

Register No.: ..... Name: .....

## SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FOURTH SEMESTER B.TECH DEGREE EXAMINATION (Regular), JULY 2022

(2020 SCHEME)

Course Code : 20RBT292

Course Name: Sensors and Actuators for Robots

Max. Marks : 100

Duration: 3 Hours

### PART A

*(Answer all questions. Each question carries 3 marks)*

1. Describe about micro-cantilevers. Name any one of the materials used for its fabrication. List the properties of the material that make it suitable for the fabrication of micro-cantilevers.
2. List and explain the selection criteria of sensors for its use in underwater explorations.
3. What do you mean by exteroceptive sensors? List any four of them.
4. Elucidate one application use case of a capacitive type proximity sensor.
5. Describe the hierarchy of a vision system.
6. With a neat block diagram, explain the working of Kinect sensors.
7. Draw the block schematic of a typical electric drive.
8. Enumerate the advantages of electric actuators.
9. Explain about shape memory alloys.
10. State the principle behind electro-optical actuators.

### PART B

*(Answer one full question from each module, each question carries 14 marks)*

#### MODULE I

11. a) Identify the use encoders as position sensors. Compare and contrast linear and rotary encoders. (10)  
b) Explain the principle behind a Hall effect sensor. (4)

OR

12. a) With a neat sketch, illustrate the working of a gyroscope. (8)  
b) Define piezo-resistive effect. Explain the working of any one of the sensors using this principle. (6)

#### MODULE II

13. With supporting sketches, explain any one method for finding out the speed of a target with respect to a fixed as well as a moving platform. (14)

OR

14. a) Illustrate the range measurement using optical triangulation method. (9)  
b) For a robot which follows the black line on a white surface, identify the sensor to be deployed? Substantiate your answer. (5)

**MODULE III**

15. a) Differentiate CCD cameras from CMOS cameras. Which can be used to capture high quality images with low noise? Justify your answer. (7)  
b) Classify various edge detection techniques. (7)

**OR**

16. Explain in detail the criteria based on which sensors are selected for different applications. (14)

**MODULE IV**

17. a) Draw the symbol and schematic of a proportional control valve and explain its working. (9)  
b) Explain the working of a hydraulic actuator. (5)

**OR**

18. a) Compare hydraulic and pneumatic systems. (6)  
b) Explain how the speed and torque of an electric motor can be controlled? (8)

**MODULE V**

19. List various linear actuation mechanisms. Illustrate any three linear actuators with supporting diagrams. (14)

**OR**

20. List the classification of gears. Also elucidate the working of any one gear from each category. (14)

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