Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : 40975

B.E./B.Tech DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Fifth/Seventh Semester

Aeronautical Engineering

OAN 551 – SENSORS AND TRANSDUCERS

(Common to : Aerospace 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/Bio Technology/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. State the importance of static and dynamic calibrations.

3. Define the principle of operation of LIDAR.

4. Briefly state the principle of working of RVDT.

5. Define gauge factor of a strain gauge.

6. What is an Inclinometer? State two applications of Inclinometer.

7. Compare the working principle of thermistor and thermocouple.

8. Draw the functional block diagram of smart sensor.

9. Draw the Sample and Hold Circuit used in ADC.

10. What are the sensors used in aerospace applications?

PART B — (5 × 13 = 65 marks)

11. (a) Discuss in detail the different types of errors in measurement system and explain the methods of correcting those errors. (13)

Or

(b) Using an ammeter, the current values measured in a circuit are 6.34 A, 6.75 A, 6.43 A, 5.25 A, 6.25 A, and 6.58 A. Calculate the following parameters of the ammeter.

   (i) Average Deviation (3)

   (ii) Standard Deviation (4)

   (iii) Variance (3)

   (iv) Arithmetic Mean. (3)

12. (a) Discuss in detail the working principle and types of optical encoders with neat sketch. (13)

Or

(b) Explain the principle of operation of GPS and Bluetooth range sensors with necessary functional block diagrams. (13)

13. (a) (i) With suitable functional block diagram discuss the principle of operation of a magneto resistive transducer (10)

   (ii) State some of its applications. (3)

Or

(b) (i) Discuss the working principle of a coaxial type torque sensor. (10)

   (ii) State the reasons for the inactive zone provided in the sensor. (3)

14. (a) Discuss in detail the principle of operation of LASER sensors and explain the salient features of LASER Doppler Velocimeter. (13)

Or

(b) Explain the principle, construction, working and applications of Nano sensors with neat sketches. (13)

15. (a) Explain in detail on the role of sensors in Environmental monitoring with an example. (13)

Or

(b) Draw the circuit diagram of an Instrumentation amplifier and deduce the expression for the gain/amplification factor. (13)

PART C — (1 × 15 = 15 marks)

16. (a) A LVDT output is recorded by a self-balancing potentiometric recorder having its natural frequency of 15 Hz and damping ratio of 0.707. The LVDT is excited by 12 V at 50Hz power supply. Calculate the maximum frequency of the displacement signal that can be recorded with an error of + 1.5%.

Or

(b) A thermistor has a resistance of 5.2 kΩ at 0°C and 520 Ω at 52°C. The resistance temperature relationship is given by RT = a R_0 exp(b/T). Calculate the range of resistance to be measured in case the temperature varies from 30°C to 90°C.

_____