MANIPAL INSTITUTE OF TECHNOLOGY
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IV SEMESTER B.TECH. (MECHATRONICS ENGINEERING)
END SEMESTER EXAMINATIONS, APR/MAY 2017

SUBJECT: MEASUREMENTS AND INSTRUMENTATION [MTE 2204]

REVISED CREDIT SYSTEM
(24/04/2017)

Time: 3 Hours   MAX. MARKS: 50

Instructions to Candidates:

❖ Answer **ALL** the questions.
❖ Missing data may be suitable assumed.

1A. Compare static and dynamic characteristics of measuring instruments. Describe any one static characteristic. **3**

1B. A moving coil ammeter has a fixed shunt of 0.05Ω. With a coil resistance of R= 1500 Ω and a potential difference of 600mV across it, full scale deflection is obtained. **4**

  (i) To what shunted current does this correspond?
  (ii) Calculate the value of R to give full scale deflection when shunted current I is 12A, 75A
  (iii) With what value of R is 40% deflection obtained with I = 100A?

1C. With suitable diagram and examples describe the three types of fits in metrology. **3**

2A. The stress in a mild steel flat circular diaphragm is given by: **3**

$$S = \frac{3D^2 p}{16t^2} \ N/m^2$$

Where D and t are respectively diameter and thickness of diaphragm in mm and p is the applied pressure in N/m². A diaphragm has a diameter of 15mm, thickness of 0.2mm and the pressure applied is 300x10³ N/m².

  (i) Calculate the stress.
  (ii) The known error in diameter is +1% and in thickness is 3%. Calculate the error in stress (express in terms of % and N/m² as well)

2B. Compare waviness (secondary texture) and roughness (primary texture) in surface texture measurements. **3**

2C. A group of students built a small remote controlled (RC) car and planned to measure the vibrations on the RC car, but due to torque constraints they could not afford for an additional power supply on board hence cannot have a power supply for their accelerometer. Suggest the best suited accelerometer for this scenario and explain with neat diagram the working principle of the chosen accelerometer. **4**

3A. Derive the balanced equation for Kelvin's Double Bridge. Explain the significance of Kelvin's Double Bridge over Wheatstone Bridge. **4**

3B. In a small scale industry power cuts were very often, suggest a best suited type of encoder for such situation so that there is no data loss. Explain the construction and working of the chosen encoder. Justify your selection of encoder. **6**

4A. Derive an equation to measure an unknown capacitance with the help of D'Sauty's bridge. What are the limitations of this bridge and how are they overcome using a modified form of D'Sauty's bridge? **4**

4B. Describe the two main steps involved in Analog to digital signal conversion with suitable example. **6**

5A. Explain the working principle of Linear Variable Differential Transducer with a neat diagram. **2**

5B. Suggest a temperature sensor for measuring temperature of molten metal in steel industry. Justify your answer by explaining the construction and working of the chosen temperature sensor. **4**

5C. Explain the construction and working of variable area flowmeter with suitable diagram. **4**