Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (FT)/SEM-6/ET-601/2010

2010

PROCESS INSTRUMENTATION & 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 any *ten* of the following : 10 × 1 = 10

i) The pressure measured above total vacuum is called

a) absolute pressure b) atmospheric pressure

c) barometric pressure d) gauge pressure.

ii) A thermistor can be used to control the

a) Level of water tank b) Altitude

c) Temperature d) All of these.

iii) Which of the following properties are important while selecting alloys for bimetallic thermometers ?

a) Coefficient of expansion

b) Electrical conductivity

c) Modulus of elasticity

d) All of these.

iv) Flow of liquid or gas in a pipeline is

a) Proportional to pressure in the pipeline

b) Proportional to differential pressure across the restriction introduced in pipeline

c) Inversely proportional to square root of differential pressure across restriction in pipeline

d) Proportional to square root of differential pressure across the restriction in pipeline.

v) The effect of feedback on the plant is

a) to make the plant simple

b) to reduce the sensitivity to plant parameter variations

c) to control system transient response

d) both (b) and (d).

vi) The knowledge of transfer function of a system is necessary for calculation of

a) The time constant

b) The order of the system

c) The output for any given input

d) The steady state gain.

vii) A system is called absolutely stable if any oscillations set up in the system are

a) Self sustaining & tend to last indefinitely

b) Eventually damped out

c) Not enough to change the parameters of the system

d) None of these.

viii) Load cells are devices that convert

a) force into pressure b) force into current

c) force into voltage d) force into acceleration.

ix) Thermocouples can be used to measure the temperature up to

a) 1600° C b) 1200° C

c) 500° C d) 150° C.

x) The number of root-locus segments which do not terminate on zeros is equal to

a) the number of poles

b) the number of zeros

c) the difference between the number of poles and the number of zeros

d) the sum of the number of poles and the number of zeros.

xi) The transfer function $G(s)=\frac{50}{s(s^2+4s+12)}$ indicates that the system will be

a) stable b) unstable

c) conditionally stable d) none of these.

xii) The presence of CO_2 in the intervening space of radiation pyrometers will

a) affect the reading of pyrometer

b) not affect the reading of pyrometer

c) make pyrometer read more than desired value of temperature

d) increase the sensitivity of pyrometer.

GROUP – B
(Short Answer Type Questions)

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

2. What are load cells ? Describe the operation of any load cell.

1 + 4

3. Find the transfer function of the circuit given.

Fig.

4. Explain the principle of operation of infrared transmission measurement of moisture.

5. Discuss the advantages and disadvantages of closed loop control system.

6. What is transient and steady state response ? Define the following term domain indices of a control system :

   i) Rise time

   ii) Settling time

   iii) Peak overshoot. 2 + 3

GROUP – C

(Long Answer Type Questions)

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

7. Sketch the root locus of the system mentioning all the steps.

$G(s)\,H(s) = \dfrac{K}{s(s+1)(s+6)}$.

8. Distinguish between the following :

   i) Thermistors and thermocouples

   ii) Radiation pyrometer and optical pyrometer.

9. a) Find the overall transfer function of the system shown below.

Fig.

   b) The open loop transfer function of a unity feedback control system is given by $G(s) = \dfrac{K(s+1)}{s(s+4)(s+5)}$.

   Discuss the stability of the closed loop system as a function of *K*.

10. a) Explain with relevant diagram the working principle of an electromagnetic flowmeter.

    b) How are springs used in balances ? Describe how the capacity may be enhanced in spring balances. 7 + 8

11. Write short notes on any *three* of the following : 3 × 5

    a) Strain gauge

    b) Modulation

    c) Final control element

    d) Response of a control system.