Reg. No. :

Question Paper Code : 90314

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

Fourth Semester

Electrical and Electronics Engineering

IC 8451 – CONTROL SYSTEMS

(Common to Electronics and Instrumentation Engineering/Instrumentation and Control Engineering)

(Regulations 2017)

Time : Three Hours   Maximum : 100 Marks

Answer ALL questions

PART – A   (10×2=20 Marks)

1. Distinguish between open loop and closed loop system.
2. Find the transfer function for the signal flow graph shown in figure 1.

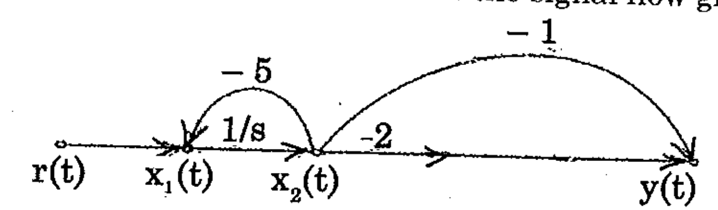

Figure 1

3. Find the steady state error of system $G(s) = \dfrac{15}{s(s+8)}$ for unit ramp input.
4. What are the features of PI controller ?
5. What is the phase shift contributed by single pole at origin in a transfer function ?
6. Define Gain cross over frequency.
7. What is the condition for stability of a closed loop system according to Nyquist stability criterion ?
8. Draw the frequency response of lead compensator.
9. What is the necessary condition for complete observability of a system.

10. Find the controllability matrix for the system $\begin{bmatrix}\dot{x}_{1r}\\ \dot{x}_{2r}\end{bmatrix} = \begin{bmatrix}-2 & -3\\ 1 & 0\end{bmatrix}\begin{bmatrix}x_{1r}\\ x_{2r}\end{bmatrix} + \begin{bmatrix}1\\ 0\end{bmatrix}u$.

$$y = \begin{bmatrix}0 & 1\end{bmatrix}\begin{bmatrix}x_{1r}\\ x_{2r}\end{bmatrix}$$

PART – B (5×13 = 65 Marks)

11. a) Reduce the block diagram shown in figure 2.

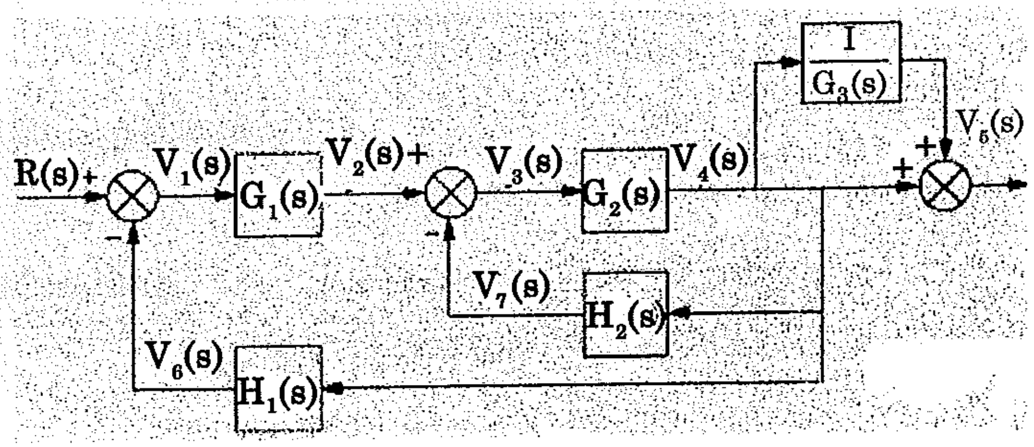

Figure 2

(OR)

b) Find the Transfer function $X_2(s)/F(s)$ for figure 3.

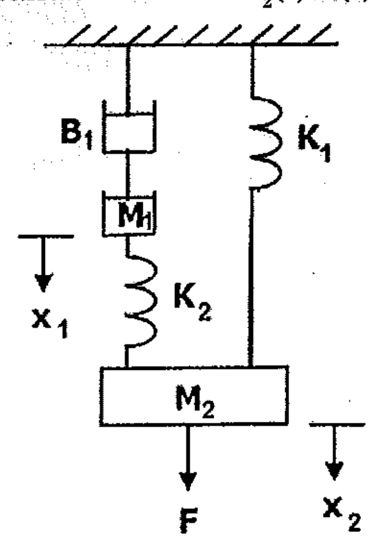

Figure 3.

12. a) Derive the unit step response of undamped second order system.

(OR)

b) Derive the transfer function of PID controller, discuss its advantages and disadvantages.

13. a) Draw Bode plot for the transfer function $H(s) = 100\dfrac{(s+1)}{(s+10)(s+100)}$.

(OR)

b) Compare polar plots of type 0, type 1 and type 2 systems.

14. a) Find the stability of the system with characteristic equation $2S^4 + S^3 + 8S^2 + S + 1 = 0$, using Routh-Hurwitz Stability criterion, state its advantages and limitations.

(OR)

b) Find the stability of system $G(s)H(s) = \dfrac{(s+2)}{(s+1)(s-1)}$ using Nyquist stability criterion.

15. a) Derive the state variable formulation of parallel RLC circuit with current source input.

(OR)

b) Derive the conditions for complete controllability of a system.

PART – C (1×15 = 15 Marks)

16. a) For the system shown in figure 4, find the rise time, peak time, peak overshoot and setting time for 2% and 4% criteria, for unit step input.

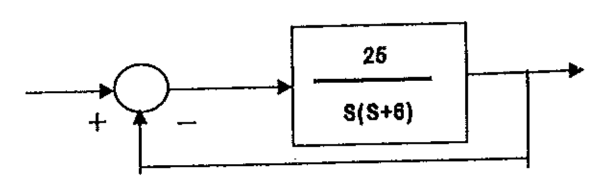

Figure 4

(OR)

b) Design a lag compensator for the system to have a phase margin of 65 degrees

$G(s) = \dfrac{1}{(s+1)(0.25s+1)}$, $H(s) = 1$

Max. steady state error for Unit Step input = 0.1