

M. MECH. ENGG. EXAMINATION, 2017 (1<sup>st</sup> Semester)

## EXPERIMENTAL METHODS IN MECHANICAL SYSTEMS

Time : 3 hours

Full Marks: 100

Answer any five [5] questions

All questions carry equal marks

1. What do you mean by 'Modifying input' and 'Interfering input'? What is signal filtering? Explain with suitable example how spurious inputs can be eliminated using signal filtering. 7+3+10
- 2a. Explain static calibration and mention the basic steps of the same. 6
- 2b. Show how high gain feedback can be useful in correcting the spurious inputs of a measurement system. 9
- 2c. What do you mean by 'Hysteresis' and 'Dead Space'. 5
- 3a. Distinguish between analog and digital modes of operation. 5
- 3b. The resistance of a certain size of copper wire is given by 15  
 $R = R_0 [1 + \alpha(T - 20)]$   
 where  $R_0$  is the resistance at 20°C, and have been measured for 10 times [in ohm] as 6.18, 6.14, 6.25, 6.11, 6.10, 6.18, 6.11, 6.18, 6.20, 6.19.  
 $\alpha = 0.004/^\circ\text{C} + 2\%$ , is the temperature coefficient of resistance.  
 the Temperature  $T$  is measured for 10 times [in °C] as 30.10, 30.11, 29.85, 29.99, 30.01, 30.05, 29.98, 30.05, 30.11, 30.11.  
 For a 95% reliability, calculate the uncertainty in measurement of the normal resistance of the wire  $R$ .
- 4a. Cite the relative advantages and disadvantages of null and deflection methods of measurement. 5
- 4b. What do you mean by 'accuracy' and 'precision'. 5
- 4c. What is the basic difference between 'variable conversion element' and 'variable manipulation element' in a measurement system? 4
- 4d. Explain with a suitable example how opposing inputs can be helpful in correcting spurious inputs of a measurement system. 6
- 5a. What do you mean by generalized static stiffness and input impedance? Explain with a suitable example. 6
- 5b. With a suitable example explain the dynamic characteristics of a first order instrument and show the step and frequency response of the same. 14
6. Write short notes on the followings: 4 x 5
- Active and Passive Transducers
  - Loading Effect
  - Mechanical Compliance
  - Random and Systematic Error
  - Threshold and Resolution