Registration No. :

Total number of printed pages – 2

B. Tech

CPBT 8310 (Old)

Sixth Semester (Back) Examination – 2013

INSTRUMENTATION AND PROCESS CONTROL

BRANCH : BIOTECH

QUESTION CODE : B356

Full Marks – 70

Time : 3 Hours

*Answer Question No. 1 which is compulsory and any **five** from the rest.*
The figures in the right-hand margin indicate marks.

1. Answer the following questions :   2×10

    (a) Which type of controller eliminates completely the offset ?

    (b) Differentiate between servo and regulatory problem.

    (c) Define phase margin and gain margin.

    (d) Differentiate between precision and accuracy.

    (e) What is thermometric effect ?

    (f) Write the Routh stability criteria for a feedback control system.

    (g) Write the working principle of optical pyrometer.

    (h) Draw the response of a second order instrument with a step input for underdamped, overdamped, and critically damped system.

    (i) Define crossover frequency.

    (j) Write any two equipments for measuring vacuum pressure.

2. (a) Explain with a neat sketch, the construction and working of a McLeod gauge, with its advantages and disadvantages.   6

    (b) Define the terms : Gauge pressure and Absolute pressure.   4

3. (a) With a neat sketch, explain the working principle of Thermal conductivity gauge.   4

    (b) Write the working principle of mass flow meter with its advantages and disadvantages.   6

4. A step change of magnitude 6 is introduced into a system having the transfer function of $20/(S^2 + 1.6S + 8)$. Determine the following characteristics : 10

    (a) % overshoot,

    (b) Rise time,

    (c) Ultimate response,

    (d) Maximum value of response, and

    (e) Period of oscillation.

5. A proportional controller is introduced to two first order instruments with time constants of 1 & 2. The measuring element is a first order instrument with time constant of 5. Determine : 10

    (a) The value of Kc for which the control system is stable and

    (b) For the value of Kc for which the system is on the threshold of instability, determine the roots of characteristics equation.

6. (a) Derive the transfer function of a mercury in glass thermometer. 4

    (b) Prove that PID controller eliminates the offset completely for regulatory problem. 6

7. (a) Write the Bode stability criteria. 2

    (b) The open loop transfer function of a control system is given as :

$$G(s) = \frac{K_c(s+3)}{s(s+1)(s+2)}$$

        Sketch the root locus diagram of the system. Find the value of Kc for which the system is just unstable. 8

8. Write short notes on any **two** : 5×2

    (a) Ziegler Nichol method

    (b) Transportation lag system

    (c) Mass spectroscopy

    (d) Magnetic flow meter.

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