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Daffodil International University
**Department of Software Engineering**
**Faculty of Science & Information Technology**
**Midterm Examination, Spring 2024**
**Course Code: SE 532; Course Title: Introduction to Robotics**
**Sections & Teachers: 38 A, B; 39- A, B, C, D;**
**Md Hafizul Imran(HI); Masrufa Tasnim (MT)**

**Time: 1 Hour 30 Mins** **Marks: 25**

## 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) | You are a robotics engineer tasked with designing an autonomous cleaning robot for household use. The robot, named RoboClean, is equipped with advanced AI algorithms to navigate and clean efficiently. However, during the development phase, you encounter a dilemma where RoboClean must make a decision that potentially violates one of Asimov's Three Laws of Robotics. Consider the following scenario: | [Marks-2+3 +5=10] | CLO-1 *Level- 2* |
| | | RoboClean is programmed to clean the house thoroughly while ensuring the safety and well-being of humans. One day, while cleaning the kitchen, RoboClean detects a hazardous spill of a corrosive substance on the floor. Simultaneously, it also detects a frail elderly person in another room who appears to be in distress, possibly due to a fall. RoboClean can only attend to one task at a time, and both situations require immediate attention.<br><br>i. **Define** Robot and Robotics.<br>ii. **Identify** and **explain** the potential conflict RoboClean faces in adhering to Asimov's Three Laws of Robotics based on the provided scenario.<br>iii. **Explain** the ethical considerations involved in RoboClean's decision-making process and propose a course of action that prioritizes human safety while addressing the competing demands of the situation. | | |
| 2. | a) | You are designing an encoder sensor system for a robotic arm in a manufacturing plant. The encoder sensor is responsible for accurately measuring the rotation of the arm's joint. The sensor provides a digital output corresponding to the angular position of the joint, with a resolution of 360 counts per revolution.<br>Suppose the robotic arm completes 5 full revolutions clockwise and then 3 full revolutions counterclockwise. Solve the total number of | [Marks-5] | CLO-2 *Level-3* |

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|---|---|---|---|---|
| | | counts registered by the encoder sensor during this movement sequence. | | |
| | b) | **Design** a circuit diagram and **write** Arduino code to autonomously control an RGB LED for a dynamic lighting system.<br>The circuit should include components for the RGB LED, appropriate resistors (if necessary), a microcontroller (such as Arduino Uno), and any other necessary components. The code should initialize the pins connected to the RGB LED and implement a sequence to cycle through RED, GREEN and BLUE colors with a delay of 0.5 seconds. | [Marks-5] | |
| | c) | You're tasked with creating a simple robot capable of navigating and avoiding obstacles in its environment. The robot needs to incorporate two types of sensors: one for detecting nearby objects and another for measuring distances. These sensors will enable the robot to perceive its surroundings and make informed decisions to avoid collisions.<br>**Design** a robot suitable for the described scenario, detailing the components required to implement obstacle detection and avoidance functionalities. Explain how the chosen sensors will enable the robot to navigate effectively without direct human intervention. | [Marks-5] | |