Degree	**: B.E Degree End Semester Examinations**	**APR/MAY 2014**
Branch	**: ELECTRONICS AND COMMUNICATION ENGG**	
Semester	**: IV**	
Code No. /Subject	**:EC285/EC 9254 Control Systems (R-2004/2008)**	
Answer ALL questions	**PART-A**	**(10X2=20 marks)**

1. What is the effect of feedback in open loop system ?
2. Derive the transfer function of the network shown in fig.1

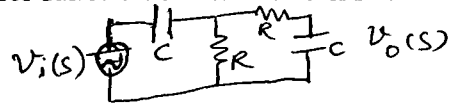


Figure 1

3. Find the rise time of unity feedback system with open loop transfer function G(s) for step input of 10 units. $G(s) = \frac{10}{s(s+1)}$
4. What is the effect of PD controller on second order system?
5. What are constant M and N circles?
6. Draw the frequency response of lead compensator.
7. Find the range of K for closed loop stable behavior of system with characteristic equation $s^4+6s^3+11s^2+6s+K$ using Routh Hurwitz stability criterion.
8. State Nyquist theorem.
9. Represent the following second order linear system in the state space form.

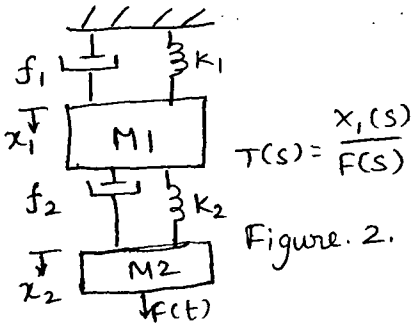
$\dot{x}_1 = -\frac{3}{2}x_1 + \frac{1}{2}x_2 + u$;
$\dot{x}_2 = -\frac{1}{2}(x_1 + x_2) + u$; $y = x_1 + x_2$;

10. Define observability of system.

PART-B (5X16=80 marks)

11. i. Consider unity feed back system with forward transfer function $G(s) = K(2s+1)/s(5s+1)(1+s)^2$. For input $r(t) = 10+5t$, find the minimum value of K so that steady state error is 0.1.
    ii. Discuss response of second order system for step input.

12. a.i. Derive the transfer function for the mechanical system shown in figure 2.
    ii. For the block diagram shown in figure 3, find the transfer function using block diagram reduction technique.



$T(s) = \frac{X_1(s)}{F(s)}$
Figure. 2.

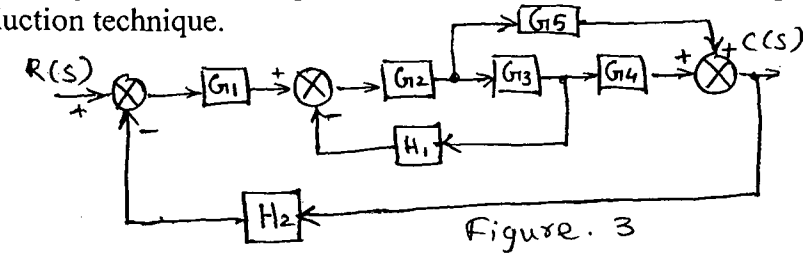


Figure. 3

(or)

b. i. Find the transfer function of the circuit shown in figure 4
   ii. Find the transfer function of the block diagram shown in figure 3 using Mason's gain formula.

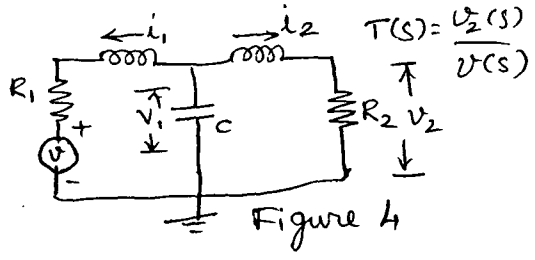


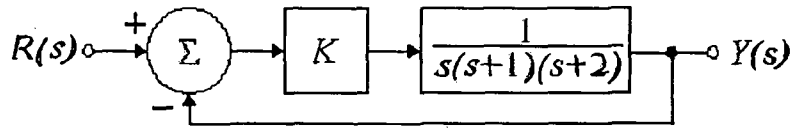
Figure 4

13. a. Open loop transfer function of the system $G(s) = 10000/s(1+0.1s)^2$. Find the following parameters.
    i. Gain margin and phase margin,
    ii. Magnitude at an angular frequency of $\omega = 20$ rad/sec
    iii. Stability of system with its bode plot.

(or)

b. i. Find Gain Margin and Phase Margin for the system $G(s) = 10(s+2)/s(s+0.1s)$ using Nichols chart.
ii. Briefly explain about lead-lag compensators.

14. a. Sketch the root locus of the following system. Determine the value of K such that the damping ratio ζ of a pair of dominant complex conjugate closed-loop is 0.5



(or)

b. Draw the Nyquist plot and find the stability of the following open loop transfer function of unity feedback control system.
$G(s)\,H(s) = K(s+2)/s^2(s+1)$.
If the system is conditionally stable, find the range of K for which the system is stable.

15. a. Find the transfer function for the state variable representation of the system and check its controllability.

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -5 & -25.1 & -5.03 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 25 \\ -121 \end{bmatrix} u \;;$$

$$y = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} ; \quad \text{(OR)}$$

b. i. Check the observability for the system described in question 15.a
ii. Write short notes on Sampled Data Systems