

B.Tech III Year II Semester (R13) Regular & Supplementary Examinations May/June 2017  
**CONTROL SYSTEM ENGINEERING**  
 (Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 70

**PART – A**  
 (Compulsory Question)

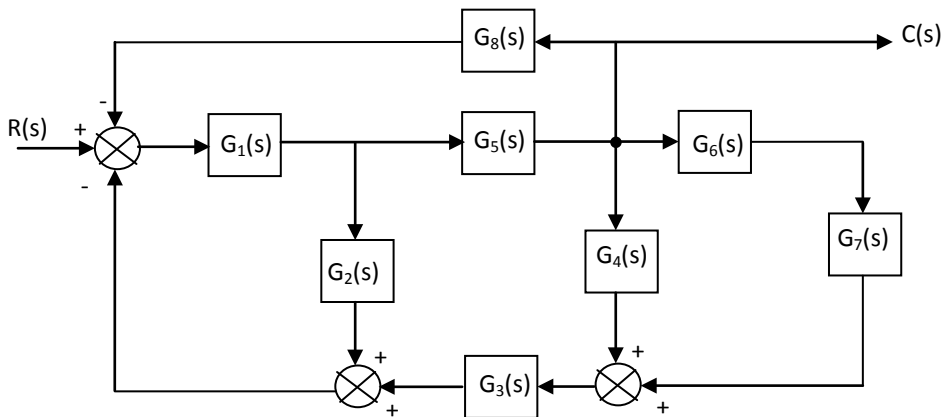
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- 1 Answer the following: (10 X 02 = 20 Marks)
- (a) Name three basic forms for interconnecting subsystems.
  - (b) What is sink and source?
  - (c) What is proportional controller and what are its advantages?
  - (d) State the importance of test signals.
  - (e) What would happen to a physical system that becomes unstable?
  - (f) When the maximum phase lead occurs in lead compensator?
  - (g) What are the frequency domain specifications?
  - (h) What are advantages of frequency response analysis?
  - (i) Write short notes on BIBO stability.
  - (j) Briefly describe the design procedure for a controller.

**PART – B**  
 (Answer all five units, 5 X 10 = 50 Marks)

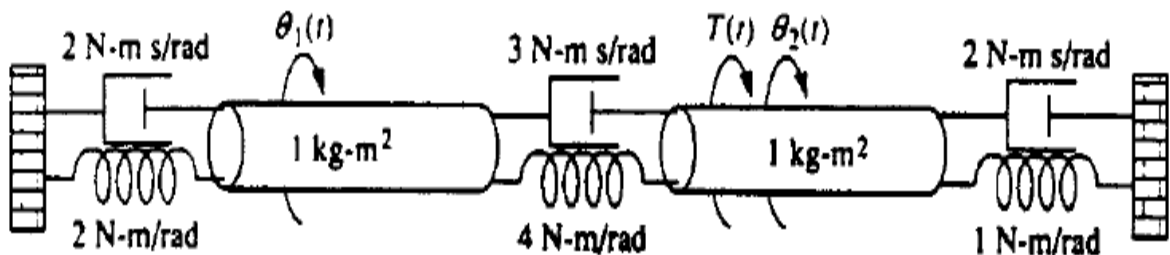
UNIT – I

- 2 Reduce the block diagram using reduction technique, shown in figure below to a single block,  $T(s) = \frac{C(s)}{R(s)}$ .



OR

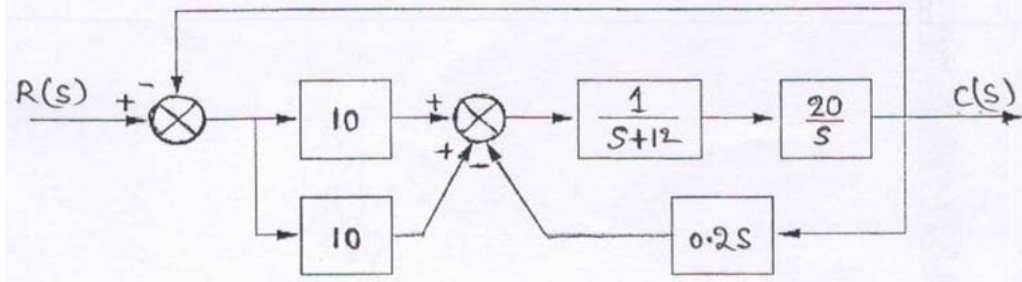
- 3 Consider the rotational mechanical system shown below represent the system as a signal-flow graph. And calculate the transfer function of the system if the output is  $\theta_2(t)$ .



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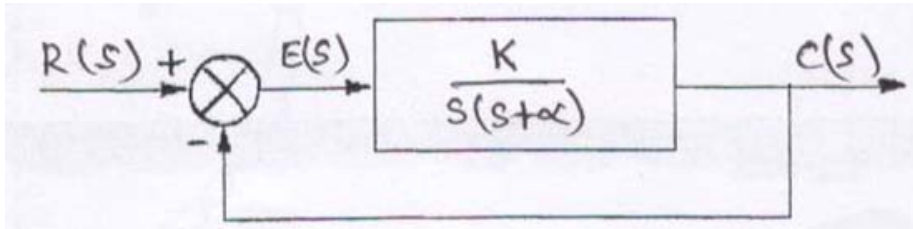
UNIT – II

- 4 For the system shown in figure below, find the following: (i) The damping ratio. (ii) Natural frequency. (iii) % overshoot. (iv) Settling time. (v) Peak time. (vi) Rise time. (vii) Damped frequency of oscillation.



OR

- 5 (a) Sketch the time response of the second order system and explain each component briefly.  
 (b) For the system shown in figure below, find K and  $\alpha$  to yield a settling time of 0.15 second and a 30% overshoot.



UNIT – III

- 6 Determine the stability of the closed-loop transfer function using R-H criteria.

$$G(s) = \frac{K}{s^5 + 2s^4 + 3s^3 + 6s^2 + 5s + 3}$$

OR

- 7 Consider the unity feedback system shown with transfer function:  $G(s) = \frac{K}{s(s+3)(s+5)(s+7)}$ . Draw the root locus and identify the stability.

UNIT – IV

- 8 For the given transfer function:  $G(s) = \frac{1}{s(s+2)(s+4)}$ , sketch the Bode asymptotic magnitude and asymptotic phase plots.

OR

- 9 Consider the unity feedback system shown with the transfer function:  $G(s) = \frac{8000}{(s+6)(s+20)(s+35)}$ . Find the: (i) Gain margin. (ii) Phase margin. (iii) Zero dB frequency. Using Nyquist diagram.

UNIT – V

- 10 (a) What are the properties of state transition matrix?  
 (b) Given the system represented in state space by:

$$\dot{X} = \begin{bmatrix} 0 & 2 \\ -2 & -5 \end{bmatrix} X + \begin{bmatrix} 0 \\ 1 \end{bmatrix} e^{-2t}$$

$$Y = [2 \quad 1]X$$

$$X(0) = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$$

Solve for the state transition matrix.

OR

- 11 A system is represented by the state and output equations that follow. Find: (i) The characteristic equation. (ii) The poles of the system.

$$\dot{X} = \begin{bmatrix} 0 & 2 & 3 \\ 0 & 6 & 5 \\ 1 & 4 & 2 \end{bmatrix} X + \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix} u(t)$$

$$Y = [1 \quad 2 \quad 0]X$$

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