15. (a) A system is given by the state equation $x(t)+\begin{bmatrix}0 & 1\\0 & 0\\2 & 1\end{bmatrix}u(t)$ and output equation $y(t)=\begin{bmatrix}0 & 0 & 1\\1 & 1 & 0\end{bmatrix}$. Justify. whether the system is controllable.

Or

(b) Determine the state space model for the electrical system shown in the Figure. 15 (b).

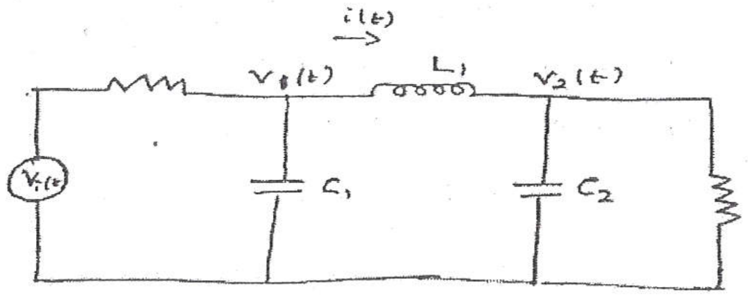

Figure. 15(b)

PART C — (1 × 15 = 15 marks)

16. (a) The transfer function of the system is given by $T(s)=\dfrac{s^2+3s+3}{s^3+2s^2+3s+1}$.

Draw the Signal Flow Graph for the given transfer function.

Or

(b) Determine the state representation of a continuous-time LTI system with system function $G(s)=\dfrac{3s+7}{(s+1)(s+2)(s+5)}$.

09/06/23 - FN

Reg. No. :

Question Paper Code : 30137

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Third Semester

Electronics and Communication Engineering

EC 3351 – CONTROL SYSTEMS

(Common to : Electronics and Telecommunication Engineering)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Find the transfer function of the network as shown in Fig. 1.

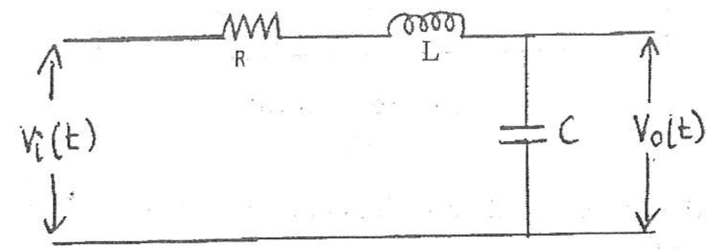

Fig. 1

2. List the components of feedback control system.

3. Recall the importance of PD control? State the effect of a PD controller on the system performance.

4. Find the order of the closed-loop transfer functions for the systems given by

   (a) $C(s)/R(s)=10[1+2s+s^2]/[1+3s+s^2+s^3]$.

   (b) $C(s)/R(s)=6[1+2s]/[1+4s]$.

5. List the disadvantages of frequency response analysis.

6. List the effects of dominant poles.

7. State the angle and magnitude criterion for root locus.

8. Define Gain margin.

9. Mention the different canonical forms.

10. List the advantages of state-variable analysis.

PART B — (5 × 13 = 65 marks)

11. (a) (i) For the block diagram of the system shown in Figure 11.(a) (i), Apply block diagram reduction technique, determine the closed-loop transfer function. (6)

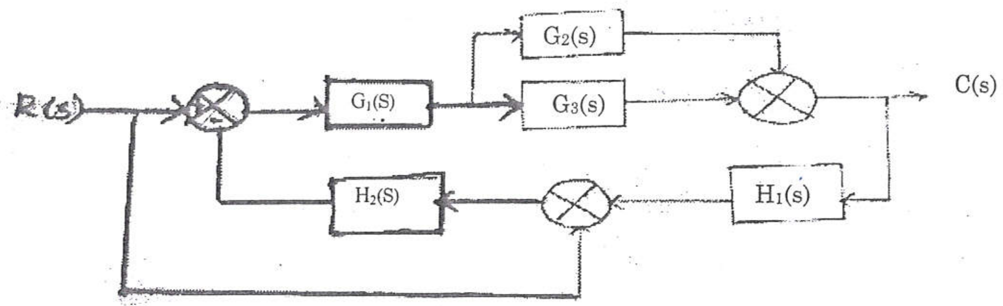

Figure. 11(a)(i)

