Roll No. ☐☐☐☐☐☐☐☐☐☐   Total No. of Pages : 02

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B.Tech.(Petroleum Refinary Engineering) (2013 Batch)   (Sem.–6)

PROCESS INSTRUMENTATION & DYNAMIC CONTROL

Subject Code : BTPC-603

M.Code : 74039

Time : 3 Hrs.   Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.
4. Assume any missing data.

SECTION-A

1. Answer briefly :

    a) Enlist any four types of pressure measuring instruments.

    b) What do you understand by first order and second order system?

    c) Compare feedback and feed forward control system.

    d) What do you understand by tuning of controller settings?

    e) Describe the terms rise time and overshoot with context to a under damped second order system.

    f) Find the Laplace transform of a function $f(t) = A \cos(\omega t)$.

    g) What do you understand by frequency response?

    h) Give the initial value theorem for Laplace transformation.

    i) What is a transfer function? Give its physical significance.

    j) Define transportation lag. Give its transfer function.

SECTION-B

2. A mercury thermometer having time constant of 1 minute has been placed in a bath at 200°C and indicating 200°C temperature on achieving steady state. Afterwards the bath temperature suddenly started increasing linearly at the rate of 1°C/min. Plot the response.

3. Derive an expression for the change in head of the second tank to unit step change in the inlet flow rate of the first tank of a two liquid level tanks in series system connected in a non-interacting fashion having equal time constant. Assuming, the linear valve resistance characteristics of the valves installed in the outlet line of first and second tank respectively.

4. For close loop system as shown in figure,

   Calculate :

   a) The value of k_c when the closed loop response has $\xi = 2$

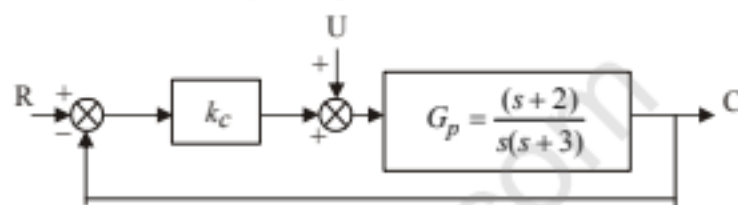   b) Find the offset for a unit step change in U for $k_c = 3$

Fig.

5. Find and draw the transient response of controllers in P, PI and PID mode for step error input.

6. Two first order systems with time constants, $\tau_1 = 10$ sec and $\tau_2 = 20$ sec and gains, $K_{p1} = 1.2$ and $K_{p2} = 1$ respectively are connected in series in a non-interacting manner. Find the value of k_c for proportional controller in the close loop unit feedback system to have a decay ratio of 0.6.

SECTION-C

7. a) Sketch the Nyquist diagram for the following open loop transfer function.

   i) $G(s) = (s + 1)$

   ii) $G(s) = \dfrac{1}{s^2}$

   b) What do you understand by stability of a control system? Discuss the stability criterion.

8. a) Describe and compare any two methods for measuring the flow rate of a fluid flowing through a pipe.

   b) With the help of neat diagram, describe principles, features and working of thermocouple for the measurement of temperature.

9. a) Explain briefly the various control techniques used in distillation column.

   b) Discuss the computer control of chemical processes.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.