F 3356 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Seventh Semester

Branch : Electrical and Electronics Engineering

EE 010 704—MODERN CONTROL THEORY (EE)

(New Scheme—2010 admission onwards)

[Regular/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

Each question carries 3 *marks.*

1. Define Controllability.
2. Comment on the stability of limit cycle.
3. Compare describing function analysis with phase plane analysis.
4. Comment on first order hold circuits. What is its transfer function ?
5. State the difference between Microprocessors and Micro controllers.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*

Each question carries 5 *marks.*

6. Explain the design of a full order observer.
7. Define singular points. How is it classified ?
8. State Popov's criterion.
9. Explain stability using Schurcohn method.
10. What is a programmable logic controller ?

(5 × 5 = 25 marks)

Turn over

Part C

Answer **all** *questions.*

Each question carries 12 *marks.*

11. Design a state feedback controller to place the poles at –10, –10 for the system represented as :

$$\dot{X} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} X + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u \quad Y = [2 \quad 0] \begin{bmatrix} x_i \\ x_2 \end{bmatrix}.$$

Or

12. Consider a system $\dot{X} = AX + Bu \quad Y = CX$ where $A = \begin{bmatrix} 0 & 20.6 \\ 1 & 0 \end{bmatrix} B = \begin{bmatrix} 0 \\ 1 \end{bmatrix} C = [0 \quad 1]$. Design a full order observer. Desired eigen values of observer matrix are $\mu_1 = -1.8 + j\,2.4, \mu_2 = -1.8 - j\,2.4$.

13. A linear second order servo is described by the equation $\ddot{Y} + 2\xi w_n \dot{Y} + w_n^2 Y - w_n^2$ where $\xi = 0.15$, $w_n = 1 \text{rad/sec}\, Y(0) = 1.5, \dot{Y}(0) = 0$. Determine singular points. Construct phase trajectory using method of isoclines.

Or

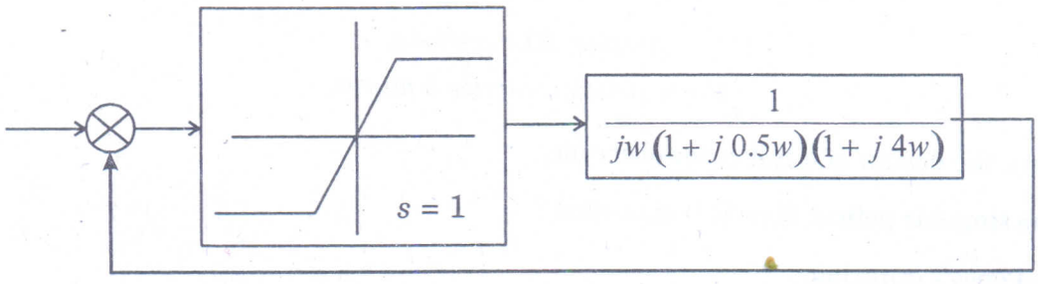
14. Obtain the phase plane portrait of the non-linear system given as :

$$\ddot{X} + |\dot{X}| + X = 0.$$

15. Derive the describing function of dead zone and saturation non-linearity.

Or

16. Consider a unity feedback system having a saturation non-linearity with gain K. Determine the maximum value of K for the system to stay stable.



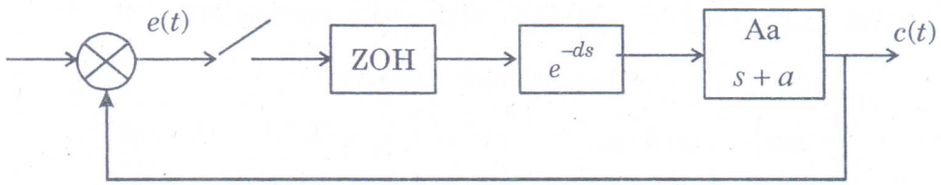
17. (a) Solve the inverse z-transform of $\dfrac{4z^2 - 2z}{z^3 - 5x^2 + 8z - 4}$.

(b) Solve the difference equation :

$$x(k+2) - 3x(k+1) + 2x(k) = 4^k \; x(0) = 0 \quad x(1) = 1.$$

Or

18. Sampled data control system of order one with transportation log is shown in figure. Determine the condition for system stability if $\delta < T$.



19. Explain different control hirarchies for plant level automation.

Or

20. Explain DSP based control with suitable example.

(5 × 12 = 60 marks)