter behavior. • Data Transmission: Sends real-time field data wirelessly to a central farm dashboard. • Local Alerts: Activates a visual strobe and audible buzzer during critical events. • Power Management: Operates for extended periods using a battery and solar charging system. Collaborate the answers to the following questions in order to design this robot: - List the components required to design this robot. - Draw and label the circuit diagram for this robot. - Describe the programming logic or code needed to make the robot detect dry soil and rainfall while also avoiding obstacles.		
b)	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-5]	