BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING)
THIRD YEAR FIRST SEMESTER (Old) – 2019

CONTROL SYSTEM ENGINEERING

Time: Three Hours **Full Marks: 100**

Answer ANY FIVE the Questions.

1. a) What is the importance of mathematical model in the study of control theory?

b) Obtain the closed-loop transfer function for the block diagram of a system shown in Fig P-1.

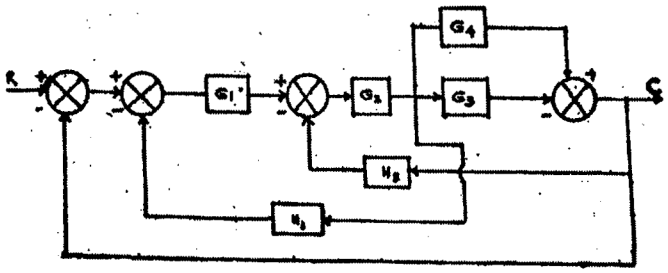

Fig P-1

[5+15=20]

2. a) State and explain Mason's Gain Formula.

b) Draw the signal flow graph of the block diagram given in Fig P-2, hence determine the overall gain of the system using Mason's Gain Formula.

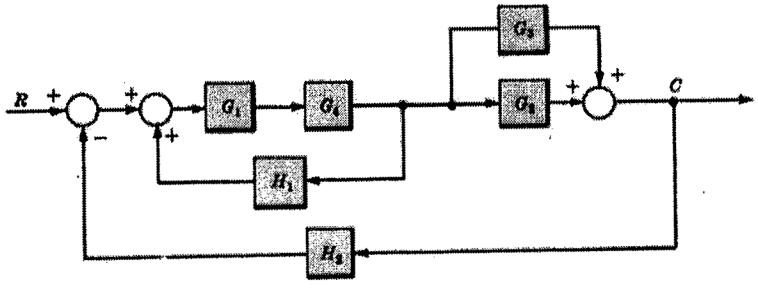

Fig P-2.

[8+12=20]

3. a) What is steady-state error? Derive the expression of steady-state error for a closed-loop system.

b) "Steady-state error of a dynamic system is influenced by the system type and nature of input" – Explain with examples.

[5+15=20]

4. The open-loop transfer function of a unity feedback system is given by:

$G(s)=\frac{K}{s(1+sT)}$, where T and K are constants having positive values. By what factor the amplifier gain K be reduced so that (a) the peak overshoot of unit step response of the system is reduced from 75% to 25%, (b) the damping ratio increases from 0.1 to 0.6 ?

[20]

5. a) Discuss the notion of stability of dynamic systems.

b) Determine the range of K, for which the system will be stable, for the system described by its closed-loop transfer function:

$$\frac{C(s)}{R(s)}=\frac{K}{s(s^2+s+1)(s+2)+K}$$

c) What are the limitations of Routh's criterion?

[7+10+3=20]

6. a) What is the utility of Root-Locus plot in linear control theory?

b) Plot the Root-Locus for a unity feedback system whose forward path transfer function is as follows:

$$G(s)=\frac{K(s+1)}{s^2(s+2)}, K\geq 0$$

Indicate significant points on the Root-Locus plot

[5+15=20]

7. Sketch the Nyquist plot of the system whose open-loop transfer function is given by:

$$G(s)H(s)=\frac{K}{s^2(1+s)(1+2s)}$$

Comment on the stability of the system.

[20]

8. Write short note on:

a) Identification of linear system by frequency response test.

b) Principle of Argument.

[10+10 = 20]