Hall Ticket No | | | | | | | | | | | Question Paper Code: AEE009

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech IV Semester End Examinations (Supplementary) - July, 2018

Regulation: IARE – R16

CONTROL SYSTEMS

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

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) Differentiate between open loop and closed loop control systems. **[7M]**
   (b) For the mechanical system shown in Figure 1, write the equilibrium equation and draw an equivalent diagram based on force-voltage analogy. **[7M]**

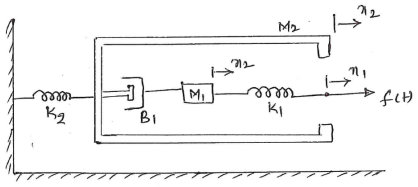

Figure 1

2. (a) What are the elements of translation and rotational mechanical systems, Write the required equations. **[7M]**
   (b) For the rotational mechanical system given in Figure 2, write equilibrium equations and draw an equivalent diagram based on torque-current analogy. **[7M]**

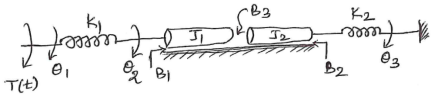

Figure 2

UNIT – II

3. (a) Differentiate between positive feedback and negative feedback systems. **[7M]**
   (b) Find the dynamic error coefficient of the unity feedback systems whose forward transfer function is G(s) =10/S(S+1). Find the steady state error to the polynomial input r(t) = $a_0 + a_1 t + a_2 t^2$. **[7M]**

4. (a) Discuss all the time domain specifications with relevant waveform and equation for second order system with unit step input. **[7M]**
   (b) A system is represented by the following set of equations, construct the signal flow graph and find the closed loop transfer function.
   $x = x_1 + t_3 * u, dx_1/dt = -q_1 * x_1 + x_2 + t_2 * u, dx_2/dt = -q_2 * x_1 + t_1 * u.$ **[7M]**

UNIT – III

5. (a) What is BIBO system? Explain with example. **[7M]**

   (b) Sketch the root locus plot for a negative feedback control system whose loop transfer function is given by $G(s)H(s) = K/S(S+3)(S^2+2S+2)$ **[7M]**

6. (a) Determine the stability of following cases, which represent characteristic equations of two different control system.
   i. $S^5 + S^4 + 2S^3 + 2S^2 + 3S + 5 = 0$
   ii. $S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16 = 0$ **[7M]**

   (b) A positional servomechanism is characterized by an loop transfer function.
   G(s)H(s) = K(S+2) / S(S-1). Determine the value of gain K
   i. When ζ of the closed loop systems is equal to 0.707.
   ii. When the closed loop system has two roots on the jw-axis. **[7M]**

UNIT – IV

7. Construct the Bode plot for a unity feedback system whose open loop transfer function is given by, G(S) = 10 / S(1+S)(1+0.02S). Find
   (a) Gain and Phase crossover frequencies. **[7M]**
   (b) Gain and Phase margin. **[7M]**

8. (a) Differentiate between time domain and frequency domain. **[7M]**
   (b) Sketch the nature of Nyquist plot for the system with G(s)H(s) = 1 / S(1+2S)(1+S), determine the closed loop stability. **[7M]**

UNIT – V

9. (a) Write a note on controllers and compensator with necessary equations and block diagram. **[7M]**
   (b) With a neat block diagram and equation, explain lead compensator and lag compensator **[7M]**

10. (a) Write a note on state space theory used for control system analysis with necessary equations. **[7M]**
   (b) For the circuit shown in Figure 3, obtain state space equations. Given e(t) as input. **[7M]**

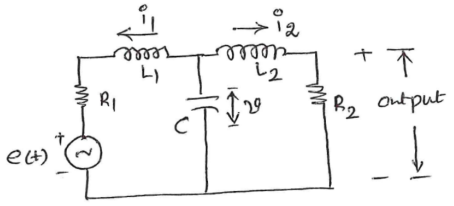

Figure 3

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