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**Question Paper Code : 81058**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

Fifth/Seventh Semester

Aerospace Engineering

OAN 551 – SENSORS AND TRANSDUCERS

(Common to: Aeronautical Engineering/Automobile Engineering/ Civil Engineering/Computer Science and Engineering/Computer and Communication Engineering/Electrical and Electronics Engineering/Industrial Engineering/Industrial Engineering and Management/Manufacturing Engineering/Marine Engineering/Material Science and Engineering/Mechanical Engineering/Mechanical Engineering (Sandwich)/Mechatronics Engineering/Production Engineering/Robotics and Automation/Artificial Intelligence and Data Science/Bio Technology/Computer Science and Business Systems/Food Technology/Information Technology/Pharmaceutical Technology)

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Differentiate Selectivity and Specificity of the transducer.
2. Define instrumental errors with an example.
3. Define the principle of operation of potentiometer.
4. What are the types of segments used in GPS?
5. Define load cell and mention its types.
6. List the types and applications of inclinometers.
7. State the different approximation methods employed in resistive thermometers.
8. What are the characteristics of Nano sensors?

9. Enumerate the input characteristics of a transducer.
10. What are the major drawbacks in using a data acquisition system?

PART B — (5 × 13 = 65 marks)

11. (a) Explain the various types of errors associated in measurement and discuss their minimization techniques. (13)

Or

- (b) Describe in detail the classification of sensors and their calibration techniques. (13)

12. (a) Distinguish between DC and AC potentiometers and explain any two applications of AC and DC potentiometers. (13)

Or

- (b) Describe the construction and working of optical sensors with necessary functional block diagrams. (13)

13. (a) Explain the basic principle of operation of the compass and discuss various types of compass with neat sketch. (13)

Or

- (b) Describe the working principle of magnetic sensor and explain the various types and advantages of magnetic sensors. (13)

14. (a) (i) Discuss in detail the principle of operation of radiation sensors with neat sketch. (10)

- (ii) Mention any two applications of radiation sensors. (3)

Or

- (b) Describe the significance of each component in the piezo electric transducer with neat sketch and deduce the equation for coupling coefficient. (13)

15. (a) Explain the principle of operation of various types of amplifiers used in acquiring and processing an analog signal with neat sketch. (13)

Or

- (b) (i) Explain the construction and working of data logging. (8)

- (ii) Mention the applications of DAQ system in environmental monitoring. (5)

PART C — (1 × 15 = 15 marks)

16. (a) A thermistor has a resistance of  $2000\ \Omega$  at the freezing point of water ( $0^\circ\text{C}$ ) and  $400\ \Omega$  at  $50^\circ\text{C}$ . The relationship between resistance and temperature is given by  $R_T = aR_0e^{b/T}$ .
- (i) Calculate the constants  $a$  and  $b$ . (8)
  - (ii) Calculate the range of resistance to be measured if the temperature varies from  $20^\circ\text{C}$  to  $80^\circ\text{C}$ . (7)

Or

- (b) A differential amplifier was provided with a common-mode input of  $600\ \text{mV}$  and a differential input of  $20\ \text{mV}$ , yielding corresponding outputs of  $6\ \text{mV}$  and  $2\ \text{mV}$ , respectively.
- (i) Find the difference-mode and common-mode gains. (10)
  - (ii) Find the CMRR value. (5)