F 3526 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Eighth Semester

Branch : Applied Electronics and Instrumentation Engineering

MODERN CONTROL THEORY (A)

(Old Scheme—Prior to 2010 Admissions)

[Supplementary/Mercy Chance]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 4 *marks.*

1. Distinguish state model and transfer function model of a system ?
2. Explain the limitations of conventional control theory.
3. What are the properties of transfer functions ?
4. Write a note on decomposition of transfer functions.
5. Write a note on controllability.
6. Compare Kalman's and Gilbert's test methods.
7. What are exogenous variables ?
8. Explain the properties of observers.
9. Write a note on MATLAB functions.
10. Define state variable and state model.

(10 × 4 = 40 marks)

Part B

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

11. (a) Design reduced order, state observe and controller for the system.

Assume the desired closed loop poles satisfy the state feedback controller design: S_1 and $S_2 = -2j2$ and $S_3 = -6$ and output $y = x_1$ which is accurately measured and desired state observer poles are – 10 and – 10 respectively.

Or

Turn over

(b) Explain how the limitations of conventional control theory are overcome in modern control theory with particular reference to non-linear systems, time varying system, design, analysis and computer applications.

12. (a) Derive the state space model of distillation column and explain the input, output and state variables.

Or

(b) Obtain the state model of the system represented by the following differential equation $y''' + 6y'' + 5y' + y = u(t)$. Draw the block diagram.

13. (a) Derive the solution of state equation for autonomous and non-autonomous system and state the properties of state transition matrix

Or

(b) Mention the conditions for complete controllability and complete observability of continuous time systems. Explain the principle of duality between controllability and observability.

14. (a) Find out the transfer function and the process is described by the following equation.

$$\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 0 & 2 \\ -4 & 6 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u \text{ and } y = [2,\ 5]\, x.$$

Or

(b) Explain the design of regulators for single input and single output systems.

15. (a) Explain the following MATLAB commands

abs, acker, c2d, conv, deconv, ctrb, dlqr, eig, inv, length, lqr, lsim

Or

(b) Explain infile and simulink block diagram to solve the differential equation $y''' + 5y'' + 6y' + 8y = u$.

(5 × 12 = 60 marks)