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)
*****

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
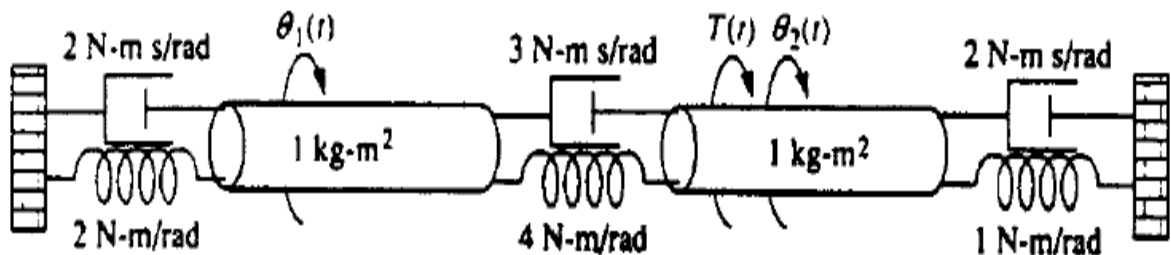(Answer all five units, 5 X 10 = 50 Marks)
UNIT – I

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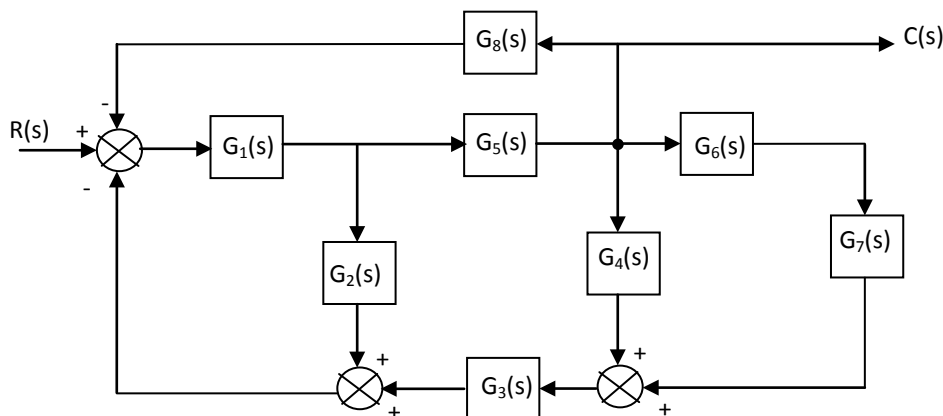

OR

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 $\theta_2(t)$.

www.jntuonline.com

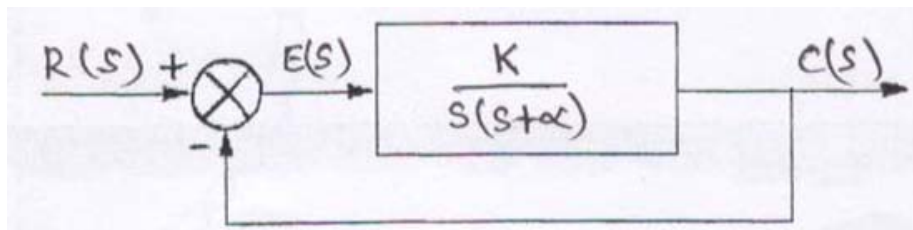<div align="center">UNIT – II</div>

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.
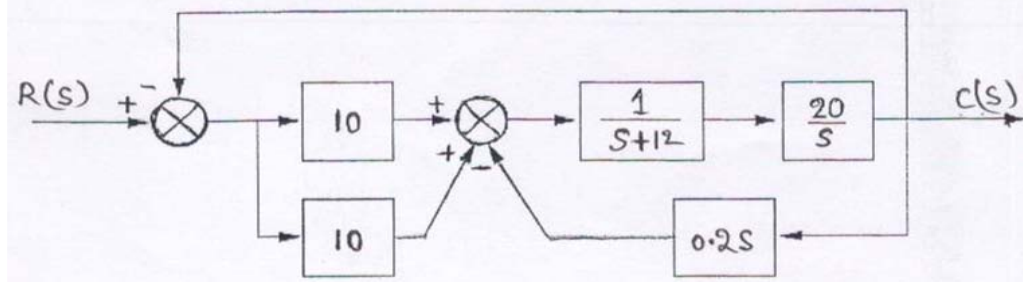
<div align="center">OR</div>

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 α to yield a settling time of 0.15 second and a 30%
          overshoot.

<div align="center">UNIT – III</div>

6   Determine the stability of the closed-loop transfer function using R-H criteria.
    $$G(s) = \frac{K}{s^5 + 2s^4 + 3s^3 + 6s^2 + 5s + 3}$$

<div align="center">OR</div>

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.

<div align="center">UNIT – IV</div>

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

<div align="center">OR</div>

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.

<div align="center">UNIT – V</div>

10 (a)   What are the properties of state transition matrix?
    (b)   Given the system represented in state space by:
    $$\dot{X} = \begin{bmatrix} 0 & 2 \\ -2 & -5 \end{bmatrix} X + \begin{bmatrix} 0 \\ 1 \end{bmatrix} e^{-2t}$$
    $$Y = \begin{bmatrix} 2 & 1 \end{bmatrix} X$$
    $$X(0) = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$$
    Solve for the state transition matrix.

<div align="center">OR</div>

11 A system is represented by the state and output equations that follow.
    Find: (i) The characteristic equation. (ii) The poles of the system.
    $$\dot{X} = \begin{bmatrix} 0 & 2 & 3 \\ 0 & 6 & 5 \\ 1 & 4 & 2 \end{bmatrix} X + \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix} u(t)$$
    $$Y = \begin{bmatrix} 1 & 2 & 0 \end{bmatrix} X$$

<div align="center">*****</div>