

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

**Term-End Examination**

**June, 2018**

00393

**BIEEE-017 : ADVANCED CONTROL SYSTEM**

*Time : 3 hours*

*Maximum Marks : 70*

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**Note :** *Attempt any five questions. All questions carry equal marks. Use of scientific calculator is permitted. Assume data if necessary, wherever required.*

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1. (a) Describe the properties of State Transition matrix. 7
- (b) Check for controllability and observability of a system having the following coefficient matrices : 7

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix}, B = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix} \text{ and}$$

$$C^T = \begin{bmatrix} 10 \\ 5 \\ 1 \end{bmatrix}$$

2. (a) Calculate the stability for the following characteristic equation using Jury stability criterion : 7  

$$P(z) = z^4 - 1.2 z^3 + 0.07 z^2 + 0.3 z - 0.08 = 0.$$
- (b) Discuss the stability of the system with Routh-Hurwitz criterion on  $r^{\text{th}}$  planes. 7
3. (a) Obtain the describing function of a relay with dead-zone non-linearity. Also, draw its input-output characteristics. 7
- (b) State necessary and sufficient conditions for the Popov criterion. 7
4. (a) Explain the minimum principle of Pontryagin. How does it affect the conditions for optimality ? 7
- (b) Derive Riccati equation using calculus of variational approach. 7
5. (a) Draw the flow chart of back propagation learning algorithm in a neural network. 7
- (b) Compare fuzzy set and crisp set. 7
6. (a) Explain Lyapunov's stability, instability, and asymptotic stability theorems with the help of graphical representation. 7
- (b) Explain the differences between artificial intelligence and neural networks. 7

7. (a) Explain the effects of state feedback on controllability of a control system. 7

(b) Show that in linear discrete-time system  
$$x(k+1) = A_d x(k) + B_d u(k), x(0) = x_0$$
is controllable if and only if  $\text{rank } C = n$ , where  $C$  is the controllable matrix and  $n$  is number of rows in the matrix. 7

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