B.Tech Even Semester Examination, May, 2025

Electronics & Communication Engineering

(6th Semester)

Course No: ECC-601

(Control System)

Full Marks: 50

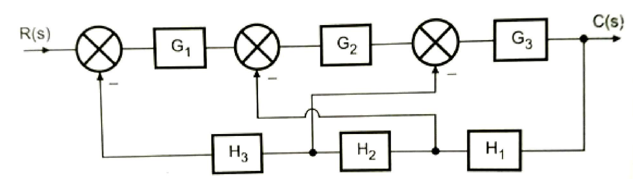
Pass Marks: 25

Time: 2 hours

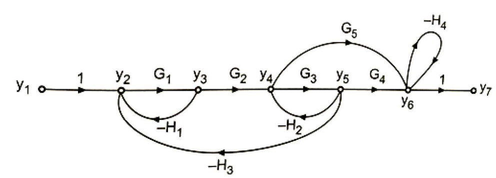
Note:

1. Attempt any five questions.
2. Begin each answer in a new page
3. Answer parts of a question at a place
4. Assume reasonable data wherever required
5. The figure in the right margin indicates full marks for the question
6. All the mathematical symbols and abbreviations have their usual meanings.

1. a) Determine $\frac{C(s)}{R(s)}$ for the block diagram given below using block diagram reduction technique.



b) Find the gain $\frac{Y_7}{Y_1}$ of the signal flow graph using Mason's gain formula 5+5=10



2. Determine the error co-efficients and static error for $G(s) = \frac{1}{s(s+1)(s+10)}$ 10

$H(s) = (s+2)$

3. Draw the Bode plot for a system having $G(s)H(s) = \frac{100}{s(s+1)(s+2)}$

Find

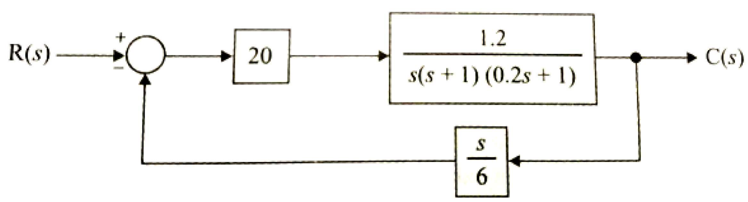
I. Gain Margin

II. Phase Margin

III. Gain cross over frequency

IV. Phase cross over frequency 10

4. For the system shown below, determine characteristics equation. Hence find the following when excitation is a unit step;



i) undamped natural frequency of oscillations

ii) damped frequency of oscillations

iii) damping ratio and damping factor

iv) maximum overshoot

v) settling time

vi) number of cycles before the response is settled within 2% of its final value and

vii) time interval after which maxima and minima will occur. 10

5. a) The characteristic equation for a certain feedback control system is given by $s^4 + a_1 s^3 + a_2 s^2 + a_3 s + K = 0$. If the numerical values of a_1=22, a_2=10 and a_3=2, find K which corresponds to the stable system.

b) Examine the stability of the system having characteristics equation $3s^4 + 10s^3 + 5s^2 + 5s + 3 = 0$ using Routh-Hurwitz criterion. 5+5=10

6. The open-loop transfer function of a unity feedback system is $G(s)H(s)=\frac{s+2}{(s+1)(s-1)}$

Comment on the stability using Nyquist plot. 10

7. Plot the root locus of a system with the transfer function 10

$$G(s) = \frac{K}{s(s+2)(s+3)}$$

8. Derive the time response of a second order system for different values of ξ for unit step input signal. 10

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