

B.TECH. DEGREE EXAMINATION, MAY 2015**Seventh Semester**

Branch : Electrical and Electronics Engineering

EE 010 704 – MODERN CONTROL THEORY (EE)

(New Scheme – 2010 Admission onwards)

[Improvement/Supplementary]



Time : Three Hours

Maximum : 100 Marks

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

1. What is compensation technique? and when we use lead compensation technique.
2. What is Popov's criterion? Explain in brief.
3. Write a note on Dead zone non-linearity.
4. What is observability? Explain with an example.
5. Write short on Direct Digital Control.

(5 × 3 = 15 marks)

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

6. Explain the concept of controllability with an example.
7. What are common physical non-linearities. Give examples along with an explanation in brief.
8. Explain along with mathematical equation of Lyapunov method of non-linearity.
9. What is state transition matrix? What are its properties?
10. What is pole placement compensation? Explain in brief.

(5 × 5 = 25 marks)

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

11. What is an observer? What are its needs? Explain the properties and structure of a full order observer.

*Or***Turn over**

12. The state equation and output equation of system is given by :

$$\begin{bmatrix} \dot{X}_1 \\ \dot{X}_2 \\ \dot{X}_3 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 1 \\ -2 & -3 & 0 \\ 0 & 2 & -3 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 2 \\ 0 \end{bmatrix} [u]$$

$$y = [1 \ 0 \ 0] \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix}$$



Find the controllability and observability of a system.

13. A linear second order servo is described by the equation :

$$\ddot{e} + 2\{w_n e' + w_n^2 c = 0$$

Where $\zeta = 0.15$, $w_n = 1$ rad/sec, $e(0) = 1.5$ and $\dot{e}(0) = 0$.

Determine the singular point. Construct the phase trajectory using the method of isoclines.

Or

14. Construct a phase trajectory by delta method for a non-linear system represented by the differential equation :

$$\ddot{X} + 4 | \dot{X} | \dot{X} + 4X = 0.$$

Choose the initial conditions as $X(0) = 1.0$ and $\ddot{X}(0) = 0$.

15. Derive the describing function equation of the non-linearity having saturation non-linearity.

Or

16. Explain the behaviour of non-linear systems.
17. Find the one sided Z-Transform of the sequences generated by mathematically sampling the following time functions :

(a) t^2 ; (b) Sincot.

Or

18. Check for stability of the sampled data control system of the characteristic equation :

$$Z^4 - 1.7 Z^3 + 1.04 Z^2 - 0.268 Z + 0.024 = 0$$

by using Jary's stability test method.

19. State the different PLC programming languages with example.

Or

20. State the different control hierarchies for plant level automation.

(5 × 12 = 60 marks)