CBCS SCHEME

USN | | | | | | | | | | |

15AE71

Seventh Semester B.E. Degree Examination, June/July 2023
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 closed loop control system with an example. What are the advantages and disadvantages of closed loop control system? **(10 Marks)**

b. Determine the transfer function $Y_2(s)/F(s)$ of the system shown in Fig.Q.1(b). **(06 Marks)**

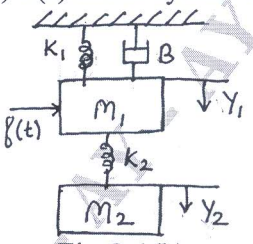

Fig.Q.1(b)

OR

2 a. Obtain the differential equations for the torsional system shown in Fig.Q.2(a). By using appropriate analogy obtain and draw the analogous force-voltage electrical network. **(10 Marks)**

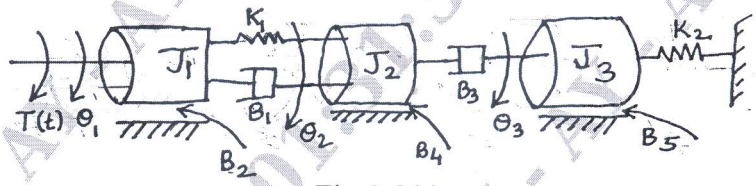

Fig.Q.2(a)

b. Derive the transfer function of an armature controlled dc motor. **(06 Marks)**

Module-2

3 a. Reduce block diagram as shown in Fig.Q3(a).

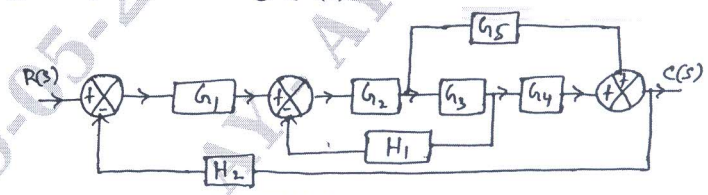

Fig.Q3(a) **(08 Marks)**

b. Find out the overall gain using Mason's gain formula shown in Fig.Q3(b).

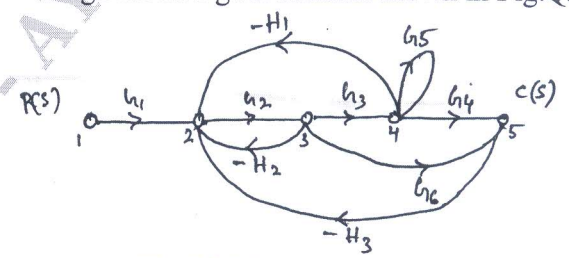

Fig.Q3(b) **(08 Marks)**

OR

4 For a spring mass damper system shown in Fig.Q4 on experiment was conducted by applying a force of 2 Newtons to the mass. The response x(t) was recorded using an xy plotter and the experimental result is as shown in the Fig.Q4 below. Find the value of M, K and B. **(16 Marks)**

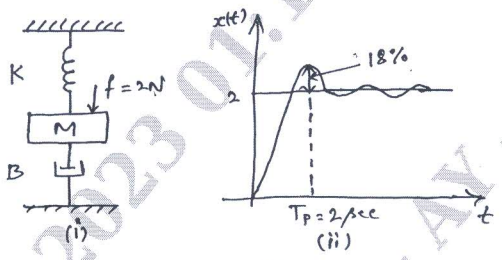

Fig.Q4

Module-3

5 Draw the complete root locus diagram for the system with open-loop transfer function $G(S)H(S) = \frac{K(s+1)}{s^2(s+3)(s+5)}$. Determine the range of variation of K over which the system remain stable. **(16 Marks)**

OR

6 Sketch the Bode plot for $G(S)H(S) = \frac{2}{s(1+s)(1+0.2s)}$. Also obtain Gain Margin and Phase Margin and cross over frequencies. **(16 Marks)**

Module-4

7 a. Derive the expression for resonant peak M_r and resonant frequency w_r for a standard second order system in terms of ξ and w_n. **(10 Marks)**

b. Find the open loop transfer function of a unity feedback second order control system for which resonant peak = 1.1 units and resonant frequency = 11.2 rad/sec. **(06 Marks)**

OR

8 For a open loop TF of a feedback control system

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

Sketch the complete Nyquist plot and hence find the range of k for stability using Nyquist criterion. **(16 Marks)**

Module-5

9 a. Explain the series and feedback compensation with block diagram. **(08 Marks)**

b. Explain the following: i) Lead compensator ii) Lag compensator. **(08 Marks)**

OR

10 a. Write a note on Kalman and Gilberts test. **(06 Marks)**

b. Define the following terms:

i) State
ii) State variables
iii) State vector
iv) State space
v) State equation **(10 Marks)**

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