Total No. of printed pages = 3

ME 181603

16/6/23

Roll No. of candidate

2023

B. Tech. 6th Semester End-Term Examination

Mechanical Engineering

MECHANICAL MEASUREMENT AND INSTRUMENTATION

(New Regulation (w.e.f. 2017-18) & New Syllabus (w.e.f. 2018-19)

Full Marks – 70

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Answer the following : (MCQ/Fill in the blanks   (10 × 1 = 10)

   (i) In an LVDT, the two secondary windings are connected in differential to obtain

      (a) Higher output voltage

      (b) An output voltage which is phase sensitive i.e. the output voltage has a phase which can lead us to a conclusion whether the displacement of the core took place from right to left or left to right

      (c) In order to establish the null or the reference point for the displacement of the core

      (d) Both (b) and (c)

   (ii) The temperature measurement by a thermocouple is

      (a) Primary measurement.

      (b) Secondary measurement.

      (c) Tertiary measurement.

      (d) Any of the above.

   (iii) Dynamic response consists of

      (a) Two parts, one steady state and the other transient state response.

      (b) Only transient state response.

      (c) Only steady state response.

      (d) Steady state and transient frequency response.

[Turn over

(iv) Which one of the following devices cannot be used to measure pressure?

    (a)   Strain gauge   (b)   LVDT

    (c)   Piezoelectric crystal   (d)   Pyrometer

(v) Dummy strain gauges are used for

    (a)   Calibration of strain gauges

    (b)   Compensation of temperature variations

    (c)   Increasing bridge sensitivity

    (d)   All of the above

(vi) The stroboscopic method of speed measurement has the advantage that

    (a)   The method is simple and straight forward

    (b)   The multiples of angular speed can be measured

    (c)   A stationary image is observed

    (d)   There is no need of any physical contact between the instrument and rotating shaft

(vii) X - Y recorders record a quantity

    (a)   With respect to another quantity

    (b)   On X axis with respect to time on Y axis

    (c)   On Y axis with respect to time on X axis

    (d)   Any of these

(viii) In CRT the focusing anode is located

    (a)   Between pre-accelerating and accelerating anodes

    (b)   After accelerating anode

    (c)   Before pre-accelerating anodes

    (d)   None of the above

(ix) Torque can be measured by the following methods

    (a)   Using strain gauges

    (b)   Using inductive transducers

    (c)   Using magneto-stricture transducers

    (d)   All of the above

(x) If a thermometer reads 92.35°C and the static correction given in the correction curve is −0.07°C, then the true value the temperature is

    (a)   92.42°C   (b)   92.28 °C

    (c)   92.45 °C   (d)   None of the above

2. (a) Formulate the governing equation of a first order system- temperature measurement by a thermal measuring element (thermocouple or thermometer). (7)

(b) What are 'desired', 'modifying' and 'interfering' inputs for an Instrumentation System? Draw a block diagram for showing their influence on the output. (3+3=6)

(c) What is the difference between scale range and scale span? (2)

3. (a) Explain Linear Variable Differential transformer used to measure linear displacement with neat diagram. (4+3=7)

(b) Why the dummy strain gauges may be used with active strain gauge? Draw the diagram to explain. (2+2=4)

(c) Explain Load cell or proving ring with neat diagram. (2+2=4)

4. (a) Give at least three advantages and disadvantages of capacitive transducer for measurement of pressure. (3+3=6)

(b) Explain magneto- stricture transducers with neat diagram. (4+3=7)

(c) Name two pressure sensitive primary devices. (2)

5. (a) Write the names of the different methods used for the measurement of angular velocity. (5)

(b) Write how LVDT can be used to measure vibration. (5)

(c) What are the desirable properties of materials to be used in resistance thermometers. (5)

6. (a) Explain the working principle of hot wire anemometer with neat diagram. What is the mechanical quantity it can measure? (5+3=8)

(b) What are Lissajous patterns? Draw lissajous pattern with two equal voltages of same frequency and phase shift of ϕ. (3+4=7)

7. (a) What is a strip chart recorder? Explain and draw the neat diagram of it. (3+4=7)

(b) Name five display devices. (5)

(c) What is a multimeter? What are the parameters it can measure? (1+2=3)