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

Question Paper Code : X 20447

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
Fourth Semester
Electronics and Communication Engineering
EC 6405 – CONTROL SYSTEM ENGINEERING
(Common to Mechatronics Engineering and Medical Electronics Engineering)
(Regulations 2013)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. Find the transfer function of the network given in Fig. Q. No. 1.

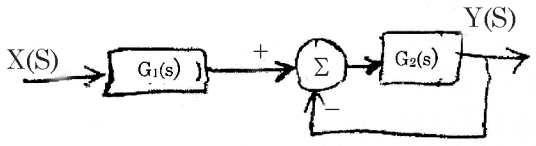


Fig. Q. No. 1

2. State Mason's gain formula.
3. State some standard test signals used in time domain analysis.
4. What is a steady state error ?
5. State the significance of Nichol's plot.
6. What is series compensation ?
7. State the necessary conditions for stability.
8. How will you find root locus on real axis ?
9. List some advantages of sampled data control systems.
10. State sampling theorem.

PART – B **(5×13=65 Marks)**

11. a) Write the differential equations governing the mechanical rotational system shown in figure Q. No. 11 (a). Draw the Electrical equivalent analogy circuits (current and voltage)

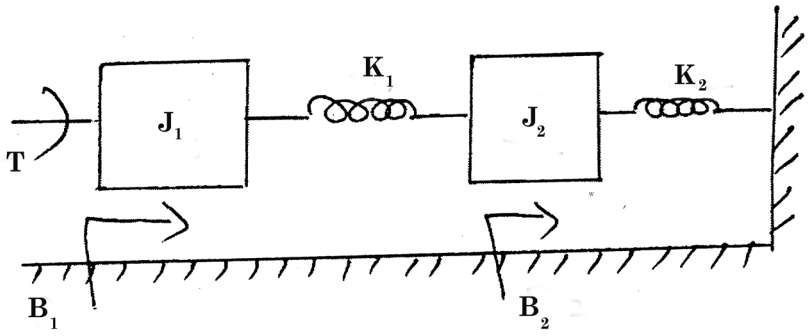


Figure Q. No. 11 (a)

(OR)

b) i) Reduce the block diagram shown in figure Q. No. 11 (b) (i) and find C/R. **(10)**

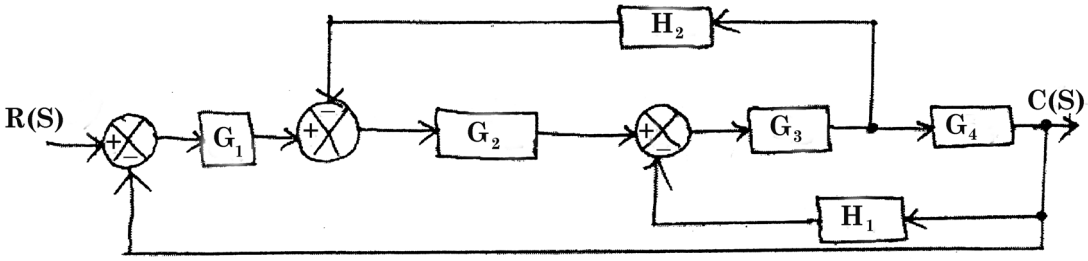


Figure Q. No. 11(b) (i)

ii) Compare open loop and closed loop control system. **(3)**

12. a) i) A unity feedback system has the forward transfer function $G(S) = \frac{KS}{(1+S)^2}$. For the input r(t) = 1 + 5t, find the minimum value of K so that the steady state error is less than 0.1 (Use final value theorem). **(6)**

ii) Briefly discuss about step response analysis of second order system. **(7)**

(OR)

b) i) For the system shown in Fig. Q. No. 12 (b) (i) find the effect of PD controller with T_d = 1/10 on peak overshoot and setting time when it is excited by unit step input. **(7)**

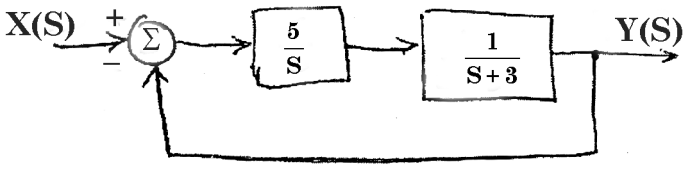


Fig. Q. No. 12 (b) (i)

ii) Discuss the effect of PID controller in the forward path of a system. **(6)**

13. a) Plot the polar plot for the following transfer function $G(S) = \frac{15}{(s+1)(s+3)(s+6)}$.

(OR)

b) Discuss briefly about the lag, lead and lag-lead compensator with examples.

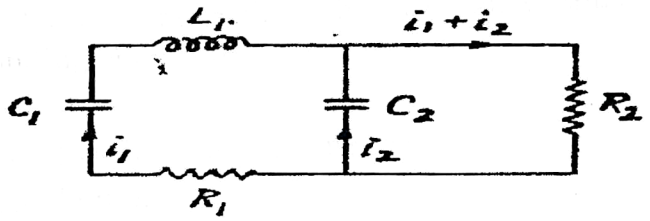
14. a) i) Using Routh Hurwitz criterion, determine the stability of a system representing the characteristic equation $S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16 = 0$ and comment on location of the roots of the characteristics equation. **(6)**

ii) Describe about Nyquist Contour and its various segments. **(7)**

(OR)

b) A unity feedback control system has an open loop transfer function $G(s) = K/[s(s^2 + 4s + 13)]$. Sketch the root locus.

15. a) Construct the state model of the following electrical system.



(OR)

b) A system is characterized by transfer function $\frac{Y(s)}{U(s)} = \frac{2}{s^3 + 6s^2 + 11s + 6}$. Find the state and output equation in matrix form and also test the controllability and observability of the system.

PART – C **(1×15=15 Marks)**

16. a) Convert the block diagram shown in Figure Q. No. 16 (a) to signal flow graph and find the transfer function using Mason's gain formula. **(15)**

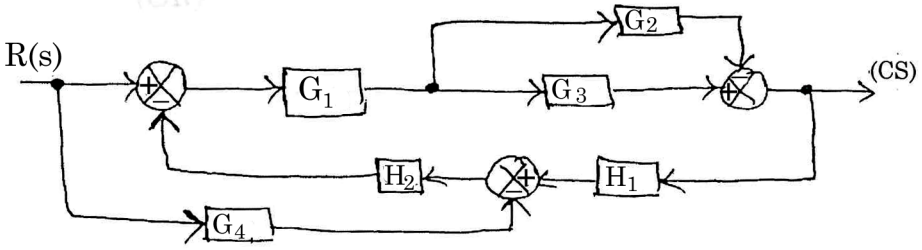


Figure Q. No. 16 (a)

(OR)

b) Sketch the Bode plot for the following transfer function. Also determine the gain and phase cross over frequencies. **(15)**

$G(s) = 10/s[s(1 + 0.4s)(1 + 0.1s)]$