USN | | | | | | | | | | 17ME73

Seventh Semester B.E. Degree Examination, July/August 2021
Control Engineering

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions.

1 a. Define Control System. Explain with a schematic diagram working of manually operated closed loop control system. **(10 Marks)**

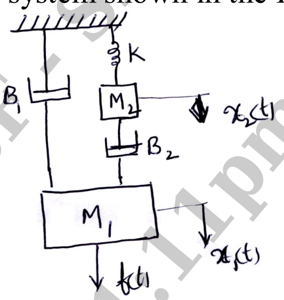
b. Mention the compansons of open loop and closed loop control system, with an example for each. **(10 Marks)**

2 a. Explain with a general block diagram the working of automatic control system. **(10 Marks)**

b. What are controllers? Explain with block diagram PI and PID controllers. **(10 Marks)**

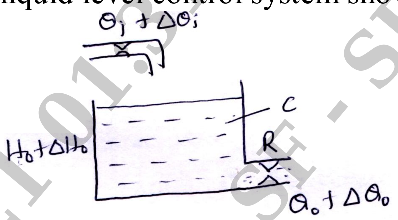
3 a. Draw the equivalent mechanical system and write the set of equilibrium equations and obtain force voltage analogy for the system shown in the Fig.Q.3(a). **(12 Marks)**

Fig.Q.3(a)



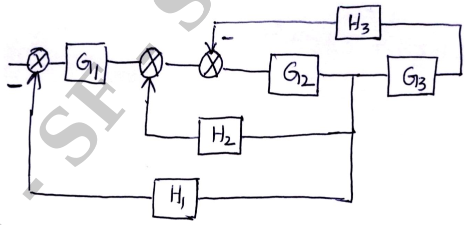
b. Obtain the transfer function of liquid level control system shown in the Fig.Q.3(b). **(08 Marks)**

Fig.Q.3(b)



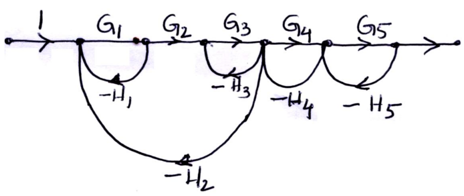
4 a. Derive the transfer function of the system shown in Fig.Q.4(a) using block diagram reduction technique. **(10 Marks)**

Fig.Q.4(a)



b. Determine the overall transfer function of the signal flow graph shown in the Fig.Q.4(b) using Masons gain formula. **(10 Marks)**

Fig.Q.4(b)



Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

5 a. A unity feedback control system is characterized by an open loop transfer function. $G(S) = \frac{10}{s^2 + 2s + 6}$, determine the following, when the system is subjected to a unit step input i) Undamped natural frequency ii) Damping ratio iii) Peak time iv) Settling time v) Peak overshoot. **(10 Marks)**

b. By applying Routh's criterion discuss the stability of the closed loop system whose characteristic equation is
$s^6 + 3s^5 + 4s^4 + 6s^3 + 5s^2 + 3s + 2 = 0$ **(10 Marks)**

6 Sketch the complete Root locus for the system having
$G(s)H(s) = \frac{K}{s(s+3)(s^2 + 3s + 11.25)}$ and comment on stability. **(20 Marks)**

7 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 and comment on stability. **(20 Marks)**

8 a. Draw the polar plot and ascertain the nature of stability for system with open loop transfer function $G(s)H(s) = \frac{12}{(s+1)(s+2)(s+3)}$. **(10 Marks)**

b. Draw the Nyquist plot for a system with open loop transfer function $G(s)H(s) = \frac{1}{s(1+2s)(1+s)}$ and comment on stability. **(10 Marks)**

9 a. Explain series and feedback compensation with block diagrams. **(12 Marks)**

b. Explain controllability and observability with reference to control system. **(08 Marks)**

10 a. Explain the following terms:
i) State ii) State variable iii) State vector iv) State space v) State equation. **(10 Marks)**

b. Discuss lag compensator, sketch the bode plot of a lag compensator. **(05 Marks)**

c. Discuss lead compensator, sketch the bode plot of lead compensator. **(05 Marks)**

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