

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

**Term-End Examination**

**00619 December, 2017**

**BIEEE-015 : STOCHASTIC CONTROL SYSTEMS**

*Time : 3 hours*

*Maximum Marks : 70*

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*Note : Attempt any **five** questions. All questions carry equal marks. Symbols used have their usual meanings.*

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1. (a) The random variable X has the probability density function

$$f_X(x) = \begin{cases} 2, & 0 \leq x \leq 1 \\ 0, & \text{elsewhere.} \end{cases}$$

Find the following :

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- (i) The cumulative function
  - (ii) The median and the mode
  - (iii) The mean-square value  $E(X^2)$
  - (iv) The variance  $\sigma^2[X]$
- (b) Define the term 'probability density function'. 2

2. Show that a second order random variable is necessarily first order, but the converse need not be true. 14
3. (a) Explain embedded Markov chain. 7  
 (b) Derive the relationship between continuous and discrete time Markov chains. 7
4. Discuss the role of Kalman filter in control system analysis and design. Also explain the algorithm of a discrete Kalman filter. 14
5. (a) Discuss the significance of estimation in the analysis of dynamic systems. 6  
 (b) Explain the parameters used to judge the quality of an estimate. 8
6. Discuss the differences between optimal fixed point smoothing, fixed interval smoothing and fixed lag smoothing. Mention their advantages and disadvantages. 14
7. (a) What are LQR problems ? Formulate an LQR problem for a system described by  

$$\dot{X} = AX + BU.$$
 Mention the assumptions made. 7  
 (b) Describe bounded optimal filter. 7

8. Write short notes on any *two* of the following :  $2 \times 7 = 14$

(a) Wiener Process

(b) Optimal Prediction for Discrete Linear Systems

(c) Formulation of Continuous Filtering Equation

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