(ii) Evaluate the transfer function of the electrical network shown in Figure 11.(a)(ii) (7)

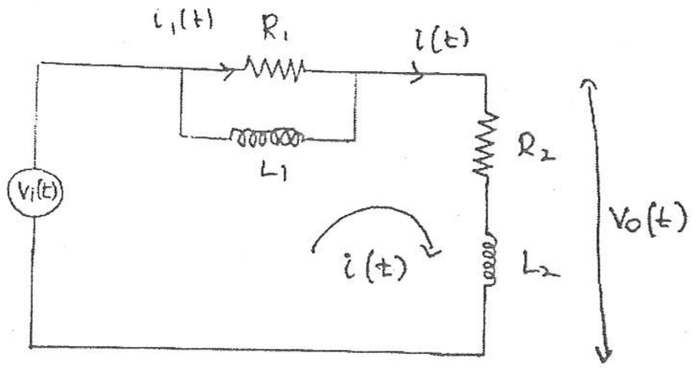

Figure. 11(a)(ii)

Or

(b) For the mechanical translational system shown in Figure 11(b) : Determine

(i) differential equations

(ii) F-V analogous circuit

(iii) F-I analogous circuit

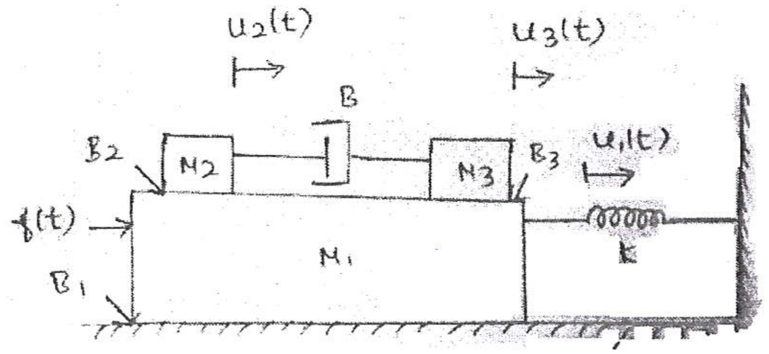

Figure. 11(b)

12. (a) (i) The unity feedback system is characterized by an open loop transfer function, $G(s)=\frac{K}{s(s+10)}$. Determine gain K, so that the system will have a damping ratio of 0.5 for this value of K. Determine settling time, peak over shoot and time to peak overshoot for a unit step input. (6)

(ii) When a unit-step signal is applied, the time response of the second order system is $c(t)=1+0.2e^{-60t}-1.2^{-10t}$. Determine

(1) the closed loop transfer function of the system

(2) undamped natural frequency. ω_n and

(3) damping ratio of the system. (7)

Or

(b) A unity feedback control system has an open loop transfer function $G(s)=10/(s(s+2))$. Find the rise time percentage overshoot, peak time and settling time for a step input of 12 units.

13. (a) The loop transfer function of a system is given by $G(s)H(s)=(Ks^2)/(1+0.2s)(1+0.02s)$. Sketch the bode plot for the given system.

Or

(b) Sketch the polar plot of the function: $G(s)H(s)=(s+2)/[s^2(s+2)(2s+1)]$.

14. (a) The unity feedback control system has an open loop transfer function :

$G(s)H(s)=K/[s(s+4)(s^2+4s+20)]$. Sketch the root locus.

Or

(b) (i) Examine the stability of the system using Routh's criterion for the characteristic equation of a system given by $s^5+2s^4+3s^3+6s^2+10s+15=0$. (6)

(ii) Determine the stability of the following system using Routh's criterion: $G(s)H(s)=1/(s+2)(s+4)$. (7)