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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- 2016

M. Tech 4<sup>th</sup> Semester

(Electronics and Communication Engineering)

COURSE CODE: 13M1WEC431

MAX. MARKS: 25

COURSE NAME: STATISTICAL SIGNAL PROCESSING

COURSE CREDITS: 03

MAX. TIME: 1Hr 30 Min

*Note: All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means.*

**Q. 1(a)** Define the estimation theory. Discuss the properties of the estimation theory. [3]

**(b)** What is the orthogonal random variable? [2]

**Q. 2(a)** Can we reduce the variance of the unbiased estimator indefinitely? What is the Cramer-Rao lower bound? [3]

**(b)** Find out the conditional density function using the joint density function. [2]

**Q. 3(a)** For the random variable  $X$  and  $Y$ , the joint probability density function is given by:

$$f_{X,Y}\{x,y\} = \begin{cases} \frac{1+xy}{4} & |x| \leq 1, |y| \leq 1 \\ 0 & \text{Otherwise} \end{cases}$$

Find the marginal density  $f_X(x)$ ,  $f_Y(y)$  and  $f_{Y|X}(y|x)$ . Are the  $X$  and  $Y$  is independent? [3]

**(b)** Define the marginal density function. [2]

**Q. 4(a)** What is the mean square error of the estimator? Establish a relation between the mean square error and variance of the estimator. [3]

**(b)** Discuss the potential methods to solve the equality constrained optimization problems. [2]

**Q. 5(b)** Discuss the Newton's method for unconstrained optimization problems. [3]

**(b)** Explain the conditions for a maximum or minimum value of a function of several variables.

[2]