Roll No. .... Total Pages : 3

009502

January 2022

B.Tech. (EIC) - V SEMESTER

Modern Control System (EI-502)

Time : 90 Minutes] [Max. Marks : 25

Instructions :

1. *It is compulsory to answer all the questions (1 mark each) of Part-A in short.*
2. *Answer any three questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART-A

1. (a) State Caley Hamilton theorem. (1)

(b) Define Subspace. Is zero vector a part of subspace? (1)

(c) Write *two* important properties of a linear transformation. (1)

(d) What is the difference between Span & basis of a vector space? (1)

(e) What is Principle of Duality? (1)

(f) What are phase variables? (1)

(g) What is stablizability of a system? (1)

(h) How do you define geometric multiplicity of an eigen value? (1)

(i) What is separation property? (1)

(j) What is the significance of Minimal Polynomial in design of a control system? (1)

PART-B

2. (a) Obtain the state transition matrix of the following system :

$$\dot{x}_1 = x_2$$

$$\dot{x}_2 = -2x_1 - 3x_2$$ (3)

(b) What are the advantages of state space modelling? (2)

Q3 (a) Derive the expression for the transfer fn. For a LTI system from its state space representation. (2)

(b) Find eigen values & corresponding eigen vectors of the matrix :

$$A = \begin{bmatrix} 1 & 2 \\ 4 & 3 \end{bmatrix}.$$ (3)

4. (a) Draw & explain the block diagram of Luenberger observer. (3)

(b) What are the conditions to be fulfilled before designing a state feedback controller? (2)

5. (a) How can the controllability of a system be found by observing its Jordan canonical form? (2)

(b) Determine the state controllability for the following system :

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 2 & 1 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} [u].$$ (3)

6. Design observer gains for the given system so that the observer eigen values lie at [–50, –50]

$$\begin{bmatrix} \dot{x}_1(t) \\ \dot{x}_2(t) \end{bmatrix} = \begin{bmatrix} -4 & -4 \\ 1 & -2 \end{bmatrix} \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} + \begin{bmatrix} 0 \\ 2 \end{bmatrix} u$$

and $y(t) = [1 \;\; 0] \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix}$ [5]