PROCESS INSTRUMENTATION & CONTROL (SEMESTER - 6)

CS/B.TECH (FT)/SEM-6/ET-601/09

1. ..... *Signature of Invigilator*

2. ..... *Signature of the Officer-in-Charge*

Reg. No. | | | | | | | | | | | | | | |

Roll No. of the Candidate | | | | | | | | | | | | | | |

CS/B.TECH (FT)/SEM-6/ET-601/09

ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009

PROCESS INSTRUMENTATION & CONTROL (SEMESTER - 6)

Time : 3 Hours] [Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

1. This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **32 pages**. The questions of this concerned subject commence from Page No. 3.
2. a) In **Group – A**, Questions are of Multiple Choice type. You have to write the correct choice in the box provided **against each question**.
   b) For **Groups – B** & **C** you have to answer the questions in the space provided marked 'Answer Sheet'. Questions of **Group – B** are Short answer type. Questions of **Group – C** are Long answer type. Write on both sides of the paper.
3. **Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.
4. Read the instructions given inside carefully before answering.
5. You should not forget to write the corresponding question numbers while answering.
6. Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.
7. **Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**
8. You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification**.
9. Rough work, if necessary is to be done in this booklet only and cross it through.

No additional sheets are to be used and no loose paper will be provided

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FOR OFFICE USE / EVALUATION ONLY

Marks Obtained

	Group – A										Group – B			Group – C			***Total Marks***	***Examiner's Signature***
Question Number																		
Marks Obtained																		

.....

Head-Examiner/Co-Ordinator/Scrutineer

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GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : 10 × 1 = 10

i) Which of the following temperature sensors has excellent linear characteristics ?

a) RTD b) Thermocouple

c) Radiation pyrometer d) Silicon-based IC chip. ☐

ii) In an electromagnetic flowmeter, the induced voltage is proportional to

a) flow rate b) square root of flow rate

c) square of flow rate d) logarithm of flow rate. ☐

iii) Bi-metal thermometer is made of two different materials having

a) different coefficient of linear expansion

b) different elatic properties

c) different thermal conductivities

d) none of these. ☐

iv) Optical pyrometer is used to measure

a) low temperature b) high temperature

c) light intensity d) intensity and temperature. ☐

v) The Laplace of step input is

a) $1/S^2$ b) $1/S$

c) S d) $1/S^3$.

vi) A system has a single pole at origin. Its impulse response will be

a) constant b) ramp

c) decaying exponential d) oscillatory.

vii) The transfer function of a unity feedback system is given by

$G(s) = \frac{K(s+2)}{s(s+1)}$. The system has

a) 3 poles and 1 zero b) 2 poles and 1 zero

c) 3 poles and no zeros d) none of these.

viii) The time constant is the time at which the system response reaches to ..... of its final steady state value.

a) 63·2% b) 36·2%

c) 50% d) none of these.

ix) Pirani gauge is used for

a) low pressure measurement

b) medium pressure measurement

c) high pressure measurement

d) any one of these.

x) The stability of a system depends on the position of the

a) poles b) zeros

c) either pole or zero d) any one of these.

xi) A load cell is essentially used for measurement of

a) static force b) static pressure

c) both (a) and (b) d) none of these. ☐

xii) The gauge factor of a strain gauge is given by

a) $G = \frac{\Delta R / R}{\Delta l / l}$ b) $G = \frac{\Delta l / l}{\Delta R / R}$

c) $G = \frac{\Delta R / R}{\Delta D / D}$ d) none of these. ☐

GROUP – B

(Short Answer Type Questions)

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

2. The resistance of the wire in plantinum thermometer is 2·4 and 3 ohms at 0°C and 100°C respectively. What will be the resistance of the wire when placed in a cold bath of 190 K ? 5

3. The $G(s)$ and $H(s)$ are forward path transfer function and feedback transfer function respectively. Show that the overall transfer function of a closed loop system is given by $\frac{G(s)}{1 + G(s)H(s)}$. 5

4. Determine the transfer function of the following liquid level system : 5

dia

5. Define the following time domain indices of a control system. 5 × 1

i) Steady state error

ii) Rise time

iii) Peak time

iv) Settling time

v) Peak overshoot.

6. Define moisture and humidity. Explain the operation of moisture measuring cell for granular material. 1 + 4

GROUP – C

(Long Answer Type Questions)

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

7. a) What factors govern the choice of the material of the thermocouple ? In which principle does it work ? Explain the principle. 5

b) Explain the working principle of radiation pyrometer. 5

c) For a certain thermistor, β = 3140 K and the resistance at 27°C is known to be 1050 Ω. The thermistor is used for temperature measurement and the resistance measured is as 2330 Ω. Find the measured temperature. 5

8. Define open-loop and closed-loop system. What are the basic components of a feedback control loop ? Compute the transfer function of a PID controller to a ramp change in the error signal. Sketch the contributions of the individual control actions separately. 2 + 2 + 8 + 3

9. a) Differentiate between unbounded and bounded strain gauges. What is a strain gauge load cell ? Discuss its methods of use. What are the advantages and disadvantages of a strain gauge ? What is the advantage of foil type strain gauge ? 2 + 1 + 2 + 2 + 1

b) The resistance of a strain gauge at no load condition is 120 ohms with area of cross-section of the wire as 0·1 mm^2 and length as 122 metres. Calculate the area of cross-section of the wire in mm^2 and its length in metres when it is elongated to give 140 ohms with applied pressure. 7

10. a) Explain the working principle of an electromagnetic flowmeter. 8

b) Can an electromagnetic flowmeter be used in vertical position ? Justify your answer. 4

c) What are the limitations of this type of flowmeter ? 3

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

a) Single seated and double seated valves

b) Principle of Macleod gauge

c) Load cell

d) Thermistor

e) Servo and regulator problem.

END