



School of Electronics Engineering
Fall Semester_2023-24 (CAT-II)
Control System BECE302L

Course Code : BECE302L
Slot : B1+TB1/B2+TB2

Duration: 90 Minutes.
Max. Marks: 50M

Answer all the Questions

S.No Questions Marks

1. The block diagram of a servomechanism system is shown in Fig. 1. Determine the characteristic equation of the system. Also, calculate the following when the unit step input is given:
- undamped and damped frequency of oscillations;
 - Damping ratio and damping factor;
 - Maximum overshoot;
 - Time interval after which maximum and minimum output will occur;
 - Settling time;
 - Number of cycles completed before the output is settled within 2% of the final value.

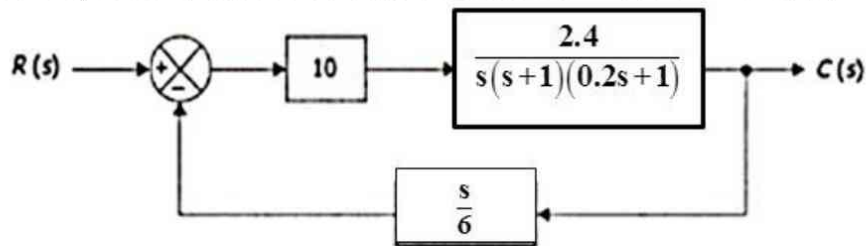


Fig. 1

2. Consider the system shown in Fig. 2 is subjected to a unit step input, the system output responds as shown in Fig. 3. Determine the values of K and T from the response curve. [10]

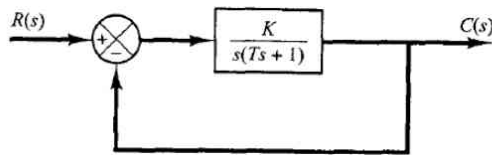


Fig.2

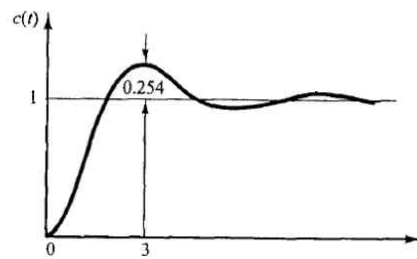


Fig. 3

3. Sketch the root locus for a system having an open-loop transfer function given by [10]

$$G(s)H(s) = \frac{K(s^2 + 6s + 25)}{s(s+1)(s+2)}$$

Determine the following

- The breakaway and break-in points.
- The Intersection of the root locus with $j\omega$ axis, and
- The Angle of departure/arrival.

4. Find the system type, static error coefficients, and steady-state error e_{ss} for the system shown in [10]

Fig. 4, for the following inputs (a) $r(t) = 12$, (b) $r(t) = 6t$, (c) $r(t) = 12 + 6t + \frac{1}{2}t^2$,

$$G_1(s) = \frac{25}{(s+5)(s+10)}, \text{ and } H_1(s) = 5s$$

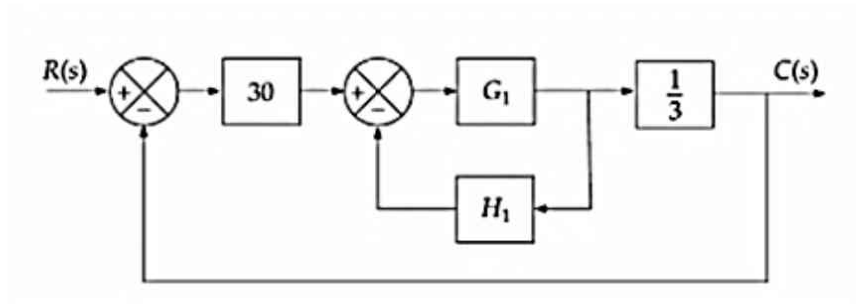


Fig. 4

5. Consider the heat exchanger temperature control room shown in Fig. 5. Find the range of values $K_A > 0$ for which the system is stable. [10]

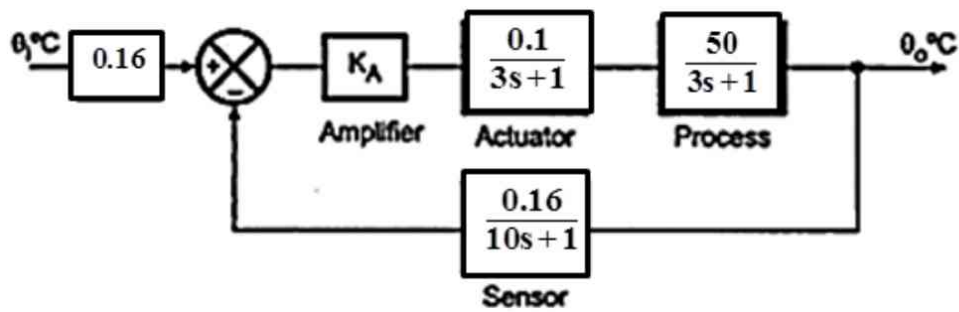


Fig. 5