Register Number: ……..

B.E DEGREE EXAMINATIONS: NOV/DEC 2012

Seventh and Sixth Semester

ELECTRONICS AND INSTRUMENTATION ENGINEERING

EIE125 : Advance Control Systems

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The determinant, characteristic equation and trace of a matrix are invariant under a __
   a) Jordan transformation b) Similarity transformation
   c) Canonical transformation d) Diagonal transformation
2. If the system matrix , A is in the form of diagonal matrix then the state model is called
   a) Bush form b) Companion form
   c) Cayley Hamilton form d) Canonical form
3. The _____ are oscillations of fixed frequency and amplitude.
   a) Limit cycles b) Stable nodes
   c) Stable focus d) Asymptotic vibrations
4. The phase plane method is _____ approach
   a) Linear plane b) Angular plane
   c) Time domain d) Frequency domain
5. The _____ is a phenomenon in which the output follows a different path for increasing or decreasing values of input
   a) Hysteresis b) Dead zone
   c) Saturation d) Relay
6. The describing function method is based on _____ linearization.
   a) Harmonic b) sub harmonic
   c) both a) and b) d) none of the above
7. In the direct method of lyapunov stability criterion V(X) IS _____
   a) Function of energy b) function of velocity
   c) function of displacement d) None of the above.
8. Consider the system described by $\dot{x} = F(x(t))$; F (0) =0 if V(x) < 0 the system is _____
   a) Stable b) unstable
   c) asymptotically stable d) asymptotically stable in the large
9. Internal model predictive control procedure is identical to the _____ control design.

a) Open loop b) Closed loop

c) Both d) None of the above.

10. Model predictive control relay on dynamic model of the process ,most often _____ empirical model obtained by system identification

a) Non linear b) Dynamic nature

c) linear d) None of the above

PART B (10 x 2 = 20 Marks)

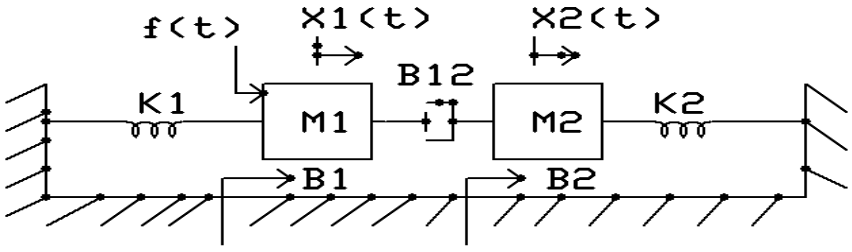
11. Draw the block diagram representation of state Model?
12. Write the solution of homogeneous state equations?
13. How the singular points are classified?
14. What is mean by Phase trajectory?
15. What is mean by Incidental non –linearity?
16. Explain briefly about Backlash**?**
17. Define the term norm in control system.
18. Define stability
19. List the advantages of optimal controller.
20. What is parameter optimization?

PART C (5 x 14 = 70 Marks)

21. a) What are state equations? Define transfer function. Consider a typical example and explain the conversion of state variable models to transfer functions.

(OR)

b) Construct the state model of mechanical system



22. a) What is phase plane, phase trajectory and phase portrait? Draw and explain in detail about the procedure to obtain the phase portrait using isocline method.

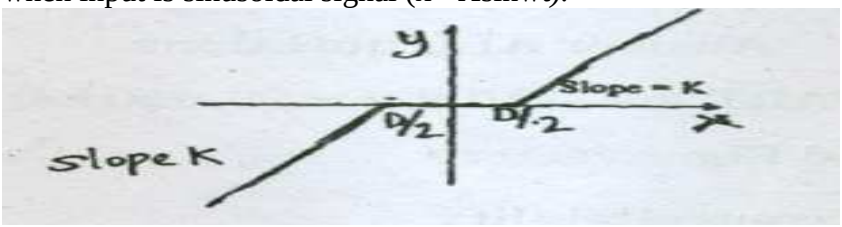
(OR)

b) A linear second order servo is described by the equation ë + $2\zeta w_n$+ $w_n^2 e$ = 0 where ζ= 0.15, *lVn* = 1 rad/sec, e (0) = 1.5 and e (0) = 0. Determine the singular point. Construct the phase trajectory, using the methods of isoclines. Choose slope as -2.0, -0.5. 0, 0.5 and 2.0.

23. a) Explain the describing functions of nonlinear system. Also explain its usefulness in determining the stability of nonlinear system.

(OR)

b) The input-output relationship of dead-zone nonlinearity is shown in the figure. The output is zero, when the input is less than *D/2.* The input-output relationship is linear when the input is greater than *D/2.* The response of the nonlinearity when input is sinusoidal signal (x =Xsinwt*).*



24. a) Defines stability? Consider the dynamics of the system is represented by

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -1 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Formulate the Lyapunov function to test the asymptotic stability of the system

(OR)

b) Write short note on
* Popov's criterion.
* Definiteness

25. a) Explain in detail about the internal model predictive control with necessary block diagram and derivation.

(OR)

b) Consider a typical computer-implemented mathematical model and explain how a state feedback and observer is used to model and solve a real system.

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