CBCS SCHEME

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15MA73

Seventh Semester B.E. Degree Examination, Aug./Sept. 2020
Control Engineering

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain the response of proportional plus integral controller to a unit step input. **(06 Marks)**

b. Give the comparisons between open loop and closed loop control systems. **(10 Marks)**

OR

2 a. What is a feedback control system? What are the characteristics of feedback? **(08 Marks)**

b. With sketch show the components of, (i) Open loop control system
(ii) Closed loop control system. **(08 Marks)**

Module-2

3 a. For electrical components (capacitor, resistor, inductor) represent the voltage-current, current-voltage and voltage-charge relationships. **(08 Marks)**

b. Obtain the transfer function of the system shown in Fig. Q3 (b). Sketch the unity feedback block diagram to represent the transfer function. **(08 Marks)**

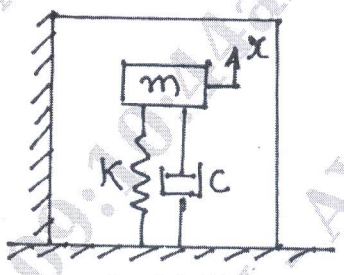

Fig. Q3 (b)

OR

4 a. Give the analogy between thermal and liquid level systems, indicating the units of measurement. **(08 Marks)**

b. Using Manson's gain formula, obtain the transfer function of signal flow graph shown in Fig. Q4 (b). **(08 Marks)**

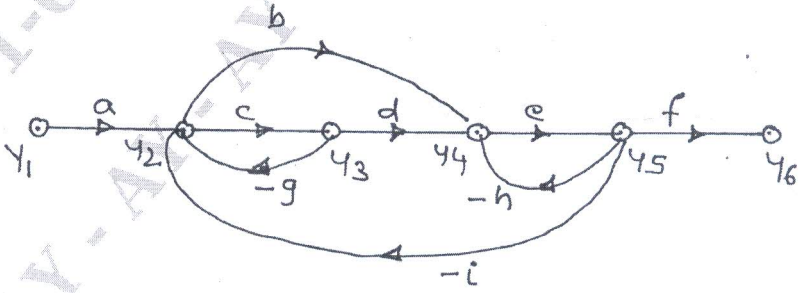

Fig. Q4 (b)

Module-3

5 a. List the steady state error constants for position (K_P) velocity (K_V) and acceleration (K_a) for Type 0, 1, 2 systems. **(08 Marks)**

b. Sketch the root locus of,

$$G(s)H(s) = \frac{K}{s(s^2+4s+13)}.$$ **(08 Marks)**

OR

6 a. Using Rouths criterion determine the range of K for a system to be stable with negative feed back of unity.

$$G(s) = \frac{K}{s(s+1)(s+2)}.$$ **(08 Marks)**

b. List the guidelines (rules) to sketch a root locus plot. **(08 Marks)**

Module-4

7 a. Sketch the polar plot of,

(i) $G(S) = \dfrac{1}{S^2(1+ST)}$ (ii) $G(S) = \dfrac{1+ST_1}{S(1+ST_2)(1+ST_3)}$ **(08 Marks)**

b. Sketch the Bode of,

$$G(s) = \frac{100}{s^2+5s+100}$$ **(08 Marks)**

OR

8 a. S-plane and GH plane conturs are shown in Fig. Q8 a(i) and Fig. Q8 a(ii) are shown. Using Nyquist criterion, comment on stability of the system. **(08 Marks)**

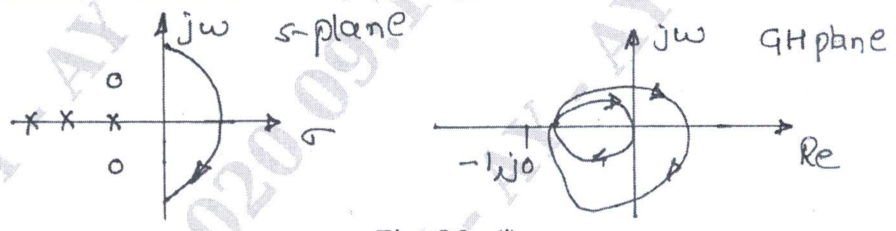

Fig. Q8 a(i)

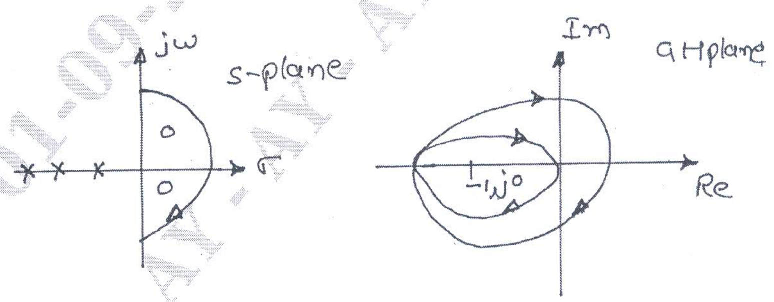

Fig. Q8 a(ii)

b. Sketch polar plot of $G(s) = \dfrac{1}{s(s+1)(s+2)}$. Indicate gain cross over, phase cross over, gain margin and phase margin. **(08 Marks)**

Module-5

9 a. What is lead compensation? Explain the feature of electrical lead compensator. **(08 Marks)**

b. Determine the state model of a system which is characterized by,

$$\dddot{y} + 2\ddot{y} + 8\dot{y} + 4y + 3y = 10u(t)$$

u(t) - unit step **(08 Marks)**

OR

10 a. Determine the state space model of the network shown in Fig. Q10 (a). **(08 Marks)**

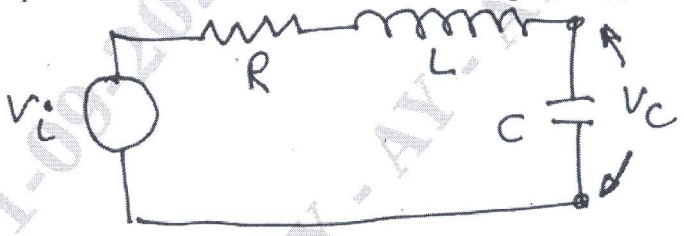

Fig. Q10 (a)

b. State the condition for controllability and observability, for state equations,

$$\dot{X} = AX + Bu$$

$$Y = CX$$

$X_{n\times 1}$ – state vector

u - Control signal.

$A_{n\times n}$ and $B_{n\times 1}$ matrices.

$C_{1\times n}$, $B_{n\times 1}$ vectors,

State the duality property of,

(i) Controllability implies observability.

(ii) Observability implies controllability. **(08 Marks)**

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