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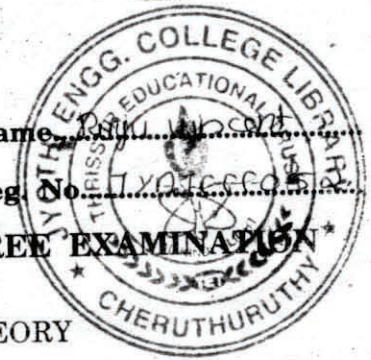
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Name:

Reg. No:

**SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION
MAY 2013**

**EE/PTEE 09 603—MODERN CONTROL THEORY
(2009 Admission onwards)**



Time : Three Hours

Maximum : 70 Marks

Part A

Answer all questions.

1. Define State and State variables.
2. What do you mean by state transition matrix ?
3. Define describing function.
4. Define negative semi-definiteness.
5. Define Controllability.

(5 × 2 = 10 marks)

Part B

Answer any four questions.

6. Compare between classical and modern control techniques.
7. What are singular points ? How are they classified ?
8. Explain the significance of limit cycles with suitable examples.
9. Explain the terms :
 - (a) Stability.
 - (b) Asymptotic stability.
 - (c) Marginal stability.
 - (d) Exponential stability, of equilibrium points.
10. What is meant by Linear Regulator problems ? Explain.
11. Explain Matrix Riccati equation.

(4 × 5 = 20 marks)

Part C

Answer all questions.

12. (a) Determine the observable canonical state model representation of a system whose transfer

function is
$$\frac{Y(s)}{U(s)} = \frac{2s+1}{s^2+3s+1}$$

Or

Turn over

(b) A discrete time system has the transfer function $\frac{Y(z)}{U(z)} = \frac{4z^3 - 12z^2 + 13z - 7}{(z-1)^2(z-2)}$. Determine the state model of the system.

13. (a) Explain in detail the special characteristics exhibited by non-linear systems.

Or

(b) Obtain the describing function of a relay with dead zone and saturation non-linearity.

14. (a) Explain the variable gradient method for construction of Lyapunov function.

Or

(b) Consider a non-linear system :

$$\dot{x}_1 = -x_1 + 2x_1^2 x_2$$

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

Determine stability using Lyapunov criterion.

15. (a) Consider a system represented by the transfer function $\frac{Y(s)}{U(s)} = \frac{10}{s(s+1)(s+2)}$. Design a feedback controller so that closed loop poles are placed at $s = -2, -1 \pm j1$.

Or

(b) Explain the different types of optimal control problems with their respective performance measures. Also describe the different steps involved in formulation of a general optimal control problem.

(4 × 10 = 40 marks)