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Daffodil International University

Faculty of Science & Information Technology

Department of Software Engineering

Midterm Examination, Summer 2026

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

Sections & Teachers: 42 (All);

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.]

1.	***a)***	A company has developed an automated machine that can pick products from a conveyor belt and place them into boxes. The machine uses sensors to detect the position of products, makes decisions based on the sensor data, and adjusts its movements accordingly. i) Based on the characteristics of robots, **express** whether this machine can be considered a robot. Justify your answer with appropriate reasoning. ii) **Discuss** two advantages and two limitations of using such robotic systems in industrial applications.	**[Marks-5]**	**CLO-1** *Level- 2*
	b)	An autonomous rescue robot is sent to a disaster area where it detects two situations simultaneously: a trapped person requiring immediate assistance and an instruction from its operator to return to the base for maintenance due to a low battery level. According to the Three Laws of Robotics proposed by Isaac Asimov, **discuss** what action the robot should take. Explain your answer by identifying the relevant laws and their priority.	**[Marks-5]**	
2.		A startup company is developing an autonomous delivery robot that will operate on a university campus. The robot must detect obstacles while navigating through both indoor and outdoor environments. The engineering team has several sensor options available, including ultrasonic sensors, infrared sensors, and LiDAR sensors. Answer questions a) and b) using this information.		
	a)	**i) Express** the Economic factors and Environmental factors needed to be considered while choosing sensors for this device. **ii) Show** the detail working principle of Ultrasonic sensor and Infrared sensor.	**[Marks-4]**	**CLO-2** *Level-3*
	b)	A DC motor in a robot is equipped with an encoder that produces 20 pulses per revolution. In 1 second, the encoder produces 100 pulses. a) **Calculate** the RPM (revolutions per minute) of the motor. b) If the wheel diameter is 8 cm, **calculate** the linear velocity of the robot in m/s.	**[Marks-4]**	

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	c)	A robotics engineer claims that an autonomous mobile robot can operate effectively using only exteroceptive sensors. Do you agree with this statement? Justify your answer by **exploring** the roles of both exteroceptive and proprioceptive sensors and provide examples of situations where each type is necessary.	[Marks-2]	
	d)	A mobile delivery robot is designed to operate in outdoor environments. To ensure safe operation, it uses an ultrasonic sensor to detect obstacles and a rain sensor to detect rainfall. a) **Construct** the Arduino circuit diagram showing the connection of the ultrasonic sensor and rain sensor. b) **Generate** an Arduino program that performs the following operations: If an obstacle is detected within 20 cm, display "Obstacle Ahead – Stop Robot." If rain is detected, display "Rain Detected – Return to Shelter." If no obstacle and no rain are detected, display "Environment Safe – Continue Operation."	[Marks-5]	

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