



# GOVERNMENT COLLEGE OF ENGINEERING, JALGAON

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Name of Examination : **Summer 2021** - (Preview)

Course Code & Course Name : **IN251U - Automatic Control Systems**

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Maximum Marks : **60**

Duration : **3 Hrs**

**Edit** **Print** **View Answer Key** **Close** **Answer Key Submission Type:** Marking scheme with model answers and solutions of numerical

Instructions:

1. All questions are compulsory.
2. Illustrate your answer with suitable figures/sketches wherever necessary.
3. Assume suitable additional data; if required.
4. Use of logarithmic table, drawing instruments and non programmable calculators is allowed.
5. Figures to the right indicate full marks.

1) A) Determine the overall system transfer function  $C(s)/R(s)$  for the system shown in Fig. No. 1

[06]

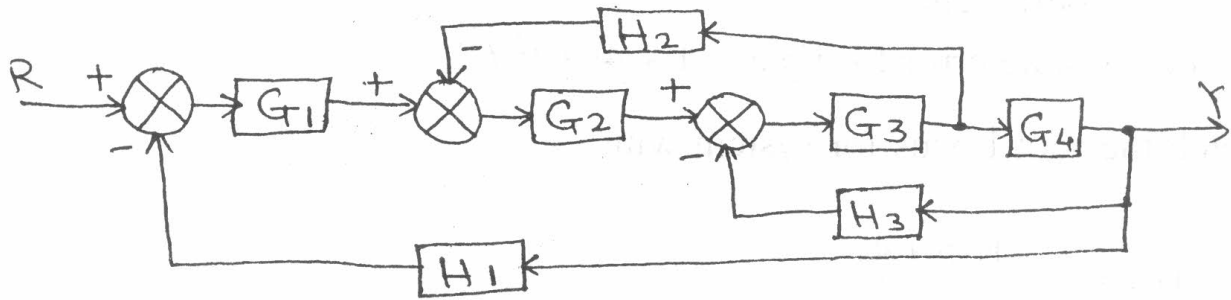


Fig. No.1

B) Determine the transfer function  $V_o(s)/V_{in}(s)$  of the Electrical system shown in Fig. No.2. If  $R=1$  ohm,  $L=1$  Henry and  $C=1$  Farad. Also draw the pole zero plot

[04]

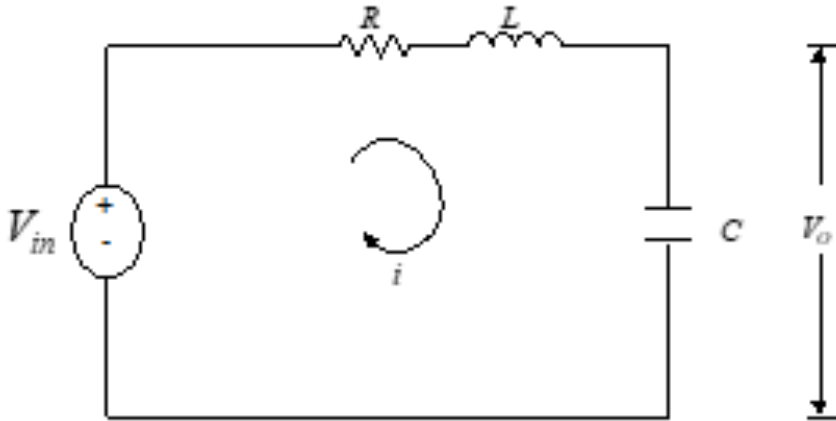


Fig. No. 2

2) A) Determine the Transfer function  $C/R$  using Mason's gain formula for the system shown in Fig. No. 3

[04]

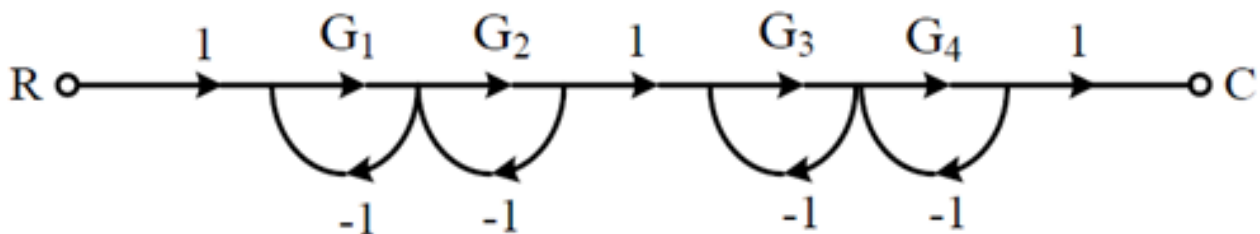


Fig. No. 3

B) For the unity feedback system with open loop transfer function  $G(s) = \frac{4(s^2+10s+100)}{s(s+3)(s^2+2s+10)}$  find order, type of the system and the static error constants  $K_p$ ,  $K_v$ ,  $k_a$  and the steady state error for the step input. [06]

3) A) For the system with closed loop transfer function  $G(s) = \frac{100}{s^2+8s+100}$ , determine the time domain specifications peak overshoot, rise time, peak time and settling time [04]

B) Find the range of  $k$  for the stability and frequency of oscillations at marginally stable condition for the unity feedback system with open loop transfer function [06]

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

4) Sketch the root locus of the unity feedback system with open loop transfer  $G(s) = \frac{K}{s(s+2)(s+3)(s+5)}$  and mark all salient points viz centroid, intersection with imaginary axis, breakaway points on the root locus. [10]

- 5) Sketch the Bode plot of the unity feedback system with open loop transfer  $G(s) = \frac{30}{s(s+3)(s+10)}$  and determine gain crossover frequency, phase crossover frequency, gain margin, phase margin and investigate stability [10]
- 6) Sketch the Nyquist plot of the unity feedback system with open loop transfer  $G(s) = \frac{50}{s(s+1)(s+5)}$  and investigate stability using Nyquist stability criterion [10]

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