

B.E DEGREE EXAMINATIONS: MAY/JUNE 2013

Eighth Semester

ELECTRONICS AND INSTRUMENTATION ENGINEERING

EIE125: Advanced Control Systems

Time: Three Hours**Maximum Marks: 100****Answer all the Questions****PART A (10 x 1 = 10 Marks)**

1. The _____ of a system consists of state equation and output equation.
 - a) State model
 - b) Physical models
 - c) Transfer Function Model
 - d) None of the above
2. A matrix is singular if and only if it has a _____ eigen value.
 - a) Zero
 - b) One
 - c) Two
 - d) Five
3. The limit cycle is a phenomenon observed in _____.
 - a) Linear systems
 - b) Non-linear systems
 - c) Stable systems
 - d) Unstable systems
4. A locus passing through the points of same slope in phase plane is called _____.
 - a) Delta
 - b) isoclines
 - c) Limit cycle
 - d) Singular point
5. When $-1/K_n$ locus is not enclosed by $G(j\omega)$ locus, the system is
 - a) Critically stable
 - b) Unstable
 - c) Stable
 - d) Marginally stable
6. The _____ is a phenomenon in which the output follows a different path for increasing or decreasing values of input.
 - a) Saturation
 - b) Stable
 - c) Unstable
 - d) Hysteresis
7. A scalar function $v(x)$ which satisfies $v(x) > 0$; $x \neq 0$ and $v(0) = 0$ for _____.
 - a) Positive definiteness
 - b) Negative Definiteness
 - c) Positive semi definiteness
 - d) Negative semi definiteness
8. The method of lyapunov stability is based on the concept of
 - a) Power
 - b) Energy
 - c) Power and energy
 - d) Stress
9. The closed loop system is _____, if the nyquist plot of $G(j\omega)$ does not intersect the circle.
 - a) Asymptotically unstable
 - b) Stable
 - c) Unstable
 - d) Asymptotically Stable
10. The dynamic model of process in linear empirical model is obtained by
 - a) System Identification
 - b) Optimal control
 - c) Adaptive control
 - d) MPC

PART B (10 x 2 = 20 Marks)

11. Draw the block diagram representation of state model.
12. Define Controllability and Observability.
13. What is saturation? Give Example.
14. Define hysteresis and back lash.
15. Define limit Cycle.
16. What is meant by Singular point?
17. Define Popov Criterion.
18. What is meant by norm?
19. Write about optimal controller?
20. What is parameter optimization?

PART C (5 x 14 = 70 Marks)

21. a) A feedback system has closed loop transfer function

$$\frac{Y(s)}{U(s)} = \frac{10(s+4)}{s(s+1)(s+3)}$$

Construct three different state models for this system and give block diagram representation.

(OR)

- b) Determine whether the system is completely controllable and observable.

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 1 \\ -2 & -3 & 0 \\ 0 & 2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 2 \\ 0 \end{bmatrix} u ; y = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

22. a) A linear second order servo is described by the equation

$$\ddot{e} + 2\xi\omega_n\dot{e} = 0 \text{ where } \xi = 0.15, \omega_n = 1 \text{ rad/sec, } e(0) = 1.5$$

Determine the singular point. Construct the phase trajectory, using the method of isoclines. Chose slope as -2.0,-0.5,0.5 and 2.0

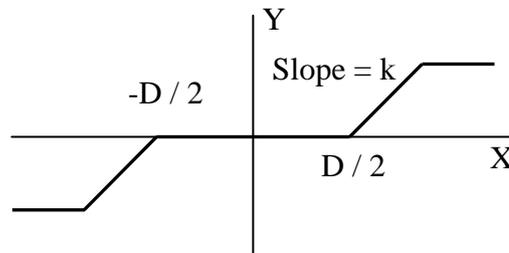
(OR)

- b) Explain different types of singular point based on the eigen values in details with necessary phase portrait.

23. a) Explain in detail about the stability of non-linear systems.

(OR)

- b) Derive the describing function of the element whose input and output characteristics is shown in below figure.



24. a) Define Lyapunov stability. Explain direct method of lyapunov stability.

(OR)

- b) Discuss in detail about popov's criterion.

25. a) With the neat sketch, explain in detail about Model Predictive Control.

(OR)

- b) Explain with necessary diagrams applications of adaptive control in chemical reactor.
