CBCS SCHEME

USN | | | | | | | | | |

15AE71

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. Define Transfer function. What are the advantages and disadvantages of the transfer function. **(06 Marks)**

b. Define Control System? Distinguish between (i) Open loop system and Closed loop system (ii) Time varying and Time invariant system **(10 Marks)**

OR

2 For the mechanical system shown in Fig.Q2
(i) Draw the mechanical network
(ii) Write differential equation of the system.
(iii) Obtain F-V and F-I analogous electrical networks. **(16 Marks)**

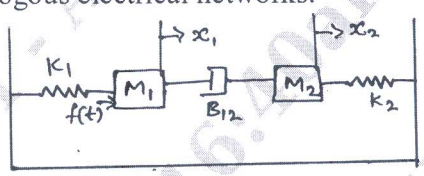

Fig.Q2

Module-2

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

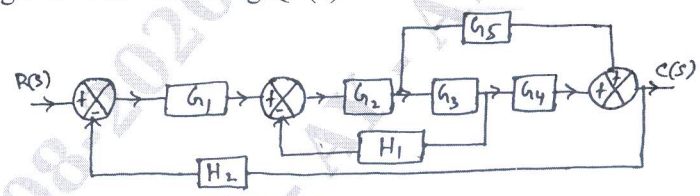

Fig.Q3(a) **(08 Marks)**

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

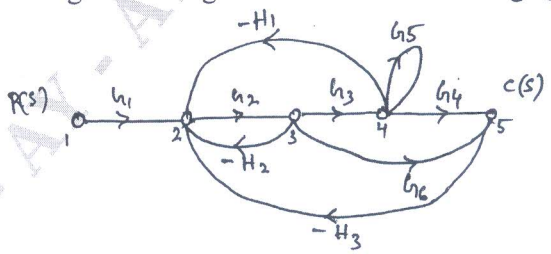

Fig.Q3(b) **(08 Marks)**

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)**

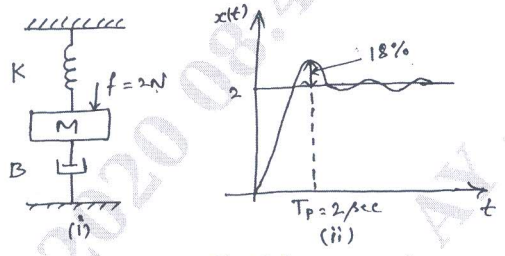

Fig.Q4

Module-3

5 Sketch the complete root locus for the system having

$$G(s)H(s) = \frac{k}{s(s+3)(s^2+3s+4.5)}$$ **(16 Marks)**

OR

6 For a unity feedback system

$$G(s) = \frac{k}{s(s+2)(s+10)}$$

Determine marginal value of 'k' for which system will be marginally stable, using Bode plot. **(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 Explain the types of Controllers. **(16 Marks)**

OR

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

b. Obtain the state transition matrix for

$$A = \begin{bmatrix} 0 & -1 \\ 2 & -3 \end{bmatrix}$$ **(06 Marks)**

* * * * *