Total No. of printed pages = 4

CAI-501/CS/5th Sem/2017/M

CONTROL SYSTEMS

Full Marks – 70

Pass Marks – 28

Time – Three hours

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

Answer any *five* questions.

1. (a) What are the basic elements of a control system ? Define each of them.

With the help of a suitable example, describe the operation of a closed loop control system. 1+2+5=8

(b) What is the function of Laplace transform ? Obtain the equation of force for a translational motion linear system ? What are the conditions for a system to be linear ? 1+4+1=6

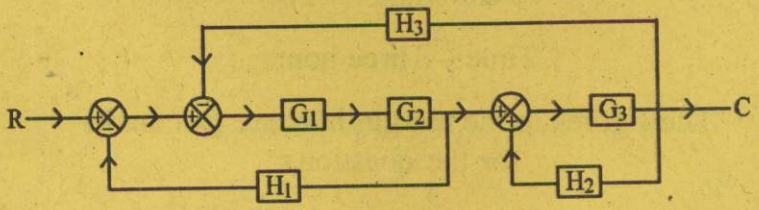
2. (a) Determine the transfer function of a separately excited D.C motor. 6

[Turn over

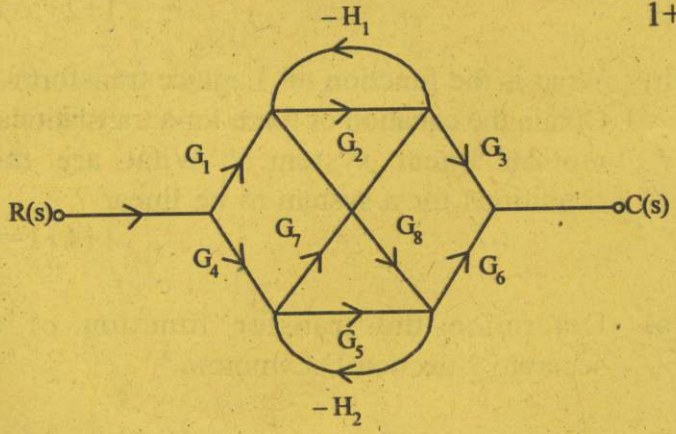
(b) Describe the working principle of stepper motor. 5

(c) Briefly explain the working principle of magnetic amplifier. 3

3. (a) Obtain the transfer function of the following block diagram. 7



(b) What do you mean by mode and loop in SFG ? Obtain the transfer function $\frac{C(s)}{R(s)}$ of the following SFG (Signal Flow Graph) : 1+6=7



4. (a) Determine the unit impulse response of a first order system. Also calculate the steady state error. 5+1=6

(b) Define rise time, delay time and peak overshoot for a second order system. 3

(c) Derive the equation of steady state error of a type O system due to a step input. 5

5. (a) Under what conditions a system is said to be

(i) marginally stable and

(ii) unstable. 2

(b) Examine the stability of the following system whose characteristic equation is given by –

$s^5 + s^4 + 3s^3 + 3s^2 + 4s + 8 = 0$ 6

(c) Calculate the angle of asymptotes and centroid of a system having

$$G(s)H(s) = \frac{K(s+2)}{s(s+1)(s+4)} \text{ where } K > 0. \quad 6$$

6. A unity feedback control system has $G(s) = \frac{40}{s(s2+s5)}$. Draw the bode plot and find the gain margin and phase margin. 14

7. Write short notes on any *two* of the following :

   (a) Automatic chemical system

   (b) Synchro transmitter

   (c) Level control system using servomechanism.

   $2 \times 7 = 14$