



Name :

Roll No. :

Invigilator's Signature :

CS/B.Tech (BT-NEW)/SEM-6/CHE-615/2011

2011

PROCESS INSTRUMENTATION AND 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) Which of the following controllers has the best maximum deviation ?

- a) *P*-controller b) *PI*-controller
c) *PID*-controller d) *PD*-controller.

ii) Bourdon gauges are used for measuring pressure

- a) < atmospheric b) > 2kg/cm² gauge
c) < 2kg/cm² gauge d) > 10kg/cm².



iii) Which of the following judges the accuracy of an instrument ?

- a) Dead zone
- b) Drift
- c) Static error
- d) None of these.

iv) Which is the most suitable instrument for measuring a temperature of 2000° C ?

- a) Mercury thermometer
- b) Radiation pyrometer
- c) Bimetallic thermometer
- d) None of these.

v) is a desirable static characteristic of instruments.

- a) Drift
- b) Dead zone
- c) Static error
- d) Reproducibility.

vi) Which of the following is not a mechanical pressure sensing element ?

- a) Bellows
- b) Diaphragm
- c) Bourdon tube
- d) U-tube.



- vii) Dead weight tester is used for
- a) testing dead weight
 - b) measuring the process pressure accuracy
 - c) producing the high pressure
 - d) calibrating the pressure instruments.
- viii) One tor is defined as
- a) one mm Hg
 - b) one inch Hg
 - c) one atmosphere
 - d) one kilopascal.
- ix) Bode diagram is a plot of
- a) $\log (AR) vs f$
 - b) $\log \phi vs f$
 - c) $AR vs \log (f)$
 - d) $\phi vs \log (f)$.
- x) Bode stability method uses loop transfer function.
- a) open
 - b) close
 - c) either (a) or (b)
 - d) none of these.
- xi) Phase margin is equal to
- a) $180 - \text{phase lag}$
 - b) $\text{phase lag} - 180$
 - c) $\text{phase lag} + 180$
 - d) $\text{phase lag} + 90$.
- xii) Critically damped system means damping coefficient is
- a) 1
 - b) < 1
 - c) > 1
 - d) 0.



GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. a) State the advantages of electronic instrumentation system. 2

- b) Draw the block diagram of electronic instrumentation system. Briefly state the function of each block. 3

3. Draw the circuit diagrams of
 - a) digital to analog controller

 - b) current to pressure converter.

4. Define overshoot and decay ratio, time constant with their expressions.

5. What do you mean by process reaction curve ? Give a brief comparison between feedback and feed forward control. 3 + 2

6. Describe a method for measurement of vacuum pressure.



GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Describe three desirable and three non-desirable static characteristics of an instrument measuring any process parameter.
- b) What is Doppler meter ? Mention its application and limitation.
- c) Outline the essential principles of Gas Chromatography (GC). $6 + 4 + 5$
8. a) Derive the transfer functions of proportional (P), proportional plus integral (PI), proportional plus derivative (PD) and proportional plus integral plus derivative (PID) control actions and explain the terms used therein. Differentiate between the actions of P , PI and PID controllers. 9
- b) Draw the block diagram of a control system illustrating a cascade control loop. Explain its purpose. $9 + 6$



9. a) What is Bode stability criteria ? Define gain margin and phase margin.
- b) What is controller tuning ?
- c) What are the different methods of tuning of controller ?
- d) In the Ziegler-Nichols tuning method, the critical gain was found 4.2 and the critical period was 2.21 minute. Find the standard setting of PID controller.

2 + 3 + 2 + 2 + 6

10. a) Define any *four* of the following : 4 × 2
- i) Resolution
 - ii) Sensitivity
 - iii) Dead band
 - iv) Drift
 - v) Hysteresis
 - vi) Accuracy
 - vii) Precision
 - viii) Transducer.
- b) Compare the function of LVDT and RVDT. 7



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

- a) Cascade control
 - b) Principle of operation of recording instrument
 - c) Characteristic curve of a control valve
 - d) Dynamic characteristics of instruments
 - e) ON-OFF control.
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