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Name of Examination : **Winter 2020** - (Preview)

Course Code & Course Name : **ET301U - 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) Solve any two Question

[12]

- a) Determine the overall transfer function for the system using block reduction rules, whose block diagram is shown in Figure- 1

[6]

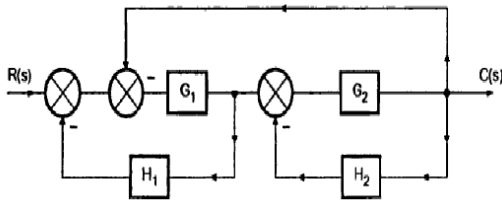


Figure- 1

- b) i. What is control system? Mention any three difference between the open loop and close loop control system. [3]
 ii. Write short note on 'digital control system'. [3]
 c) Define following terms in relation of signal flow graph: source node, sink node, chain node, forward path, feedback path, self-loop and Non-touching loops. [6]

2) Solve any two Question

[12]

- a) Explain Type 1 and 2 control system. Derive equation for the steady state error of the Type 2 control system for step and parabolic input. [6]
 b) Explain transfer function with its merits and demerits. [6]
 c) Determine the range of values of $K(K>0)$ such that the characteristics equation. [6]

$$S^3 + 3(K+1)S^2 + (7K+5)S + (4K+7) = 0$$

3) Solve any two Question

[12]

- a) i. Define magnitude plot and phase plot of Bode plot. [3]
 ii. Define Gain Margin (GM) and Phase Margin (PM) from Nyquist plot. [3]
 b) A unity feedback control system has [6]

$$G(s)H(s) = \frac{K(s+4)(s+5)}{(s+3)(s+1)} \quad (K>0)$$

Draw its Root locus.

- c) A system has step response of $c(t) = 1 - e^{-0.1t}$, Determine its impulse response and ramp response (assume zero initial condition). [6]

4) Solve Each Question

[12]

- a) i. How stability can be ensured from Routh's table? [3]
 ii. How stability can be ensured from open loop poles and closed loop poles? [3]
 b) For a unity feedback control system has $G(s) = 20/s(s+2)$. sketch the Bode plot. [6]

5) Solve Each Question

[12]

- a. Explain PID controller with block diagram. [6]
 b. Draw a Nyquist plot for The open loop transfer function of a unity feedback system and also comment on stability [6]

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

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