ME 181603

3/8/22

Roll No. of candidate | | | | | | | | | | |

2022

B.Tech. 6th Semester End-Term Examination

MECHANICAL MEASUREMENTS AND INSTRUMENTATION

(New Regulation & New Syllabus)

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. Choose the most appropriate one from given four alternatives : $(10 \times 1 = 10)$

(i) In measurement systems, which of the following are undesirable static characteristics :
   (a) Sensitivity and accuracy
   (b) Drift, static error, and dead zone
   (c) Reproducibility and non-linearity
   (d) Drift, static error, dead zone, and non-linearity

(ii) Identify the correct statement from the following.
   (a) LVDT is an active transducer
   (b) At null point the output voltage of LVDT should be maximum
   (c) LVDT can tolerate a high degree of shock and variation, especially when the core is loaded with spring
   (d) LVDT does not get affected by the vibrations and temperature variation

(iii) For a given strain gauge, the relative change in electrical resistance to mechanical strain $\frac{dR/R}{dL/L}$ is called
   (a) Stress factor
   (b) Gauge factor
   (c) Resistivity
   (d) Poisson's ratio

(iv) Which transducer measure changes in acceleration, pressure, strain and temperature?

(a) Photoelectric transducer

(b) Capacitive transducer

(c) Piezo-electric transducers

(d) Inductive transducer

(v) Which of the following is a practical application of Strain Gauge:

(a) Cables of civil bridges

(b) Railway Engineering

(c) Aerospace Engineering

(d) All of these

(vi) Photoconductive transducers produce output ————————

(a) due to change in inductance

(b) due to change in light

(c) due to change in resistance

(d) due to change in temperature

(vii) Which of the following conditions is/are to be satisfied by the seismometer for it to be used as velometer?

(a) It's natural frequency should be large

(b) It's natural frequency should be small

(c) It's output signal should be proportional to relative acceleration of the vibrating body

(d) None of the above

(viii) The output of a flowmeter based on electromagnetic induction has

(a) Variable frequency

(b) Variable amplitude

(c) Variable frequency and amplitude

(d) Variable dc amplitude

(ix) A CRO indicates

(a) Peak to peak value of voltage

(b) RMS value of voltage

(c) Average value of voltage

(d) DC value of voltage

(x) X -Y recorders

(a) Record one quantity with respect to another quantity

(b) Record one quantity on X-axis with respect to time on Y-axis

(c) Record one quantity on Y-axis with respect to time on X-axis

(d) None of the above

2. (a) Explain different types of instrumentation systems. (3)

(b) Describe in detail the different types of dynamic errors in a measurement system. (5)

(c) Four length bars A, B, C, D of approximately 250 mm each are to be calibrated with standard calibrated metre bar which is actually 0.0008 mm less than a metre. It is also found that, bar 'B' is 0.0002 mm longer than bar 'A', bar 'C' is 0.0004 mm longer than bar 'A' and bar 'D' is 0.0001 mm shorter than bar 'A'. The length of all four bars put together is 0.0003 mm longer than the calibrated standard metre. Determine the actual dimensions of each bar. (7)

3. (a) With a block diagram, distinguish between primary and secondary transducers. (7)

(b) Derive an expression for gauge sensitivity of a strain gauge for measurement of strain on account of force acting on a cantilever using four active strain gauges. (8)

4. (a) Describe the different modes of operation of piezo electric transducers. (7)

(b) What is the principle of inductive torque transducer? (4)

(c) What are the different types of magneto-strictive transducer? (4)

5. (a) What is the principle of photoelectric tachometer? Explain with neat figure. (5)

(b) Explain the working of electrical resistance type thermometer. (8)

(c) A thermometer has a time constant of 3.5s. it is quickly taken from a temperature degree celsius to a water bath having temperature 100 degree celsius. What temperature will be indicated after 1.5s? (2)

6. (a) Explain the principle of turbine flow meter. What is the output of a turbine meter? (7)

(b) With neat figure explain the working principle of a CRO. (8)

7. (a) Draw a neat diagram on X–Y recorder. (3)

(b) What are the different types of magnetic recording? (4)

(c) Explain about different data display and storage systems. (8)