Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech(CT)/SEM-7/CHE(CT)-701/2009-10

2009

INSTRUMENTATION & PROCESS CONTROL

Time Allotted : 3 Hours | Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following :

   i) Each instrument must have ..... elements.

      a) one

      b) two

      c) three. 1

   ii) Mention the typical input to the following transducers : $3 \times 1 = 3$

      X. Photovoltaic cell :

         a) Force

         b) Light

         c) Temperature.

      Y. Pressure gauge :

         a) Speed

         b) Vibration

         c) Force.

      Z. Magnetic pick up :

         a) Temperature

         b) Light

         c) Vibration.

iii) Mention the typical output of the following transducers : 3 ∞ 1 = 3

X. Strain gauge :

a) Resistance change

b) Voltage

c) Inductance change.

Y. Load cell :

a) Voltage

b) Inductance

c) Resistance.

Z. L.V.D.T.

a) Inductance

b) Voltage

c) Resistance.

iv) Find out the undesirable characteristics of the following : 3 ∞ 1 = 3

X. Accurancy :

a) Static error

b) Lag

c) Dynamic error.

Y. Speed of response :

a) Static error

b) Lag

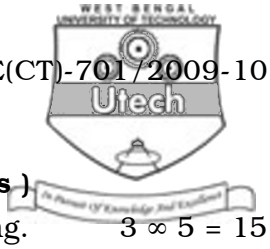
c) Dead zone.

Z. Reproducibility :

a) Drift

b) Lag

c) Dead zone.



GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 ∞ 5 = 15

2. Explain how Wien's law of radiation can be applied for measuring the temperature in an industrial furnace.
3. State the woking principle of a vaccum gauge used in cercamic process industries (with sketch).
4. What are the different forcing functions to a measuring system ? How are they analytically represented ?
5. How many modes of control action are normally encountered in process industries ? Give example of each type.
6. Explain in brief the working principle of a capacitance type level gauge (with sketch).

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 ∞ 15 = 45

7. Explain with neat sketch, the operation of a Bourdon gauge. Indicate the pressure range. Mention the errors normally found in such elastic deformation type gauge and explain how these errors can be eliminated.
8. Explain with neat sketch, the working principle of electromagnetic flowmeter. What type of level measurement instrument should be used for underground oil or water reservoir ? Explain the operating principle with a neat sketch. 8 + 7

9. What is meant by linearisation of a system ? Define transfer function of a system. Explain the time constant and transport lag with physical example. What is open loop system ? Give an example of open loop system.

10. a) Explain quadratic lag system. A step change of magnitude 10 is introduced in a system having transfer function as

$$\frac{Y(s)}{X(s)} = \frac{10}{5s^2 + 8s + 20}$$

Find out,

i) percentage overshoot

ii) rise time

iii) maximum and ultimate value of $y(t)$

iv) period of oscillation.

b) Explain with sketch, the operation of the industrial 'Ratio' controller and 'cascade' controller.