

Code No: RT41354

R13**Set No. 1**

IV B.Tech I Semester Supplementary Examinations, February - 2019
MECHANICAL MEASUREMENTS AND INSTRUMENTATION
(Agriculture Engineering)

Time: 3 hours

Max. Marks: 70

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any THREE questions from Part-B

PART-A (22 Marks)

1. a) Define accuracy and sensitivity of an instrument. [4]
b) What is static sensitivity? [3]
c) Define (i) atmospheric pressure (ii) gauge pressure and (iii) absolute pressure. [3]
d) Enumerate advantages and applications of strain gauges. [4]
e) Explain the working of liquid in glass thermometer. [4]
f) What are the desirable properties of materials used in resistance thermometers? [4]

PART-B (3x16 = 48 Marks)

2. a) Explain the elements of a generalized measurement system. [8]
b) A Bourdon pressure gauge having a linear calibration has a 50 mm long pointer. It moves over a circular dial having an arc of 270° . It displays a pressure range of 0 to 15 bar ($1 \text{ bar} = 10^5 \text{ Pa}$). Determine the sensitivity of the Bourdon gauge in terms of scale length per bar (i.e., mm/bar). [8]
3. a) Explain different static performance characteristics of an instrument. [8]
b) Explain about different data display and storage systems. [8]
4. a) Explain the working of well-type manometer with a neat sketch. [8]
b) A McLeod pressure gauge has volume of bulb $V=100 \times 10^{-6} \text{ m}^3$ and measuring capillary diameter of 1mm. Calculate the pressure indicated when the reading of the measuring capillary is 30 mm in case approximate formula is used. What is the error if the exact formula is used for measurement of pressure? [8]
5. a) A bridge circuit has two fixed resistors and two strain gauges all of which have a value of 120Ω . The gauge factor is 2.04 and strain applied to twin strain gauges, one in tension and the other in compression is 165×10^{-6} . If the battery current is 50 mA, determine the (i) voltage output of the bridge, (ii) the sensitivity in volt per unit strain. If the galvanometer connected to output terminals reads $100 \mu\text{V}$ per scale division and if $1/10^{\text{th}}$ of a division can be read with confidence, determine the resolution. [8]
b) Derive an expression for gauge sensitivity of a strain gauge for measurement of strain on account of force acting on a cantilever using one active strain gauge in Wheatstone bridge. [8]

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6. a) Explain the classification of temperature measuring devices. [8]
b) A bimetallic strip is constructed of strips of yellow brass and Invar bonded together at 30°C. Each has a thickness of 0.3 mm. Calculate the radius of curvature when a 60 mm strip is subjected to a temperature of 100°C. One end of the bimetallic strip is fixed. The thermal coefficient of expansion of yellow brass and Invar are respectively $20.2 \times 10^{-6}/^{\circ}\text{C}$ and $1.7 \times 10^{-6}/^{\circ}\text{C}$ and their modulus of elasticity are respectively 96.5 GN/m^2 and 147 GN/m^2 . [8]
7. a) Two machines are working in noisy environments. The background noise when the machines are inoperative is 65 dB. If the two machines having individual sound pressure levels of 84 and 88 dB are switched on simultaneously, determine the combined sound pressure level of the machines along with the background noise. [8]
b) Explain the working of linear variable differentiation transformer (LVDT) for displacement measurement. [8]