Total No. of Questions :10] *[Total No. of Printed Pages :4*

Roll No .....

ME - 503

B.E. V Semester

Examination, December 2012

Mechanical Measurement and Control

Time : Three Hours

Maximum Marks : 70/100

Note : *1. Attempt five questions in all. selecting one question from each unit.*
2. Assume suitable data if necessary.
3. All questions carry equal marks.

Unit - I

1. a) Distinguish between the following instruments and give appropriate examples in each case:

   i) Deflection and Null type.

   ii) Manually operated and automatic type.

   iii) Analog and digital type.

   iv) Contacting and non-contacting type.

   b) Analyse the following devices as a generalized measurement system:

   i) Bourdon tube pressure gauge.

   ii) Digital revolution counter.

OR

2. a) Define the following terms:
   i) Repeatability
   ii) Accuracy
   iii) Precision
   iv) State sensitivity
   v) Resolution

   b) Define the following terms used for dynamic systems with proper diagrams.
   i) Speed of response and measuring lag.
   ii) Fidelity and dynamic error.
   iii) Over shoots.
   iv) Dead time and dead zone.

Unit - II

3. a) What are the assumptions made for deriving the normal error distribution? Define the standard deviation and explain the meaning of probable error.

   b) Explain clearly how the method of least squares is adopted in fitting scientific observed data in the form of suitable equation.

OR

4. a) Eight different students turned on the circuit for resonance and the values of resonant frequency in kHz were recorded as:

   412, 428, 423, 415, 426, 411, 423, 416.

   Calculate the following:

   i) Arithmetic mean
   ii) Average deviation
   iii) Standard deviation
   iv) Variance

b) Explain the significance of confidence interval and confidence level in statistical analysis of data.

Unit - III

5. a) Explain with a neat sketch the constructional features and basic working principle of Mcleod gauge used for the measurement of low pressure.

   b) Describe the construction and working of a venturimeter. Derive an expression for actual flow rate of incompressible fluids.

OR

6. a) Sketch a thermocouple circuit showing the important details. How output from a thermocouple is measured and what are the sources of errors in thermocouples?

   b) Draw diagrams to show how LVDT's can be used with bellows elements and Bourdon tubes for measurement of pressure. Give them advantages and disadvantages.

Unit - IV

7. a) What are the requirements of materials for strain gauge? Explain the construction and bonding technique for an electrical resistance strain gauge on what factors the selection of grid material based and why?

   b) Explain the stroboscopic method for angular speed measurement. What are the limitation of this method?

OR

8. a) Explain the construction and working of the following:

   i) Rope brake

   ii) Prony brake

   Explain the advantages and disadvantages of each.

b) What are load cells? Explain the working of a load cell using strain gauges with suitable diagram.

Unit - V

9. a) Discuss the salient features of a first order system response with step input. Show that after a time constant of the system, the output reaches 0.63 of the step value.

b) Represent the block diagram of a feed back control system. Show that the closed loop transfer function of the system with negative feed back is-

$$\frac{C(s)}{R(s)} = \frac{G(s)}{1 + G(s)\,H(s)}$$

OR

10. a) Discuss the dynamic response of II order instrument to standard test inputs.

b) Establish an expression for the value of transfer function for a mechanical translational system.

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