G 6099 (Pages : 2) Reg. No.............................

Name...............................

B.TECH. DEGREE EXAMINATION, MAY/JUNE 2009

Eighth Semester

Branch : Applied Electronics and Instrumentation Engineering

MODERN CONTROL THEORY (A)

(Regular/Supplementary)

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

Part A

Each question carries 4 marks.

1. What are the limitations of conventional control theory ?
2. Explain with an example the use of Lagrang's equation.
3. Discuss the nonuniqueness state space representation of systems.
4. Explain the significance and properties of state transition matrix.
5. Derive the state model of a series RLC circuit driven by a voltage source.
6. Discuss on the stabilizability of systems that are not completely controllable.
7. Explain the different types of regulators used in optimal control.
8. What is a linear observer ? What are its uses ?
9. What are the advantages of MATLAB ?
10. Write an m-file to plot on full-wave of the function 230 sin 100 πt.

(10 × 4 = 40 marks)

Part B

Each question carries 12 marks.

11. Derive the state model of the system represented by $\dddot{y}(t) + 3\ddot{y}(t) + 2\dot{y}(t) = \dot{x}(t) + 3x(t)$.

Or

12. Find the state model for the system shown in Fig. 1

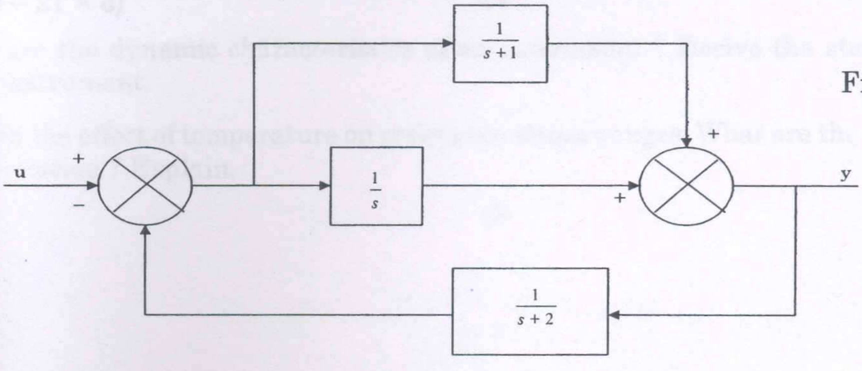

Fig 1

Turn over

13. Solve the state equations with the coefficient matrices $A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -2 & -3 \end{bmatrix}; B = \begin{bmatrix} 0 \\ 0 \\ -1 \end{bmatrix}$ and $x(0) = [1\ 0\ 0]^T$.

Or

14. Obtain the transfer function matrix of the system represented by :

$$A = \begin{bmatrix} 1 & 2 \\ -1 & 3 \end{bmatrix}; B = \begin{bmatrix} 1 & 0 \\ -1 & -2 \end{bmatrix}; C = \begin{bmatrix} 1 & -1 \\ 2 & 1 \end{bmatrix}; D = [0].$$

15. Derive the state space model of an instrument servo.

Or

16. Consider the system $\dot{X}(t) = \begin{bmatrix} 1 & e^{-t} \\ 0 & -1 \end{bmatrix} X(t)$, $y(t) = [1 \quad 1]\, x(t)$. Is this system observable at $t = 0$? If yes, find X (0) when $y(t) = e^{+t}$.

17. Design a state observer for the following system such that the estimation error will decay in less than 4 sec.

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

Or

18. Find the optimal control law for the system $\dot{X} = \begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix} X + \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix} u$ with the performance index

$$J = \int_0^\infty \left(x_1^2 + u_1^2 + u_2^2\right) dt.$$

19. Explain the role of MATLAB in the analysis of control system.

Or

20. Derive a SIMULINK model a missile guidance system.

(5 × 12 = 60 marks)