Registration No.										

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B.TECH
PCCH4304

6th Semester Regular / Back Examination 2015-16
PROCESS DYNAMICS AND CONTROL
BRANCH : Chemical
Time : 3 Hours
Max Marks : 70
Question Code :W114

Answer Question No. 1 which is compulsory and any FIVE from the rest.
The figures in the right-hand margin indicate marks.
Assume suitable notations and any missing data wherever necessary.
Answer all parts of a question at a place.

1. Answer the following questions : **(2 x 10)**

(a) What is the significance of transfer function?

(b) Differentiate between stable and unstable system.

(c) Solve the following equation for x(t):

$$\frac{dx}{dt} = \int_0^t x(t)dt - t \text{ for } x(0) = 3.$$

(d) Represent the following forcing function mathematically and graphically.

i. Step function
ii. Sinusoidal function

(e) What is the transfer function of first order system with pure time delay?

(f) A thermometer having a time constant of 0.1 min is at a steady state temperature of 90 ^{o}F. At time t=0, the thermometer is placed in a temperature bath maintained at 100 ^{o}F. Determine the time needed for the thermometer to read 98 ^{o}F.

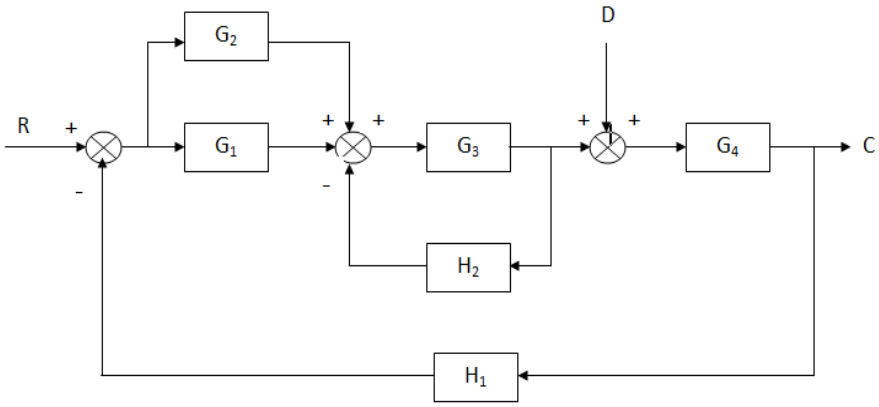
(g) If the input to a first order system is a sinusoidal forcing function, then what should be the characteristic features of ultimate periodic response?

(h) Two non-interacting tanks are connected in series of which the time constants are $\tau_1 = 0.5$ and $\tau_2 = 1$ respectively. The resistance offered by the tank 1 and tank 2 are 2 and 1 respectively. Write the response of the level in tank 2 if a unit step change is made in the inlet flow rate to tank 1.

(i) What do you mean by proportional band and it is related to proportional gain.

(j) A open loop transfer function of a control system is given by: $G(s) = \frac{K}{s(s+2)}$. What should be the transfer function equation in Z-transform?

2. Determine the ratio of C/R, C/D and the total output for the system whose block diagram is given below. **(10)**



3. **(a)** The transfer function of a second order system is given by: **(05)**

$$G(s)=\frac{10}{s^2+2.4s+4}.$$

Determine:

i. Percent overshoot
ii. Decay ratio
iii. Period of oscillation

(b) A second order system is observed to exhibit an under damped response having the ultimate value of response is 16 and the minimum value of the response is 10. Show that as the damping co-efficient is inversely proportional to overshoot for the system. Take $\xi = 0.6,0.4,0.2,0.1$. **(05)**

4. Sketch the root locus for the open-loop transfer function of a unity feedback control system given below. **(10)**

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

Determine:

i. The value of K for $\zeta = 0.5$.
ii. The value of K for marginal stability.
iii. The value of K at $s=-4$.

5. With the help of process reaction curve method find the controller setting of PI controller if the open-loop transfer function is given by: **(10)**

$G(s)=\frac{1}{(s+1)^4}$. Solve this problem analytically.

6. **(a)** State Bode stability criterion. Differentiate between cross over frequency and corner frequency. **(2+2)**

(b) Plot the Bode diagram for the system whose overall transfer function is: $G(s) = \frac{1}{(s+1)(s+5)}$. **(06)**

7. For the control system given below, determine: **(10)**

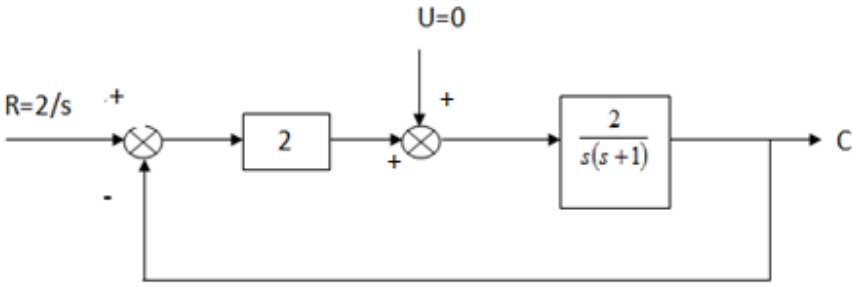
i. $C(s)/R(s)$

ii. $C(\infty)$

iii. Offset

iv. $C(0.5)$

v. Whether the closed loop response is oscillatory.



8. Write short notes on any **TWO**: **(5 x 2)**

(a) Dead time compensation

(b) Controller tuning

(c) Cascade control

(d) Feed back control
