Code No: **RT41354** **R13** **Set No. 1**

IV B.Tech I Semester Supplementary Examinations, February/March - 2018

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) Briefly explain the classification of measurements. [4]
   b) Explain the working of mechanical amplifying element. [4]
   c) What are the different electromechanical pressure devices? [4]
   d) What are the materials used for manufacturing strain gauges? [3]
   e) What are the salient features of liquid in glass thermometers? [4]
   f) Calculate the sound pressure level of a rocket engine producing an acoustic pressure of 0.7 N/m. [3]

PART–B *(3x16 = 48 Marks)*

2. a) Briefly describe the functional elements of the instruments with examples. [8]
   b) The true value of voltage across a resistor is 50 V. The measurement finds a value of 49 V. Calculate (a) the absolute error (b) the percent error (c) the percent accuracy. [8]

3. a) Explain the classification of electrical indicating instruments. [8]
   b) Explain the working of operational amplifier. [8]

4. a) List out different types of manometers and explain the working if inclined tube manometer. [8]
   b) A Bridgman gauge is to be used to measure a pressure of 80 MN/m^2 using a Manganin element having a resistance of 200 Ω at atmospheric pressure. The co-efficient of manganin is 30×10^{-12}/Pa. Calculate the resistance of the gauge under high pressure conditions. If the gauge is one leg of a bridge whose other legs all have a value of exactly 200 Ω, calculate the voltage output of the bridge for a constant bridge input voltage source of 34 V. [8]

5. a) What are the special problems encountered while using strain gauges for experimental work? [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 two active strain gauges in adjacent arms. [8]

6. a) A bimetallic thermometer is made up of strips of a nickel-chromium alloy and Invar bonded together at 25˚C. Each strip has a thickness of 1 mm and a length of 50 mm. Calculate the radius of curvature produced when the strip is unstrained and is subjected to a temperature of 200˚C. For nickel chrome alloy and Invar the moduli of elasticity and co-efficients of expansion respectively are 216 GN/m^2, 147 GN/m^2 and 12.5×10^{-6}/˚C, 1.7×10^{-6}/˚C. [8]
   b) Explain the working of gas thermometers. [8]

7. a) Explain the working of different mechanical tachometers. [8]
   b) Explain the working of proving ring used for force measurement. [8]