



B.E DEGREE EXAMINATIONS: NOV2015

(Regulation 2009)

Seventh Semester (Fast Track)

ELECTRONICS AND INSTRUMENTATION ENGINEERING

EIE125: Advanced Control System

(Provide Necessary Graph Sheet)

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

- Which of the following is a Linear system
 - $Y=mx+2c$
 - $Y=mx+c^2$
 - $Y=m^3x$
 - $Y=mx-c$
- The statement “Every square matrix satisfies its own characteristic equation” is according to _____.
 - The Manson’s theorem
 - The Jordon’s canonical theorem
 - The Cayley Hamilton’s theorem
 - Superposition principle
- The starting point of phase trajectory is _____.
 - Infinity
 - Initial condition
 - Origin
 - Boundary condition
- Which of the following method is used for predicting limit cycles?
 - Phase plane method
 - Lyapunov method
 - Describing function method
 - Kalman method
- The main reason to introducing Describing Function method is to design control systems for _____.
 - Medical applications
 - Industrial applications
 - Tracking applications
 - Chemical applications
- Limit cycles exists at the intersection point of _____ locus and $G(j\omega)$ locus.
 - $1/K_N$
 - $-K_N$
 - $-1/K_N$
 - K_N
- The function $v(x) = x_1^2 + x_2^2$ is _____.
 - Negative definite
 - Positive definite
 - Positive semi definite
 - Negative semi definite

- (ii) Find Eigen values and Eigen vectors for the system described by System (7)

$$\text{Matrix} \begin{bmatrix} 3 & 4 \\ 2 & 1 \end{bmatrix}.$$

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

$$\ddot{e} + 2\varepsilon\omega_n\dot{e} + \omega_n^2 e = 0$$

where $\varepsilon = 0.15$, $\omega_n = 1 \text{ rad/sec}$, $e(0) = 1.5$ and $\dot{e}(0) = 0$.

Determine the singular points and construct a phase portrait using the method of Isoclines.

(OR)

- b) (i) Explain stability analysis of phase portraits using appropriate diagrams. (7)

- (ii) Draw the phase portrait for the system described as (7)

$$\begin{bmatrix} \dot{x} \\ \dot{y} \end{bmatrix} = \begin{bmatrix} -1 & 2 \\ 0 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix}$$

23. a) Derive Describing Function for dead zone non-linearity.

(OR)

- b) Derive Describing Function for saturation non-linearity.

24. a) (i) Describe different types of stability in the sense of Lyapunov. (7)

- (ii) Find the stability of the following system using Lyapunov direct method (7)

$$\dot{X} = \begin{bmatrix} 0 & 1 \\ -1 & -1 \end{bmatrix} X$$

(OR)

- b) (i) Discuss the concept of Sign Definiteness of a scalar function. (7)

- (ii) State Popov criterion. Describe the principle and operation of popov criterion for stability analysis of nonlinear systems. (7)

25. a) Explain in detail with necessary diagram the concept of Model Predictive Control.

(OR)

- b) Explain the concept of Optimal control with a neat diagram. Briefly discuss its applications.
