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

Roll No. ....

**ME-503(N)****B. E. (Fifth Semester) EXAMINATION, June, 2010**

(New Scheme)

(Mechanical Engg. Branch)

**MECHANICAL MEASUREMENT AND CONTROL****[ME - 503(N)]**

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Attempt five questions in all, selecting one question from each Unit. Assume missing data. All questions carry equal marks.

**Unit-I**

1. (a) Draw a generalised measurement system explaining all the components and their functions. 10
- (b) How the order of an instrument is decided ? Discuss the dynamics for sinusoidal input to a first order system. 10

Or

2. (a) What are primary, secondary and tertiary measurements ? Explain with suitable examples. 10
- (b) Distinguish between the following and give appropriate examples in each case : 10

(i) Accuracy and Precision

10. (a) Explain the difference between the following : 10

- (i) Open loop and closed loop control system
- (ii) Positive and negative feedback
- (iii) Servo mechanism, process control and regulator

- (b) Define Laplace transform and transfer function and comment upon their utility for solution of control system.

Determine the transfer function of control system whose input and output are related by the following equation : 10

$$\frac{d^2y}{dt^2} + 3\frac{dy}{dt} + 2y = x + \frac{dx}{dt}$$

- (ii) Error and accuracy
- (iii) Hysteresis and dead zone
- (iv) Drift and reproducibility

## Unit-II

3. (a) Define the following terms in the context of normal frequency distribution of data : 10
- (i) Mean value
  - (ii) Deviation
  - (iii) Average deviation
  - (iv) Standard deviation
  - (v) Variance
- (b) What is calibration and why is it necessary for an instrument? How do you proceed to draw calibration curve, a correction curve and an error curve? 10

Or

4. (a) Explain the following errors by giving suitable examples. Discuss the means adopted to minimise these errors : 10
- (i) Gross errors
  - (ii) Systematic errors
  - (iii) Random errors
- (b) Explain the importance of statistical analysis in measurements. What is the significance of the term precision index used to characterise the random errors by Gaussian probability distribution? 10

## Unit-III

5. (a) Describe the construction and working of thermocouples. Describe the thermo-electric laws and their applications. 10

- (b) Describe the construction and working of Potometer. Explain its advantages and disadvantages. 10

Or

6. (a) Compare and contrast the advantages and limitations of : 10
- (i) Resistance thermometers and thermistors
  - (ii) Thermocouples and Resistance thermometers.
- (b) What are different Electro-Mechanical pressure transducers? What are their advantages and disadvantages? 10

## Unit-IV

7. (a) Describe the Gauge factor of a resistance strain gauge. Derive an expression for it. How strain gauges can be used to measure multidirectional strains? 10
- (b) What are the various transducers used for measurement of force? Discuss the working of Hydraulic and Pneumatic load cells with suitable diagrams. 10

Or

8. (a) What are dynamometers? How are dynamometers classified? Explain the difference between absorption, transmission and driving dynamometers. 10
- (b) Discuss briefly the basic methods of measurement of force. 10

## Unit-V

9. (a) Differentiate between a physical and a mathematical model. How mathematical equation of a system can be used to derive the transfer function of a system? 10
- (b) What are the elements of control system? Explain the control system terminology. 10