

**B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024**

Third Semester

**Mechanical and Automation Engineering****20MUPW301 - SENSORS IN AUTOMATION**

Regulations - 2020

Duration: 3 Hours

Max. Marks: 100

**PART - A (MCQ) (20 × 1 = 20 Marks)**

Answer ALL Questions

- |  | <i>Marks</i> | <i>K-<br/>Level</i> | <i>CO</i> |
|--|--------------|---------------------|-----------|
| 1. What is the smallest change in the input signal that can be detected by and instrument called?<br>(a) Accuracy                      (b) Precision                      (c) Resolution                      (d) Sensitivity  | 1            | K1                  | CO1       |
| 2. The change in resistance of an electrical strain gauge with a gauge factor of 2.0 and resistance of 50 Ω when subjected to a strain of 0.001 is<br>(a) 0.1 Ω                      (b) 0.01 Ω                      (c) 0.001 Ω                      (d) 0.0001 Ω   | 1            | K1                  | CO1       |
| 3. Sensors convert signals from analog to _____ domain.<br>(a) Digital                      (b) Electrical                      (c) Mechanical                      (d) Both a and b   | 1            | K1                  | CO1       |
| 4. Potentiometric resistance transducer measures _____.<br>(a) linear displacement                      (b) Triangular displacement<br>(c) Square displacement                      (d) Rectangular displacement   | 1            | K1                  | CO2       |
| 5. The layers present in the Bluetooth technology are named as<br>(a) Application layer                      (b) Middleware layer<br>(c) Data link layer                      (d) All of the mentioned   | 1            | K1                  | CO2       |
| 6. Compared to a magnetic encoder, _____ can offer higher resolution and higher accuracy.<br>(a) Absolute encoders                      (b) Linear encoders                      (c) Magnetic encoder                      (d) Optical encoder   | 1            | K                   | CO2       |
| 7. In a foil strain gauge, strain is detected through _____.<br>(a) capacitance element                      (b) a resistance wire                      (c) a gold foil                      (d) a metal foil  | 1            | K1                  | CO3       |
| 8. A _____ is a measurement device that uses gravity to measure the inclination of an object.<br>(a) Strain gauge                      (b) Inclinator                      (c) Gyroscope                      (d) Magento resistance   | 1            | K1                  | CO3       |
| 9. Hall sensor is used to measure the following<br>(a) Angular velocity                      (b) Position of shaft<br>(c) Strength of magnetic field                      (d) All of the mentioned   | 1            | K1                  | CO3       |
| 10. Thermistors _____<br>(a) sense large changes in temperature<br>(b) cannot sense any change in temperature<br>(c) sense small changes in temperature<br>(d) have a positive temperature coefficient of resistance   | 1            | K1                  | CO4       |
| 11. Pressure measurement devices make use of _____.<br>(a) non-elastic member                      (b) elastic member<br>(c) bendable member                      (d) non-bendable member  | 1            | K1                  | CO4       |
| 12. Which of the following are piezoelectric substances?<br>1. Barium titanate                      2. Lead titanate                      3. Lead zirconate                      4. Cadmium sulphate.<br>(a) 1, 2 and 4                      (b) 1,3 and 4                      (c) 1, 2 and 3                      (d) 2, 3 and 4 | 1            | K1                  | CO4       |
| 13. On the bases of application of optic fiber sensor, which of the following is not considered to be the classification of fiber optic sensor?<br>(a) biomedical/photometric sensors                      (b) physical sensors<br>(c) thermal sensors                      (d) chemical sensors                                   | 1            | K1                  | CO5       |

14. Photoconductors are made of \_\_\_\_\_ 1 K1 CO5  
 (a) thick layer of semiconductor (b) thin layer of semiconductor  
 (c) capacitive substrate (d) inductive substrate
15. Which of the following is not correct for fiber optic sensors? 1 K1 CO5  
 (a) Immune to electro magnetic interference (b) Immune to radiation hazard  
 (c) Can be used in harsh environments (d) None of the mentioned
16. In photo emissive transducers, electrons are attracted by \_\_\_\_\_ 1 K1 CO5  
 (a) Cathode (b) Anode (c) Grid (d) Body
17. What is the main purpose of a data acquisition system? 1 K1 CO6  
 (a) To control processes (b) To transmit data over long distances  
 (c) To collect and analyze data (d) To increase the complexity of data handling
18. Which type of data logger is typically used for environmental monitoring? 1 K1 CO6  
 (a) Temperature data logger (b) Pressure data logger  
 (c) Voltage data logger (d) All of the above
19. What is the purpose of a pressure sensor in a manufacturing environment? 1 K1 CO6  
 (a) To monitor air quality (b) To detect temperature changes  
 (c) To measure the force exerted by fluids (d) To control lighting conditions
20. What is the role of a knock sensor in an automobile engine? 1 K1 CO6  
 (a) To monitor fuel level (b) To detect engine vibrations and knocking  
 (c) To measure exhaust temperature (d) To control the throttle position

**PART - B (10 × 2 = 20 Marks)**

Answer ALL Questions

21. Draw the functional block diagram of a measurement system. 2 K1 CO1
22. List the factors responsible in selection of transducer. 2 K1 CO1
23. What is LIDAR? 2 K1 CO2
24. List down the types of potentiometer sensors. 2 K1 CO2
25. Mention the applications of strain gauge. 2 K1 CO3
26. What are the types of gyroscope? 2 K1 CO3
27. State the principle of hot wire anemometer. 2 K1 CO4
28. Classify the materials used for thermistors. 2 K1 CO4
29. What is photo emissive cell? 2 K1 CO5
30. List out the major areas where sensing is required in automobile systems. 2 K1 CO6

**PART - C (6 × 10 = 60 Marks)**

Answer ALL Questions

31. a) In a test, temperature is measured 100 times with variations in apparatus and procedures. After applying the corrections, the results are 10 K2 CO1

Temp°C	397	398	399	400	401	402	403	404	405
Freq of Occurrence	1	3	12	23	37	16	4	2	2

Calculate (a) arithmetic mean, (b) mean deviation, (c) standard deviation, (d) the probable error of one reading, (e) the probable error of mean and standard deviation, (f) the standard deviation of standard deviation.

**OR**

- b) Explain calibration technique in detail and draw the calibration curve in general. 10 K2 CO1
32. a) With neat sketch explain the construction and working principle of LVDT. Explain how the magnitude and direction of the displacement of core is detected. 10 K2 CO2

**OR**

- b) What is Inductive transducer? Explain its working principle with its advantages and disadvantages. 10 K2 CO2
33. a) Describe the basic principle of hall effect sensor and show how it can be used as a magnetic field sensor. 10 K2 CO3

**OR**

- b) Enumerate the different types of MR sensor with suitable example. 10 K2 CO3
34. a) Explain the constructional and functional details of thermocouple with neat sketch. 10 K2 CO4

**OR**

- b) Discuss the principle, construction, working and applications of Ultrasonic Flow meter with neat sketch. 10 K2 CO4
35. a) Explain the construction and working of photo voltaic with neat sketch. 10 K2 CO5

**OR**

- b) How is optical fibre used for stress sensing? Describe any microbend sensor and discuss its operation. 10 K2 CO5
36. a) Discuss the importance of Data logging and Explain the components of Data logger with neat diagram. 10 K2 CO6

**OR**

- b) Summarize the effects of Environmental monitoring and explain the sensors involved in monitoring. 10 K2 CO6