

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

**00306 Term-End Examination**

**June, 2015**

**BIEEE-017 : ADVANCED CONTROL SYSTEM**

*Time : 3 hours*

*Maximum Marks : 70*

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

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1. Explain the concept of Lyapunov's stability theorem. How is Lyapunov function for a system determined ? 10
  
2. Determine the stability of the system  $\dot{X} = Ax$ , where  $A = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}$  by Lyapunov's theorem and hence determine a Lyapunov function for the system. 10

3. A system is described by the following state space model :

$$\dot{\mathbf{X}} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -6 & -5 \end{bmatrix} \mathbf{x} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u$$

Design a state feedback controller such that the closed loop poles are placed at  $-1 \pm j$  and  $-5$ . 10

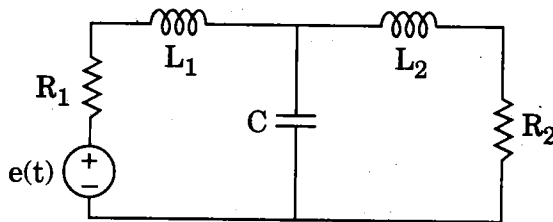
4. Find Z transform of the discrete ramp function

$$g(k) = k, k \geq 0$$

$$= 0, k < 0. \quad 10$$

5. Explain non-linear system linearization methods in detail. 10

6. Construct the state model of the following electrical system : 10



7. Explain the Genetic Algorithm application in adaptive control system with suitable examples. 10

8. A system is described 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 system.

10

9. Write down the general form of "steady state Riccati-equation". How are these equations important? How do we solve these equations? 10

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

- (a) Pontryagin's Maximum-Minimum Principle
- (b) Constrained Optimization
- (c) Describing function and its applications