

**B.Tech. – VIEP – ELECTRICAL ENGINEERING
(BTELVI)**

Term-End Examination

December, 2015

BIEEE-017 : ADVANCED CONTROL SYSTEM

Time : 3 hours

Maximum Marks : 70

Note : *Attempt any seven questions. Each question carries equal marks. Use of scientific calculator is allowed.*

1. State and explain Lyapunov stability theorem.

Investigate the system described by

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

for stability.

10

2. Using Routh's criteria check the stability of a system whose characteristic equation is given by

$$s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0.$$

10

3. Explain Jury stability criterion in detail for discrete systems. 10

4. (a) What do you mean by Fuzzy logic ? Explain it with an example. 5

(b) What is the significance of membership functions in fuzzy logic ? 5

5. A system is characterized by transfer function

$$\frac{Y(s)}{U(s)} = \frac{2}{s^3 + 6s^2 + 11s + 6}$$

Find the state and output equation in matrix form and also test the controllability and observability of the systems. 10

6. Obtain the state transition matrix in the form e^{At} and determine the time response for the system,

$$X = Ax, \text{ where } A = \begin{bmatrix} 0 & 1 \\ -2 & 0 \end{bmatrix}$$

and $x_1(0) = 1, x_2(0) = 10$. 10

7. Write down the general form of "Steady state Ricatti Equation". How are these equations important ? How do we solve these equations ? 10

8. Determine the Z transform and ROC of the signal

$$x(n) = [3(2^n) - 4(3^n)] u(n),$$

where $x(n)$ is a discrete time signal. 10

9. Explain the methods for generating Lyapunov's function for discrete systems in detail. 10

10. Write short notes on any *two* of the following: 2×5=10

- (a) Popov's Criterion
 - (b) Self Tuning Regulators
 - (c) Sample and Hold Circuit
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