G 1231 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2015

Sixth Semester

Branch : Applied Electronics and Instrumentation/Electronics and Instrumentation Engineering

AI 010 605/EI—010 605—CONTROL ENGINEERING—II (AI/EI)

(New Scheme—2010 Admission onwards)

[Regular/Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. Obtain the state model of a linear system.
2. What are the properties of STM.
3. Define observability.
4. Write the transfer function of a first order bold circuit.
5. What are non-linear system ?

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Obtain the eigen values of matrix $A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -1 \end{bmatrix}$.
7. Obtain state space representation of armature controlled d.c. motor.
8. Check the controllability of the given system :

$$\begin{bmatrix} -2 & 1 \\ 1 & -2 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u \quad y = \begin{bmatrix} 1 & -1 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}.$$

9. What are the practical aspect for the choice of sampling rate ?
10. Comment on the stability of limit cycle.

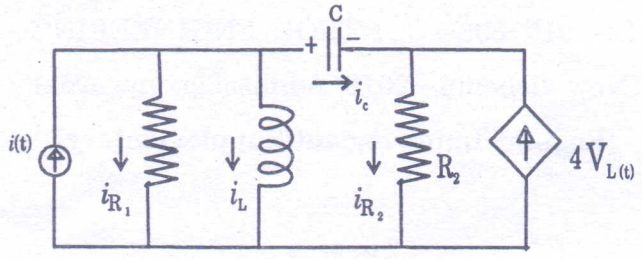
(5 × 5 = 25 marks)

Turn over

Part C

Answer **all** *questions.*
Each question carries 12 *marks.*

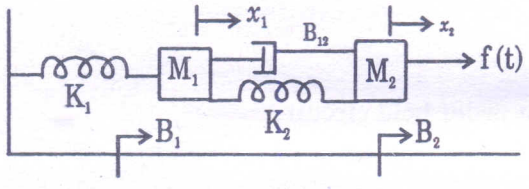
11. Find the state and output equation for the electrical network if output vector $\begin{bmatrix} v_{R_2} & i_{R_2} \end{bmatrix}^T$



(12 marks)

Or

12. Obtain the transfer function of the following mechanical system



(12 marks)

13. Obtain STM :

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}.$$ Obtain the inverse of $\phi(t)$. (12 marks)

Or

14. Obtain the time response of the following system :

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$ where $u(t)$ is unit step input function occurring at $t = 0$ or $u(t) = 1(t)$.

(12 marks)

15. Design a state observer to place the poles at –10 and – 10 for the system represented as

$$\dot{X} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} X + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u \qquad y = [2 \quad 0]\, X.$$

(12 marks)

Or

16. Explain full order state observer. Draw a state diagram of asymptotic state observer. Under what condition state estimators are used.

(12 marks)

17. Derive the describing function of a saturation non-linearity. (12 marks)

Or

18. Obtain the phase plane portrait of non-linear system given as $\ddot{X} + |\dot{X}| + X = 0$. (12 marks)

19. Find the z domain transfer function of the following s domain transfer function :

(i) $\dfrac{a}{(s+b)^2 + a^2}$.

(ii) $\dfrac{s+b}{(s+b)^2 + a^2}$.

(12 marks)

Or

20. Find the inverse z transform :

(i) $\dfrac{2z}{(2z-1)^2}$

(ii) $\dfrac{z - 0.4}{z^2 + z + 2}$.

(12 marks)

[5 × 12 = 60 marks]