TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR DEGREE OF:

BACHELOR OF TECHNOLOGY IN RENEWABLE ENERGY
BACHELOR OF TECHNOLOGY IN APPLIED PHYSICS

AMA 4117: PROBABILITY & STATISTICS

END OF SEMESTER EXAMINATION
SERIES: APRIL 2015
TIME ALLOWED: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Mathematical tables*
- *Scientific Calculator*

This paper consist of **FOUR** 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)** Statistic **(2 marks)**
- **(ii)** Random variable **(2 marks)**
- **(iii)** Mutually exclusive events **(2 marks)**

b) A four sided die has the number 1 through 4 written on its side, one on each side. If the die is rolled twice.
- **(i)** Write down suitable sample space S **(2 marks)**
- **(ii)** If X is the random variable denoting the sum of numbers appearing, determine the values of x **(2 marks)**

$P(2 \le x \le 5)$

(iii) Determine **(3 marks)**

c) If $P(A) = 0.4$ $P(B) = 0.6$ $P(A \cup B) = 0.7$ and . Calculate $P(A \cap B)$ **(3 marks)**

d) Define the following terms:

(i) Skewness

(ii) Kurtosis **(4 marks)**

e) Compute the mean and standard deviation of the following data: **(5 marks)**

Observation (x)	0	1	2	3	4
Frequency (y)	5	2	13	16	3

f) Find a and b in the regression line $y = a + bx$ given that $\sum x = 440,\ \sum y = 4400,\ \sum xy = 25607,\ n = 10\ \sum x^2 = 25796$ **(5 marks)**

Question Two

a) The following data was obtained from the manufacturers of electronic calls. A sample of electronic cells was taken and life spans were recorded as shown in the following table:

Life span (hrs)	1600 – 1799	1800 – 1999	2000 – 2199	2200 – 2399	2400 – 2599	2600 – 2799	2800 - 2999
No of cells	25	32	46	58	40	30	7

Using the assumed mean A = 2299.5, find:

(i) Mean life span of cells **(5 marks)**

(ii) Variance of the life span of cells **(4 marks)**

(iii) Standard deviation of the life span of the cells **(2 marks)**

b) Let X be a random variable denoting the life time of an electrical equipment and suppose that the pdf $f(x) = ce^{-cx}$ of x is for x > 0

(i) Determine the constant C **(3 marks)**

(ii) Calculate the probability that x is at least equal to 10 time units **(3 marks)**

(iii) If the probability in part (ii) is 0.5, what is the given value of C? **(3 marks)**

Question Three

a) Compute the moment coefficient of skewness from the following data and hence comment on the skewness of the frequency curve: **(10 marks)**

Marks	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
Frequency	6	12	22	24	16	12

b) State Bayes theorem **(2 marks)**

c) Three machines I, II and III manufacture 30%, 30% and 40% respectively of the total output of certain items. Of them 4%, 3% and 2% respectively are defective. One item is drawn at random from the total output and is tested.

(i) What is the probability that the item is defective **(3 marks)**

(ii) If it is found to be defective, what is the probability the item was produced by machine I **(5 marks)**

Question Four

$$f(x) = 3x^2,\ 0 < x < 1$$

a) Let X be a random variable with pdf

(i) Show that f(x) is indeed a pdf **(3 marks)**

(ii) Calculate the quantities E(X), $E(X^2)$ and Var (X) **(5 marks)**

(iii) If the random variable Y is defined by $Y = 3X - 2$ calculate E(Y) and the var (Y) **(4 marks)**

$$f(x) = e^{-x},\ x > 0$$

b) Given that x is a random variable with p.d.f then:

(i) Find the mgf $M_x(t)$ of f(x) **(4 marks)**

(ii) Using $M_x(t)$ obtain the quantities, E(x) and var (x) **(4 marks)**

Question Five

a) In one stage of development of a new medication for an allergy, an experiment is conducted to study how different dosages of the medication affect the duration of relief from the allergic symptoms. Ten patients are included in the experiments. Each patient receives a specific dosage of the medication and is asked to report back as soon as the protection of the medication seems to wear off. The results were recorded below which shows the dosage (x) and respective duration of relief (y) for the patients:

(i) Draw a scatter diagram of the data **(4 marks)**

(ii) Compute the least squares estimates of a and b and draw the regression line **(6 marks)**

(iii) Find the coefficient of determination R^2 and hence give its interpretation **(4 marks)**

x	3	4	5	6	6	7	8	8	9
y	9	5	12	14	16	22	18	24	22

b) A vendor submits tots of fabric to a textile manufacturer. The manufacturer wants to know if the lot average breaking strength exceeds 200psi. If so she wants to accept the lot. Past experience indicates that a reasonable value of the variance of breaking strength is 100 $(psi)^2$. Is the average breaking strength of the lot exceeding 200psi at 5% level of significance **(6 marks)**