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IV SEMESTER B.TECH. (MECHATRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, APRIL 2018

SUBJECT: MEASUREMENTS & INSTRUMENTATION [MTE 2204]

(27/04/2018)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ALL the questions.
- ◆ Data not provided may be suitably assumed with justification.
- **1A** Identify the type of characteristic analysis shown in the Fig.1A, Also explain any three characteristics of such type of analysis.

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- 1B A Galvanometer gives a deflection of 150mm on a linear scale distant 2.5m 03 for a steady current of 1µA. The period of oscillations is 4s and the movement of inertia of the moving system is 1x10⁻⁶kgm². Calculate the coil circuit resistance necessary to obtain critical damping, assuming damping torque produced due to other effects to be negligible. (Note: the galvanometer uses a mirror & scale arrangement with a collimated light falling on the mirror.
- 1C With a neat diagram, elaborate on the usage of Ayrton Shunt to protect 03 sensitive galvanometer from excessive current. In what way High resistance and Low resistance can be connected to a Galvanometer?

- 2A Define the following by mentioning its application for each :
 - (i).Quantizing,
 - (ii). Sweep circuit
 - (iii).Sample and hold,
 - (iv).Anti-aliasing,
- 2B Discuss on the usage of the circuit shown in Fig.2B in measuring High (unknown) resistance. Also, derive the expression for determining the unknown resistance (R_x).





- 2C The Dead zone in a certain Pyrometer is 0.125 percent of span. The o2 calibration is 400°C to 1000°C. What temperature change must occur before it is detected?
- 3A In the production of steel in a smelting furnace, a non-contact based 05 temperature sensor must be used for the measurement of molten steel temperature without affecting the process control and metallurgical quality. Suggest a suitable temperature sensor for this purpose. With a neat diagram, explain its construction and working principle.
- **3B** Cold drawn shaft up to accuracy of ± 0.01 mm are available and an **03** interference fit is designed for a 50mm nominal size of hole. Determine the tolerance for hole if minimum and maximum interference are to be 0.01mm and 0.07mm respectively.
- 3C Elaborate on the usage of Capacitor sensor with sketch for the measurement 02 of mechanical shock, vibration and acceleration in machines.
- 4A For the flow measurement of water with ions (such as salt water), suggest 04 a suitable flow meter. Explain the operation of this flow meter using a neat diagram.

- 4B Derive an expression for modified De Sauty's bridge with its circuit. Also04 mention about its dissipation factor.
- 4C The solution for the unknown resistance of the Wheatstone bridge is: 02 R=(Q*S)/P, where P= 100±0.5%Ω, Q=1000±0.5%Ω, and S=842±0.5%Ω. Determine the magnitude of the unknown resistance and the limiting error in percent and in ohm for the unknown resistance R.
- 5A Discuss the theory used for designing the Gauging. Cite an example to reason why a gauge used for measuring the 'Least Material Condition' is relatively shorter than the 'Maximum Material Condition'? And why it should measure only one dimension at a given time?
- 5B Explain with suitable diagram how LVDT and bourdon tube can be 03 physically combined for converting mechanical displacement into proportional output voltage.
- **5C** A platinum thermometer has a resistance of 150 Ω at 29°C. Find its **02** resistance at 75°C if the platinum has a resistance temperature coefficient of 0.00462/°C. If the thermometer has a resistance of 200 Ω , calculate the temperature.