Student Exam No._____

GANPAT UNIVERSITY

B. Tech. SemesterVI (Electronics and Communication Engineering)

CBCS Regular Theory Examination April - June 2015

(2EC604) Introduction to Detection Theory

Time:3 Hours **Total Marks: 70**

Instructions:

1. All questions are compulsory.
2. Write answer of each section in separate answer books.
3. Figures to the right indicate marks of questions.
4. Standard terms and notation are used.

Section - I

Q-1 **(A)** Prove that correlation coefficient is independent of the origin and scale. [6]

(B) A random variable X is exponentially distributed with parameter λ=1.Use Tchebycheff's inequality to show that $P\{(-1 \leq X \leq 3) \geq 0.75\}$ also Find the actual probability. [6]

OR

Q-1 **(A)** Compute correlation coefficient(r_{xy}) between X and Y. [6]

X	80	45	55	56	58	60	65	68	70	75	85
Y	82	56	50	48	60	62	64	65	70	74	90

(B) Prove Tchebycheff's inequality. [6]

Q-2 **(A)** Explain Strict sense stationary (SSS) and wide sense stationary (WSS) Processes. [6]

(B) Prove that output of the Matched filter depends on the energy rather than shape of the input signal. [5]

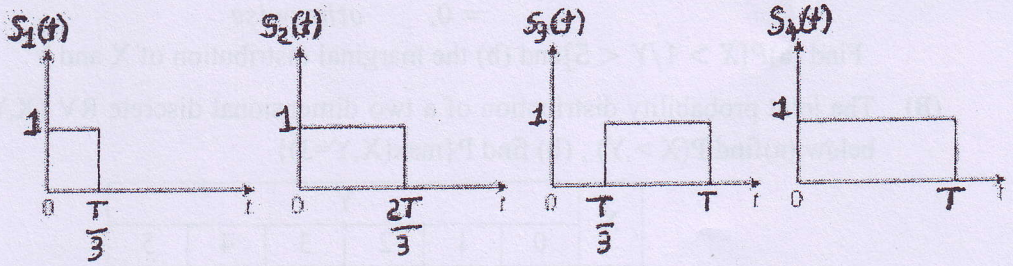
OR

Q-2 **(A)** Show that Match filter is an alternate option of the correlation type demodulator. [6]

(B) Justify that SNR can be improved by "*Wiener-hopf filter*" [5]

Q-3 **(A)** Explain binary Maximum Likelihood detection. [6]

(B) Find the orthogonal basis signals using Gram-Schmidt procedure. [6]



Section – II

Q-4 **(A)** There are 3 true coins and 1 false coin with 'head' on both sides. A coin is chosen at random and tossed 4 times. If 'head' occurs all the 4 times, what is the probability that the false coin has been chosen and used? [6]

(B) Do as directed. [6]

(1) If A and B are any events then prove that

$P(A \cup B) = P(A) + P(B) - P(A \cap B) \leq P(A) + P(B)$.

(2) If A and B are mutually exclusive events such that $P(A) = 0.5$ and $P(B) = 0.33$, find $P(A \cup B)$ and $P(A \cap B)$.

OR

Q-4 **(A)** Two defective tubes get mixed up with 2 good tubes. The tubes are tested, one by one, until both defective are found. What is the probability that the last defective tubes is obtained on **(a)** the second test, **(b)** the third test and **(c)** the fourth test. [6]

(B) Suppose that colored balls are distributed in 3boxes as follows; A box is selected at random from which a ball is selected at random and it is observed to be red. What is the probability that box 3 is selected? [6]

	Box1	Box2	Box3
Red	2	4	3
White	3	1	4
Blue	5	3	5

Q-5 **(A)** Find binomial distribution mean and variance and where is it used? [7]

(B) If the PDF of a RV X is $f(x) = x/2$ in$0 \leq x \leq 2$, find $P\{X > 1.5/X > 1\}$. [4]

OR

Q-5 **(A)** If the probability mass function of a RV X is given by [7]

$$P(x = r) = Kr^3;\ r = 1, 2, 3, 4$$

find **(a)** The value of K, **(b)** $P\{(1/2 < X < 5/2) / (X > 1)\}$, **(c)** the mean and variance of X.

(B) The discrete random variable X has the following probability distribution. Find value of 'a' and CDF of X. [4]

x:	0	1	2	3	4	5	6	7	8
P(x):	a	3a	5a	7a	9a	11a	13a	15a	17a

Q-6 **(A)** Given that the joint pdf of (x,y) is [6]

$$f(x, y) = e^{-y};\quad x > 0, y > x$$
$$= 0,\quad otherwise$$

Find **(a)** $P\{X > 1/Y < 5\}$ and **(b)** the marginal distribution of X and Y.

(B) The joint probability distribution of a two dimensional discrete RV (X,Y) is given below: **(a)** find $P(X > Y)$, **(b)** find $P\{\max(X,Y=3)\}$ [6]

X	Y					
	0	1	2	3	4	5
0	0	0.01	0.03	0.05	0.07	0.09
1	0.01	0.02	0.04	0.05	0.06	0.08
2	0.01	0.03	0.05	0.05	0.05	0.06
3	0.01	0.02	0.04	0.06	0.06	0.05

END OF PAPER