TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN MATHEMATICS & COMPUTER SCIENCE (BMCS 13J)

BACHELOR OF SCIENCE IN STATISTICS & COMPUTER SCIENCE (BSSC 13J)

BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY (BSIT 12J)

SMA 2102/AMA 4107: PROBABILITY & STATISTICS I

END OF SEMESTER EXAMINATION

SERIES: APRIL 2014

TIME ALLOWED: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Mathematical tables*
- *Scientific Calculator*

This paper consist of **FIVE** questions

Answer question **ONE (COMPULSORY)** and any other **TWO** questions

Maximum marks for each part of a question are as shown

This paper consists of **THREE** printed pages

Question One (Compulsory)

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)**

$$S = \{x | x^2 + 4x - 5 = 0\}$$

(ii) The set **(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 **(2 marks)**

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

(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, without replacement, from the lot. Determine the following probabilities:

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

(ii) The second one selected is defective given that 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 time a 1 is transmitted and the probability that a 1 is correctly received is 0.95, while the probability that a transmitted 0 is correctly received is 0.90. Determine the following probabilities.

(i) a 1 being received **(6 marks)**

(ii) Given a one is received the probability that 1 was transmitted **(1 mark)**

Question Two

The following frequency distribution shows the ages of adult students attending classes in Makadara ward in Nairobi

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 age **(4 marks)**

(ii) The standard deviation of the ages **(4 marks)**

(iii) The median age and quartiles **(7 marks)**

(iv) The interquartile range **(1 mark)**

Question Three

In an experiment to measure the stiffness of a spring the length of the spring under different loads was measured 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 **(10 marks)**

b) Find the regression equation of length on load **(10 marks)**

Question Four

a) Disks of polycarbonate plastic from a supplier are analyzed for scratch and shock resistance. The results from 100 disks are summarized as follows:

Shock Resistance				
Scratch Resistance		High	Lo w	Total
	High	70	9	79
	Low	16	5	21
	Total	86	14	100

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

(i) P(A) **(1 mark)**
(ii) P(B) **(1 mark)**
(iii) P(A/B) **(1 mark)**
(iv) P(B/A) **(1 mark)**
(v) Are the events A and B independent? **(2 mark)**

b) Determine the value of C so that the following function can serve as a probability mass function.

$$f(x) = C\binom{2}{x}\binom{3}{3-x}$$

for 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 the disease.
B = Event that the test result is positive. It is known that:

$P(B/A) = 0.99$ and $P(B/\overline{A}) = 0.005$ and 0.1% of the population actually has the disease. Determine the probability that a person has the disease given the test result is positive.

(10 marks)

Question Five

The following data represent the heights in inches of 100 male students from 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 **(12 marks)**
   (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 marks)**