CBCS SCHEME

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15MA73

Seventh Semester B.E. Degree Examination, Dec.2018/Jan.2019
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. With an example and block diagram, explain the closed loop control system. **(05 Marks)**

b. Explain the requirements of an ideal control system (any six). **(06 Marks)**

c. Compare open loop and closed loop control system (any five). **(05 Marks)**

OR

2 Explain with block diagram and transfer function the following controllers:
i) Proportional integral ii) PID controller. **(16 Marks)**

Module-2

3 a. Obtain the transfer function of the mechanical system shown in Fig.Q.3(a). **(08 Marks)**

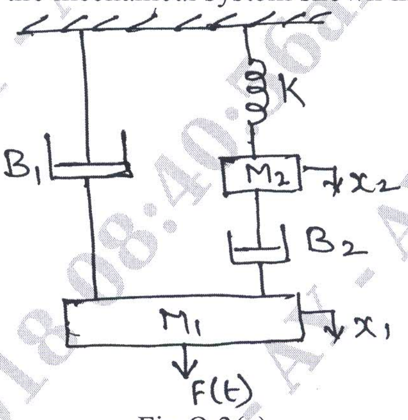

Fig.Q.3(a)

b. Obtain the transfer function of an armature controlled DC motor with a neat circuit. **(08 Marks)**

OR

4 a. Reduce the block diagram by reduction technique and find its transfer function shown in Fig.Q.4(a). **(08 Marks)**

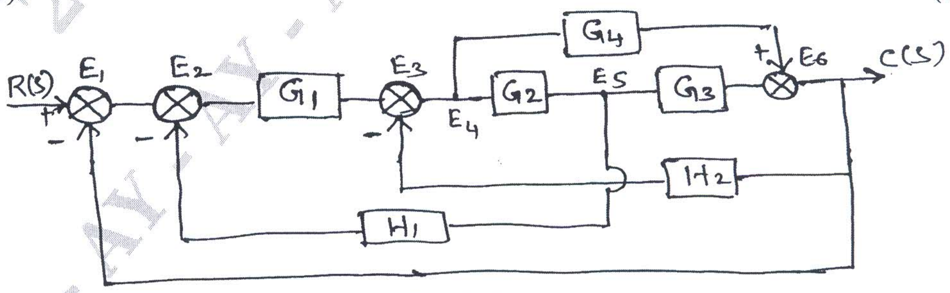

Fig.Q.4(a)

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.

b. Calculate $\frac{C(s)}{R(s)}$ of the system using Mason's gain formula shown in Fig.Q.4(b). **(08 Marks)**

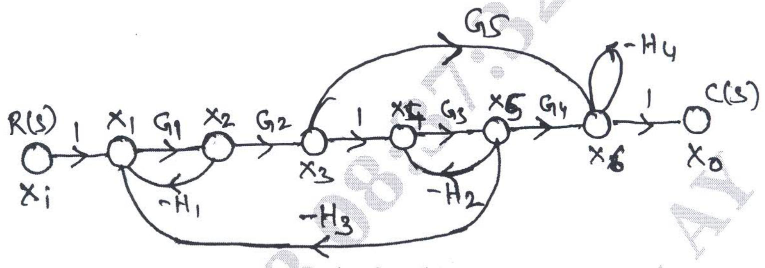

Fig.Q.4(b)

Module-3

5 a. Derive an expression of a second order system subjected to an unit step input for an underdamped system. **(08 Marks)**

b. Check the stability of the system with the characteristic equation, $s^6 + 4s^5 + 3s^4 - 16s^2 - 64s - 48 = 0$. Find W. **(08 Marks)**

OR

6 Plot the root locus for the system with $G(s)H(s) = \frac{K}{s(s^2+4s+10)}$. Comment on the stability of the system. **(16 Marks)**

Module-4

7 Draw the Nyquist plot for the OLTF $G(s)H(s) = \frac{K}{s(s^3+8s^2+17s+10)}$. Comment on the stability of the system. **(16 Marks)**

OR

8 Sketch the Bode plot for the system with $G(s)H(s) = \frac{4(s+2)}{s(s+0.5)(s+20)}$. Find GM, PM, W_{gc}, W_{pc} and comment on the stability. **(16 Marks)**

Module-5

9 a. What is system compensation? Explain series and feedback compensation. **(08 Marks)**

b. Explain the following with respect to state variable analysis:
i) State ii) State variables iii) State vector iv) State space and trajectory. **(08 Marks)**

OR

10 a. The state equation of the system is given by

$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\\ \dot{x}_3\end{bmatrix} = \begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ -6 & -11 & -6\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix} + \begin{bmatrix}0\\ 0\\ 1\end{bmatrix}U(t)$$

Estimate the controllability by Kalman's method. **(08 Marks)**

b. Evaluate the observability of the system using Gilbert's test.

$$A = \begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ 0 & -2 & -3\end{bmatrix} \quad B = \begin{bmatrix}0\\ 0\\ 1\end{bmatrix} \quad \text{and } C = [3 \;\; 4 \;\; 1].$$ **(08 Marks)**

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