G 739 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2014

Seventh Semester

Branch : Electrical and Electronics Engineering

EE 010 704—MODERN CONTROL THEORY (EE)

(Improvement—Supplementary)

[2010 Admissions]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 marks.

1. Define observability.
2. Enumerate different types of nonlinearity.
3. When a system is considered as assymptotically stable in the large ?
4. What is pulse transfer function ?
5. What are the applications of PLC ?

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 marks.

6. Obtain the state space model in which observability can be assessed by inspection.
7. Explain the behaviour of nonlinear system.
8. Explain the stability analysis by describing function method.
9. Explain PLC with an illustrative example.
10. Examine stability of the following characteristic equation

$$P(z) = z^4 - 1.2\,z^3 + 0.07z^2 + 0.3z - 0.08.$$

(5 × 5 = 25 marks)

Turn over

Part C

Answer **all** *questions.*
Each question carries 12 marks.

11. Explain the design of a full order state observer.

Or

12. Design a state observer to place the poles at –10 and –10 for the system represented as

$$\dot{X} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} X + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u \qquad Y = \begin{bmatrix} 2 & 0 \end{bmatrix} X.$$

13. The following equation is called Van der Pol equation $\dot{x} - (1 - x^2)\dot{x} + x = 0$, determine the type of singular point. Draw a phase plan potrait.

Or

14. (i) Explain with example the phenomenon of Jump resonance.

(ii) Briefly discuss about state variable feedback. Enumerate the conditions to be fulfilled to apply state feedback.

15. The system is described by the following state equation. Check stability at equilibrium point using quadratic function

$$\dot{X} = \begin{bmatrix} -1 & -2 \\ 1 & -4 \end{bmatrix} X.$$

Or

16. Investigate the stability of the origin of the following system using Lyapunou second method :—

$$\dot{x}_1 = x_2$$

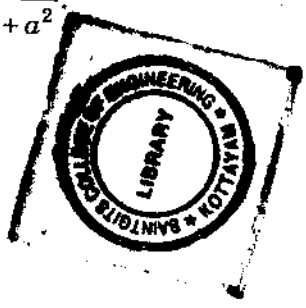
$$\dot{x}_2 = -x_1 - x_2.$$

17. Find Z domain transfer function of the following S domain transfer function

(i) $\dfrac{a}{(s+a)^2}$.

(ii) $\dfrac{s}{s^2 + w^2}$.

(iii) $\dfrac{a}{(s+b)^2 + a^2}$.



Or

18. The input-output of a sampled data system is described by the difference equation $c(n+2)+3c(n+1)+4c(n)=r(n+1)-r(n)$. Determine Z transfer function. Also obtain the weighting sequence (Discrete impulse response) of the system.

19. Explain principle of operation and architecture of a programmable logic controller.

Or

20. Explain microprocessor based control with suitable example.

(5 × 12 = 60 marks)