TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR:

BTAP/BTRE

AMA4117: PROBABILITY & STATISTICS

END OF SEMESTER EXAMINATION

SERIES: APRIL 2016

TIME: 2HOURS

DATE: 17 May 2016

<u>**Instructions to Candidates**</u>
You should have the following for this examination
-Answer Booklet, examination pass and student ID
This paper consists of Choose No questions. Attempt Choose instruction.
Do not write on the question paper.

Question ONE (30 MarkS)

   (a) Define the following terms:

      (i)   Random experiment   (1 mark)

      (ii)   Random variable   (1 mark)

      (iii)   Sample space   (1 mark)

      (iv)   Independent events   (1 mark)

   (b) List the elements of each of the following sample spaces:

      (i)   The set of integers between 1 and 50 divisible by 6   (2 marks)

      (ii)   The set $S = \{x | x^2 + 4x - 5 = 0\}$ (2 marks)

   (c) A coin is tossed 3 times. Let X be the random variable denoting the number of heads observed.

     Determine:

      (i)   The probability distribution of X   (2marks)

      (ii)   The mean of the distribution of X   (2marks)

      (iii)   The variance of X   (3 marks)

(d) A lot of 100 computer memory chips contains 20 that are defective. Two chips are selected at random from the lot without replacement. Determine the following probabilities:

       (i)   The first one selected is defective   (2 marks)

       (ii)   The second one selected is defective given the first one was defective

                          (2 marks)

       (iii)   Both chips are defective   (2 marks)

(e) State Baye's theorem   (2 marks)

(f) A binary communication channel carries messages by using only two signals, 0 and 1. If , for a given binary channel , 40% of the tisme a 1 is transmitted and the probability that a 1 is correctly received is 0.95, while that a transmitted 0 is correctly received is 0.90. Determine the following probabilities:

       (i)   A 1 being received   (4 marks)

       (ii)   Given 1 is received, the probability that 1 was transmitted   (3 mark)

Question TWO (20 MarkS)

The following frequency distribution shows the ages of adult students attending class in a location in rural Kenya.

Age(years)	40-44	45-49	50-54	55-59	60-64
Frequency	6	10	25	11	8

(a) Draw a histogram to represent the data   (4 marks)

(b) Determine the following:

       (i)   The mean   (4 marks)

       (ii)   The standard deviation   (4 marks)

       (iii)   The median and quartiles   (7 marks)

       (iv)   The inter-quartile range   (1 mark)

Question THREE (20 MarkS)

In an experiment to measure the stiffness of a spring, the length of the spring under different loads was measures as follows:

X(loads)(gms)	3	5	6	9	10	12	15	20	22	28
Y(length)(mm)	10	12	15	18	20	22	27	30	32	34

(a) Find the product moment correlation coefficient between X and y   (8 marks)

(b) Find the regression equation of the length on load   (6 Marks)

(c) A machine is designed to produce automotive break disks of diameter 120mm and

$\sigma = 4mm$. If a random sample of 40 disks had a mean diameter of 120.97, test at 5% level significance whether the machine is working normally (6 marks)

Question FOUR (20 MarkS)

(a) Disks used in data storage are obtained from a supplier and analyzed for scratch and shock resistance. A sample of 100 disks produced the following results;

		Shock resistance		
		High	Low	Total
Scratch	High	70	9	79
resistance	Low	16	5	21
	Total	86	14	100

Let A denote the event that a disk has high shock resistance and B the event that a disk has high scratch resistance. Determine the following:

(i)   P(A)   (1mark)
(ii)   P(B)   (1mark)
(iii) P(A\B)   (1mark)
(iv)   P(B\A)   (1mark)
(v)   Whether the events are independent   (2marks)

(b) Determine the value of c so that the following function can serve as a probability mass function
$$f(x) = c\binom{2}{x}\binom{3}{3-x} \text{ for } x = 0,1,2$$ (4 marks)

(c) A laboratory test to detect a certain disease has the following statistics. Let:

A= event that the tested person has a disease

B= event that the test result is positive.

It is known that:

P(B/A)=0.99 and P(B/A')= 0.005 and 0.1% of the population actually has the disease.

Determine the probability that a person has the disease given the result is positive   (10 marks)

Question FIVE(20 Marks)

The following data represent the height in inches of 100 male students at TUM

Height(Inches)	59.5-62.5	62.5-65.5	65.5-68.5	68.5-71.5	71.5-74.5
Frequency	5	18	42	27	8

(a) Calculate:

(i)   The coefficient of skewness   (12marks)
(ii)   The coefficient of kurtosis   (5 marks)
(iii) The excess kurtosis in (ii)   (2 marks)

(b) Using (a)(iii), define kurtosis in a(ii)   (1 mark)