EE 131501 (NR)

Roll No. of candidate

B.Tech. 5th Semester End-Term Examination

EE + ECE + AEI + EEE

CONTROL SYSTEM – I

(New Regulations)

Full Marks – 70   Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Answer the following :   (5 × 2 = 10)

    (a) Define transfer function, Loop, Non-touching loop and self-loop?

    (b) What is feedback and its effect in close loop system?

    (c) What is an asymptote.

    (d) Define Mason's gain formula.

    (e) Draw polar plot for $G(s)H(s) = K/jw$.

2. (a) Find the Range of K for the system to be (i) stable (ii) unstable (iii) Marginally stable by Nyquist Criterion.   (10)
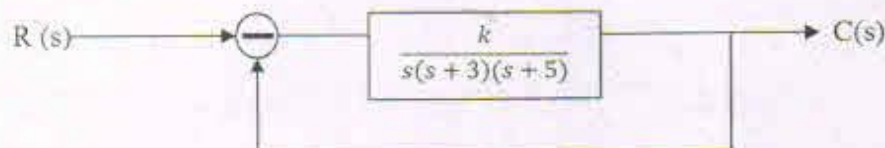
   (b) Explain the effect of adding a pole to the forward path transfer function.   (5)

[Turn over

3. (a) For unity feedback system $G(S) = \dfrac{30}{s(1+0.5s)(1+0.08s)}$, Determine GM and PM by sketching Bode Plot on semi log paper. Comment on stability of the system. (10)

   (b) For a unity feedback control system, the open loop transfer function $G(S) = 10(S+2)/S^2(S+1)$. Find the steady state error when the input is $R(S) = 3/S - 2/S^2 + 1/3S^3$. (5)

4. (a) The open looptransfer function of a system is $G(s)H(s) = k(s+1)(s^3 + bs^2 + 3s + 1)$. Determine the values of K and b so that system will oscillate at frequency of 2 rad/sec by using R-H criteria. (10)

   (b) Derive the expressions for the peak overshoot and peak time of a second order underdamped feedback system subjected to unit step input. (5)

5. (a) Consider SISO control system having overall transfer function $T(s) = (s^2 + 4s + 4)/(s^3 + 5s^2 + 4s)$. Represent state model in terms of Canonical variable with block diagram and obtain matrices A, B, C. State its stability. (7)

   (b) Determine the transfer function C/R of the system show in figure using block diagram reduction technique. (8)
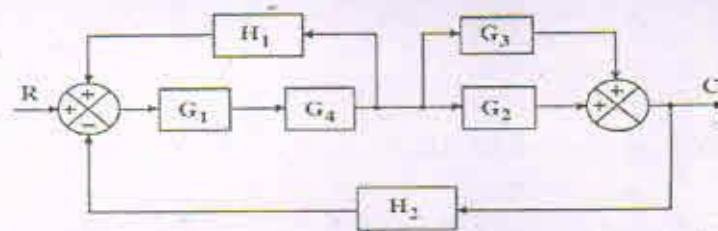
6. (a) Determine the ratio C/R, C/D and the total output for the system whose block diagram is (10)
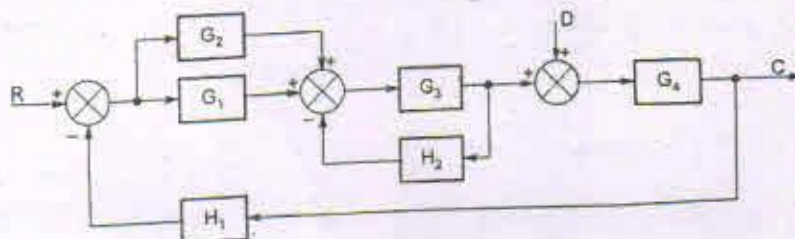
(b) Draw the mechanical circuit diagram of given mechanical system. (5)
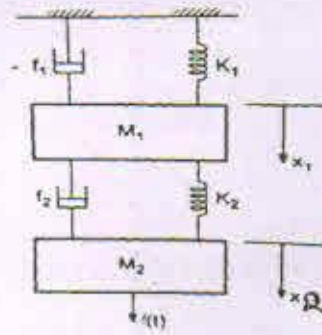
7. (a) State the advantages and limitations of frequency domain approach. (5)

(b) Find the transfer function expression for armature control DC motor. (10)