

Printed Pages: 02

Subject Code: REE503

Paper Id: 120503

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BTECH
(SEM V) THEORY EXAMINATION 2018-19
CONTROL SYSTEM

Time: 3 Hours

Total Marks:70

Notes: Assume any Missing Data.

SECTION – A

1. Attempt all parts of the following. (7*2=14)

- (a) What is Masons's gain formula?
- (b) What is an impulse response?
- (c) What is steady state error?
- (d) Define damping ratio.
- (e) Define gain cross over frequency and phase margin?
- (f) What is Centroid in root locus?
- (g) Define State variable and state space.

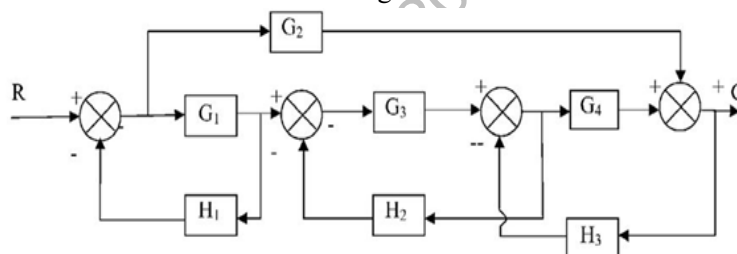
SECTION – B

2. Attempt any three parts of the following: (3*7=21)

- (a) For a unity feedback system the open loop transfer function is given by
$$G(s) = K/s(s + 2)(s^2 + 6s + 25)$$
 - (i) Sketch the root locus
 - (ii) At what value of 'K' the system becomes unstable.
 - (iii) At this point of instability determine the frequency of oscillation of the system.
- (b) Explain the working of servomotor with suitable diagram and also derive the field controlled D.C. motor transfer function.
- (c) Draw the Nyquist plot for the unity feedback system whose open loop transfer function is

$$G(s)H(s) = \frac{K}{s^2(1+sT)}$$

(d) Determine the transfer function of the circuit given below-



(e) Establish the correlation between time response and frequency response analysis and suitably explain with diagrams.

SECTION - C

Note: - All questions are compulsory.

(5*7=35)

3. Attempt any one parts of the following:

- (a) Find the generalized error coefficients for a system whose $G(S) H(S) = 1/S (S+2)$ and also find the expression for steady state error for input $r(t) = 2 + 3t + 2t^3$.
- (b) Sketch the polar plot for the following transfer function
 $G(S) = (1+4S)/S^2 (S+1) (2S+1)$

4. Attempt any one parts of the following:

- (a) Explain P, PI, PID controllers and also give their advantages.
- (b) Derive the expressions for second order system for under damped case and when the input is unit step.

5. Attempt any one parts of the following:

- (a) Construct the state model of a system characterized by the differential equation. Give the block diagram representation of the state model.

$$\frac{d^3y}{dt^3} + 6\frac{d^2y}{dt^2} + 11\frac{dy}{dt} + 6y = u$$

- (b) A single input signal output system is given as

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 2 & -3 \end{bmatrix}, B = \begin{bmatrix} 0 & 1 \\ 0 & 0 \\ 1 & 1 \end{bmatrix} \text{ and } C = [1 \ 0 \ 0].$$

Test for controllability and observability.

6. Attempt any one parts of the following:

- (a) For the given transfer function-

$$G(s) H(s) = \frac{2}{s(1+0.5s)(1+0.05s)}$$

Determine phase crossover frequency and gain margin.

- (b) The forward path transfer function of unity feedback control system is $G(s) = 100/s(s+6.45)$. Find the resonance peak M_r , resonant frequency ω_r and bandwidth of the closed loop system.

7. Attempt any one parts of the following:

- (a) What is the effect of adding pole to a system? Discuss.
- (b) Explain the lag compensation.