F.Y. M. Tech (microtronics.)

COLLEGE OF ENGINEERING, PUNE

(An Autonomous Institute of Government of Maharashtra.)
SHIVAJI NAGAR, PUNE - 411 005

END Semester Examination

- Advanced Control Systems - MX-519

Year: 2014-2015 | Max.Marks:60

Duration: 3 Hours Time:- 2.00pm to 5.00pm | Date: 26th Nov 2014

Instructions: MIS No. [ ]

1. Figures to the right indicate the full marks.
2. Mobile phones and programmable calculators are strictly prohibited.
3. Writing anything on question paper is not allowed.
4. Exchange/Sharing of anything like stationery, calculator is not allowed.
5. Assume suitable data if necessary.
6. Write your Seat Number on Question Paper

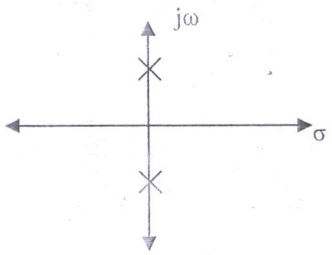
Q1. Any Five (20)

1. Justify 'Describing function is also called as Harmonic linearization of nonlinearities'.
2. Find transfer function for control system with state model defined by

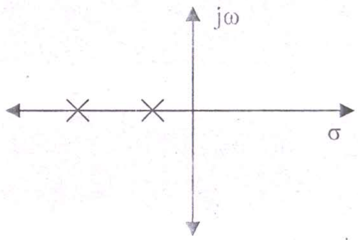
$$A = \begin{bmatrix} -2 & -2 \\ 0 & -1 \end{bmatrix} \quad B = \begin{bmatrix} 3 \\ 1 \end{bmatrix} \quad C = [1 \;\; 0]$$

3. Explain reduced order observer.
4. Explain limit cycles and their significance.
5. Write short note on state regulator problem for optimal control system design.
6. For given pole-zero plot, identify singular point and draw approximate phase trajectory. Comment on stability.

a.



b.



Q2. Any Five (40)

1. Design state feedback control for a system to have poles at s = -2 ±j4 and -10. The system is defined by –

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -5 & -6 \end{bmatrix} \quad B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

2. Design full state observer such that observer poles are at -20, -10.
$\dot{x}1 = -4x1 + x2$
$\dot{x}2 = -5x1 + x2$
$y = x1$

3. Derive expression for Lyapunov's second method and explain how it can be applied to investigate stability of linear as well as non-linear systems.

4. A linear second order servo is described by the equation –

$\ddot{y} + 2\xi\omega n\ \dot{y} + \omega n^2\ y = \omega n^2$ where $\omega n = 1$, $y(0) = 2.0$, $\dot{y}(0) = 0$

Determine the singular points when $\xi = 0.15$. Construct phase trajectory.

5. For system given below find all equilibrium points and determine type of each isolated equilibrium points.
a. $\dot{x}1 = x1^3 + x2$; $\dot{x}2 = x1 - x1^3$
b. $\dot{x}1 = x1(2 - x2)$; $\dot{x}2 = 2x1^2 - x2$

6. Explain minimization of functions in optimal control system.
