



**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.]*

|    |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |           |                  |
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| 1. | a) | <p>In a robotic arm system, there are two servo motors labelled as servo 1 and servo 2.<br/>Initially, servo 1 = 90° and servo 2 = 45°.<br/>When the program starts, the robotic arm should perform the following sequence:<br/>Rotate servo 1 from 90° to 150°,<br/>Move servo 2 from 45° to 100°,<br/>Wait for 2 seconds,<br/>Rotate servo 1 to 30°,<br/>Move servo 2 to 20°,<br/>Finally, return both servos to their initial positions.<br/><b>Build</b> the circuit and <b>code</b> the Arduino program for this servo motor action.</p> <div> </div> | [Marks-5] | CLO-2<br>Level-3 |
|    | b) | <p>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:</p> <ol style="list-style-type: none"> <li>Start the motor and run it in the forward direction at full speed for 3 seconds,</li> <li>Stop the motor for 2 seconds, then turn right</li> <li>Run the motor in the reverse direction at half speed for 5 seconds and turn left</li> <li>Stop the motor.</li> </ol> <p><b>Draw</b> the circuit and <b>code</b> the arduino program for this motor action.</p>     | [Marks-5] |                  |

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|    | <p>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 <b>applying</b> concepts of motor:</p> <ol style="list-style-type: none"> <li>1. From the DC motor, servo motor, and stepper motor, choose the most suitable motor for this robot and justify your answer.</li> <li>2. Describe the control mechanism of the selected motor and explain how it helps the robot perform the required task accurately.</li> </ol>                                                                                               | [Marks-5]      |                  |
|    | <p>d) i. A vector is described as <math>P=32i-6j-7k</math>. <b>Compute</b> its matrix form if it were to describe a direction as a unit vector.</p> <hr/> <p>ii. A frame, F is positioned in a 3D coordinate system.</p> <p><math>F_{old} =</math></p> $\begin{bmatrix} 0.707 & -0.707 & 0 & 3 \\ 0.707 & 0.707 & 0 & 2 \\ 0 & 0 & 1 & 4 \\ 0 & 0 & 0 & 1 \end{bmatrix}$ <p>The frame undergoes the following sequence of transformations: The frame is first rotated by <math>90^\circ</math> about the y-axis. Then, the resulting frame is rotated by <math>90^\circ</math> by x-axis, Finally, the frame is translated by <math>[-9,5,-1]</math>, shifting its position in the space. <b>Determine</b> the final coordinates of the frame after applying all these transformations.</p>                                                                                  | [Marks-3+7=10] |                  |
| 2. | <p>a) You are tasked to design and implement a “Smart Agricultural Monitoring Robot” for a crop field environment. The robot should be able to:</p> <ul style="list-style-type: none"> <li>• Move along a predefined path between crop rows,</li> <li>• Detect obstacles such as rocks or tools placed in the field,</li> <li>• Measure soil moisture to identify dry areas,</li> <li>• Detect rainfall to help decide whether irrigation is needed.</li> </ul> <p><b>Decide</b> the answers to the following questions in order to design this robot:</p> <ol style="list-style-type: none"> <li>i. List the components required to design this robot.</li> <li>ii. Draw and label the circuit diagram for this robot.</li> <li>iii. Describe the programming logic or code needed to make the robot detect dry soil and rainfall while also avoiding obstacles.</li> </ol> | [Marks-10]     | CLO-3<br>Level-5 |
|    | <p>b) <b>Explain</b> your design choices, sensor integration, challenges faced while designing this robot.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | [Marks-2]      |                  |
|    | <p>c) In ROS, different parts of a robot can communicate with each other using nodes, topics, and messages. <b>Explain</b> these concepts with a simple example of a robot system.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | [Marks-3]      |                  |