Hall Ticket No | | | | | | | | | | | Question Paper Code: AEEB16

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech IV Semester End Examinations (Regular/Supplementary) - July, 2021

Regulation: R18

CONTROL SYSTEMS

Time: 3 Hours **(ECE|EEE)** **Max Marks: 70**

Answer FIVE Questions choosing ONE question from each module
(NOTE: Provision is given to answer TWO questions from any ONE module)
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) Explain closed loop temperature control systems with relevant diagram. **[7M]**
   (b) Write the analogous quantities in torque- voltage analogy and torque-current analogy. **[7M]**
2. (a) Define transfer function. How to obtain the transfer function of mechanical systems? **[7M]**
   (b) Write the differential equations governing the mechanical rotational system shown in Figure 1. **[7M]**

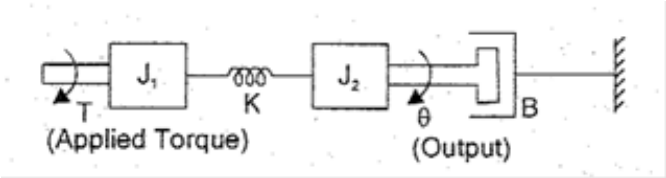

Figure 1

MODULE – II

3. (a) List the properties of signal flow graphs. Discuss the steps to construct a signal flow graph from the equations. **[7M]**
   (b) Obtain the response of unity feedback system whose open loop transfer function is $G(S) = \frac{4}{s(s+5)}$ and when the input is unit step. **[7M]**
4. (a) Obtain the closed loop transfer function $C(S)/R(S)$ of the system shown in Figure 2 block diagram **[7M]**

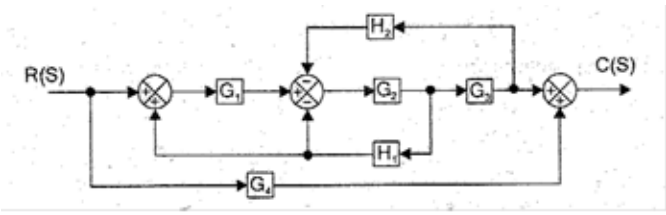

Figure 2

(b) For a unity feedback control system the open loop transfer function, $G(S) = \frac{10(s+2)}{s^2(s+1)}$. Find the position, velocity and acceleration error constants. **[7M]**

MODULE – III

5. (a) State necessary and sufficient conditions for stability in Routh stability criterion. Explain the construction of Routh array. **[7M]**

   (b) A unity feedback system has an open loop transfer function $G(S) = \frac{k}{(s^2+4s+5)(s+2)}$. Use RH test to determine the range of positive values of K for which the system is stable **[7M]**

6. (a) Briefly explain the various steps involved in the construction of root locus. **[7M]**

   (b) Use the Routh stability criterion to determine the location of roots on the S-plane and hence the stability for the system represented by the characteristics equation **[7M]**

$$s^5 + 4s^4 + 8s^3 + 8s^2 + 7s + 4 = 0$$

MODULE – IV

7. (a) What is frequency response? Write short notes on various frequency domain specifications? **[7M]**

   (b) What is Bode plot and corner frequency? Draw the bode plot of $G(S) = \frac{40(1+s)}{(1+5s)(s^2+2s+4)}$. Determine gain margin and phase margin. **[7M]**

8. (a) Write a short notes on the correlation between time and frequency response. What are advantages of frequency response analysis? **[7M]**

   (b) Determine the phase crossover frequency, gain margin of a system with open loop transfer function $G(S) = \frac{100(1+0.1s)}{s(1+0.2s)(1+0.5s)}$ **[7M]**

MODULE – V

9. (a) Construct a state model for a system characterized by the differential equation **[7M]**

$$\frac{\mathrm{d}^3y}{\mathrm{d}t^3} + 6\frac{\mathrm{d}^2y}{\mathrm{d}t^2} + 11\frac{\mathrm{d}y}{\mathrm{d}t} + U = 0$$

   (b) Compute state transition matrix for a system matrix given $A = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ **[7M]**

10. (a) How to decide whether the given control system is the controllable and observable of a control system using kalman's test. **[7M]**

    (b) Verify the controllability of a control system which is represented by the matrix **[7M]**

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -2 & -3 \end{bmatrix} \text{ and } B = \begin{bmatrix} 0 & 1 \\ 0 & 0 \\ 1 & 0 \end{bmatrix}$$

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