Roll No. ☐☐☐☐☐☐☐☐☐☐☐☐☐   **Total No. of Pages : 02**

Total No. of Questions : 09

B.Tech.(Automation & Robotics) (2011 & Onward)   (Sem.–4)

LINEAR CONTROL SYSTEMS

Subject Code : BTEE-402

M.Code : 57108

Time : 3 Hrs.   **Max. Marks : 60**

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**

2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**

3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

Q1. Write briefly :

a. What do you mean by plant and system? Explain.

b. List the mechanical and electrical analogies.

c. Explain how the pole zero locations effect the stability of the system.

d. Explain the step and impulse test input signals.

e. List the advantages and disadvantages of root locus technique.

f. What do you mean by relative stability? Explain.

g. Discuss the need of compensation.

h. List the main characteristics of servomotors.

i. Define state and state vector.

j. What is Controllability and Observability of a system?

SECTION-B

Q2. Explain the following in detail with suitable examples

a. Open and closed loop systems

b. Continuous and sampled data control systems

Q3. What is the need of signal flow graphs? List the different rules to draw the signal flow graphs. Determine the overall transmittance relating x_2 and x_i for the signal flow graph shown below
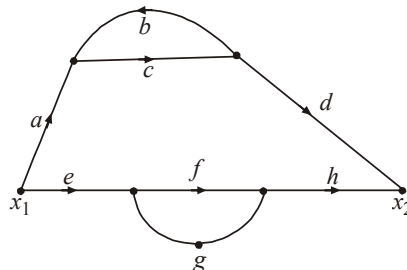

Fig.1

Q4. Using the Routh-Hurwitz criterion determine the relation between K and T so that unity feedback control system having open loop transfer function $G(s)H(s) = \dfrac{K}{s\left[s\,(s+10)+T\right]}$ is stable.

Q5. The open loop transfer function of a system is given by $G(s)H(s) = \dfrac{K}{s(sT-1)}$ of the system using Nyquist Criterion.

Q6. Explain the different steps required to draw a root locus.

SECTION-C

Q7. Discuss the following :
   a. Tachogenerators
   b. Series and parallel compensators

Q8. Sketch the Bode plot for the transfer function given below :

$$G(s)H(s) = \frac{48(s+10)}{s(s+20)\,(s^2+2.4s+16)}$$

Apply correction to magnitude plot for the quadratic term and comment on the stability.

Q9. Find controllability and observability of given system :

$$\begin{bmatrix} x^1 \\ x^2 \\ x^3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} \cdot \begin{bmatrix} x^1 \\ x^2 \\ x^3 \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix} u(t)$$

$$y = \begin{bmatrix} 10 & 5 & 1 \end{bmatrix} \begin{bmatrix} x^1 \\ x^2 \\ x^3 \end{bmatrix}$$

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.