2006 VISVESVARAYA TECHNOLOGICAL UNIVERSITY
FIFTH SEMESTER B.E DEGREE EXAMINATIONS
MODERN CONTROL THEORY
(ELECTRICAL AND ELECTRONICS ENGINEERING)

TIME: 3 HOUR
MAXIMUM MARK :100

Note: 1. Answer any Five full questions.

1. a. What is a controller? Explain P, I, PI and OPID controllers.   (10 Marks)

b. Obtain the state space representation model for the following electrical circuit in fig .1(b).Given R = 1 Ohm and C = 1 Farad.

2. a. Explain the terms :

   i)   State
   ii)   State Variable
   iii)   State vector
   iv)   State space –with an example.   (10marks)

b. Obtain the state space representation of the following system and draw its phase variable diagram:
Y + 6 Y + 11Y + 6Y = 6u .   (10 Marks)

3. a. What is state transition matrix? List out the properties and advantages of state Transition matrix.   (10 Marks)

b. Obtain the state transition matrix using:

i) Laplace Transformation matrix using:

ii) Cayley – Hamilton method For the system describe by,

4. a. State the conditions for completely controllability and complete observability. Determine the state controllability and observability of the system described by,

b. Explain common physical nonlinearities in control systems   (10 Marks)

5. a. What are the singular points? Explain different singular points adopted in nonlinear control systems.
                                                                (08 Marks)
b. Find out singular points for the following systems:

i) + . 5 + 2 = 0   x o x x

ii) + 3 + 2 = 0   y y y

iii) + 3 - 10 = 0   y y   (12 Marks)

6. a. Obtain the necessary and sufficiency condition for arbitary pole placement .   (10 Marks)

b. Obtain the gain matrix for the system: Given :xwn =4.

7. a. Determine whether or not following quadratic form is positive definite:
1 2 2 3 1 3
2
3
2
2

2

$Q(x_1, x_2) = 10x_1 + 4x_2 + x_1 + 2x_1x_2 - 2x_2x_1 - 4x_1x_2$ (10 Marks)

b. Explain with an example – i) Liapunov Main Stability theorem

ii) Liapunov Second Method and

iii) Krasovskii's theorem
(10 marks)

8. a. Find the Liapunov function for the system:

b. Draw the phaseplane

trajectory for the following equation using Isoline method:
$\ddot{x} + 2\dot{x} + 2wx + wx = 0$

(10 Marks)