Reg. No. : | | | | | | | | |

B.E. / B.Tech. (Full Time) DEGREE END SEMESTER EXAMINATIONS, NOV/ DEC 2011

ELECTRICAL AND ELECTRONICS ENGINEERING BRANCH

THIRD SEMESTER – (REGULATIONS 2008)

EE 9201 – CONTROL SYSTEMS

Time : 3 hrs Max . Mark: 100

Answer All Questions

Part – A (10 x 2 = 20 Mark)

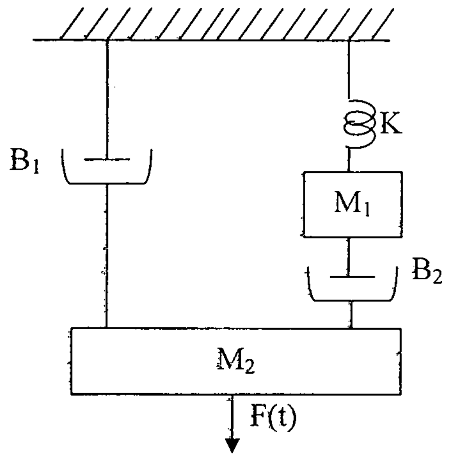
1) Distinguish between time varying and time invariant systems.
2) Write the force current analogy of mechanical rotational and translational systems.
3) Define peak time and rise time.
4) List the advantages of the Root locus.
5) Write the corelation between time and frequency response.
6) Define phase and gain cross over frequency.
7) State Nyquist stability criterion.
8) What do you understand by BIBO stability and asymptotic stability?
9) What is meant by state and state variables?
10) Obtain the transfer function of the system defined by the following state equations.

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -2 & 1 \\ 1 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u$$

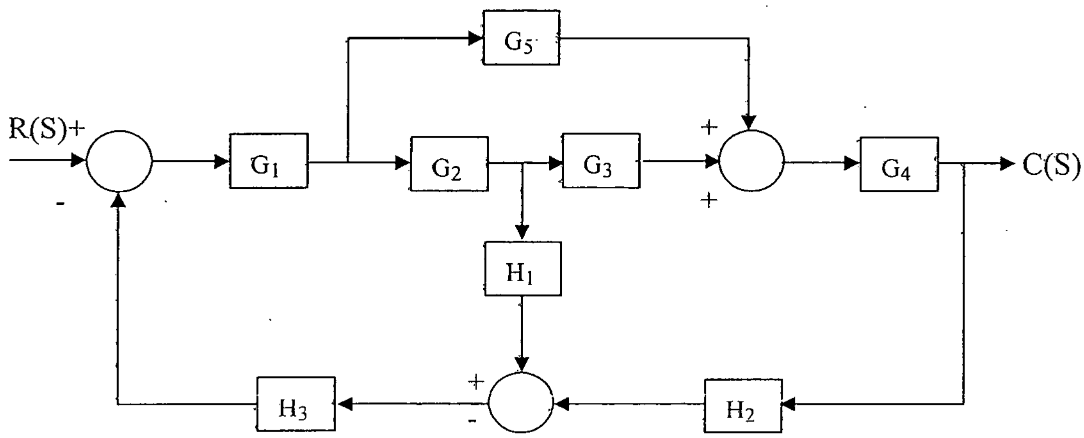
$$y = \begin{bmatrix} 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

PART – B (5X16= 80 Marks)

11. i. Draw force- voltage analogous circuit for the mechanical system shown below and write the equation.



ii. Using block diagram reduction technique find the transfer function given below.



(8+8)

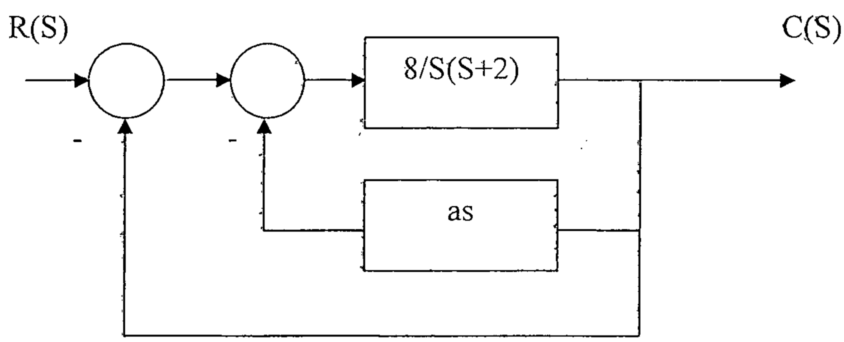
12.a)(i) Find k_p, k_v, k_a for the following system. Find e_{ss} for $r(t) = 1+t$ (6)

$$G(s) = 100 / s^2(s+2)(s+5)$$

(ii) A system is as shown below. In absence of derivative feedback (a=0) find δ and ω_n.

(iii) Find 'a' to increase δ to 0.7.

(iv) Find M_p in (ii) and (iii) (3+3+4)



(Or)

b). Sketch the root locus for the unity feedback system whose open loop transfer function is given by

$$G(s)\,H(s) = \frac{(s+4)}{s\,(s^2+6s+13)}$$

(16)

13.a) Draw the Bode diagram for the following transfer function.

$$G(s) = \frac{(1+0.2s)(1+0.025s)}{s^3\,(1+0.001s)\,(1+0.005s)}$$

(16)

(Or)

b) Sketch the Polar plot for the transfer function and determine the gain margin and phase margin.

$$G(s) = \frac{(s+6)}{s^2\,(1+2s)\,(1+8s)}$$

(16)

14.a.i. The open loop transfer function of a closed loop system with unity feedback is $G(s) = K\ /\ (s+2)\ (s+4)\ (s2+6s+25)$. Using Routh criterion, determine the stability of the system. (6)

ii. Using Routh criterion, determine the stability of the system represented by the following characteristic equation. $s^6 + 3s^5 + 5s^4 + 9s^3 + 8s^2 + 6s + 4 = 0$. (6)

iii. What is an auxiliary polynomial? What is its order? What information does the auxiliary polynomial give? (4)

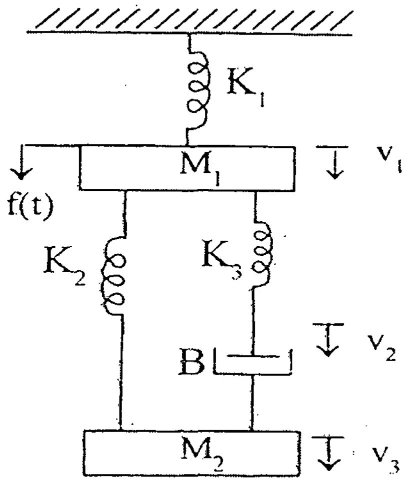
(Or)

b). Sketch the Bode plot of the given transfer function

$$G(s) = \frac{48\,(s+10)}{s(s+20)\,(s^2+24s+16)}$$

Comment on the stability of the system. (16)

15. a. i Obtain the state model of the system shown in fig.



(8)

ii. A system has the governing equation $d^3y/dt^3 + 5\, dy/dt + 4y = u(t)$. Find the state model of the system. (8)

(Or)

b. i. State controllablity and observability theorem. (4)

ii. Check the controllablity and observability of the system.

$$A = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & 0 \\ 1 & -4 & 3 \end{bmatrix} \quad B = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} \quad C = \begin{bmatrix} 1 & 1 & 0 \end{bmatrix}$$

(8)

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