



TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR:

BACHELOR OF TECHNOLOGY IN APPLIED PHYSICS

BACHELOR OF TECHNOLOGY IN RENEWABLE ENERGY

AMA 4117: PROBABILITY & STATISTICS

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 **FOUR** printed pages

Question One (Compulsory)

a) Define the following terms:

- (i) Sample space (1 mark)
- (ii) Random variable (1 mark)

b) Ten measurements of impact energy on steel at 60°C age given as 64.1, 64.7, 64.5, 64.6, 64.5, 64.3, 64.6, 64.8, 64.2 and 64.3. Calculate:

- (i) The mean (3 marks)
 - (ii) Median (2 marks)
 - (iii) Construct 95% confidence interval if the standard deviation is assumed to be 1J given that impact energy is normally distributed. (4 marks)
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$$P(A \cap B) = 0.1$$

c) If $P(A) = 0.3$, $P(B) = 0.2$ and $P(A \cap B) = 0.1$. Determine:

(i) $P(A \cup B)$ (2 marks)

(ii) $P(A' \cap B)$ (2 marks)

(iii) $P(A' \cup B)$ (2 marks)

d) An optical inspection system is to distinguish among different part types. The probability of a correct classification of any part are inspected and the classifications are independent. Let the random variable X denote the number of parts that are correctly classified. Determine:

(i) The probability distribution of X (4 marks)

(ii) The mean of X (2 marks)

(iii) Variance of X (3 marks)

e) Let X be a random variable following a binomial distribution with parameter p and n , determine the probability generating function of X . (4 marks)

Question Two

a) Each sample of water has a 10% chance of containing a particular organic pollutant. Assume that the samples are independent with regard to the presence of the pollutant. Find the probability that in the next 18 samples:

(i) Exactly 2 contain pollutant. (2 marks)

(ii) Determine the expected number of pollutants in the sample. (2 marks)

b) The number of flaws in bolts of cloth in textile manufacturing is assumed to be Poisson distributed with a mean of 0.1 flaw per square meter. What is the probability that:

(i) There are two flaws in one square metre of cloth? (2 marks)

(ii) No flaw in 20m² of a cloth. (4 marks)

c) The compressive strength of samples of cement can be modeled by a normal distribution with a mean of 6000kg/cm² and a standard deviation of 100kg/cm². What is the probability that:

(i) A sample's strength is less than 6500 (3 marks)

(ii) What is the probability that a sample's strength is between 5800 and 5900kg/cm². (3 marks)

Question Three

a) The table below shows weight of bolts in a company.

Class	Frequency
10 – 12	3
13 – 15	14

16 – 18	23
19 – 21	12
22 - 24	8
25 – 27	4
28 – 30	1

Determine:

- (i) Mean (4 marks)
- (ii) Median (3 marks)
- (iii) Mode (3 marks)
- (iv) Standard deviation (5 marks)
- (v) Quartile range (5 marks)

Question Four

- a) Define the terms:
- (i) Independent events
 - (ii) Conditional events (4 marks)
- b) Disks of poly carbonate plastic from a supplier are analyzed for a scratch and 9 shock, resistance. The results from 100 disks are summarized as follows:

		Shock	Resistance
		High	Low
Scratch	High	70	9
Resistance	Low	16	5

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

- (i) $P(A/B)$ (3 marks)
 - (ii) $P(B/A)$ (3 marks)
- c) Are event A and B independent? (2 marks)
- d) Define the following terms:
- (i) Type I error (1 mark)
 - (ii) Type II error (1 mark)
- e) Specifications require that the mean burning rate of a solid propellant must be 50cm. It is known that $\delta = 2$ the standard deviation of burning rate is $\delta = 2$ and type 1 error probability is 0.05. A sample of size $\bar{x} = 51.3cm/s$ 25 gives a sample average during rate of $\bar{x} = 51.3cm/s$. Test the hypothesis.

$$H_0; \mu_0 = 50$$

$$H_1; \mu_0 \neq 50$$

(5 marks)

at 5% level of significance

Question Five

The table below shows temperature and heat loss:

Temp (X)	20	20	20	40	40	40	60
Heat Loss (Y)	86	80	77	78	84	75	30

- a) Draw a scatter plot of the above data. **(3 marks)**
- b) Calculate the correlation coefficient between X and y. **(5 marks)**
- c) Determine the coefficient of determination between X and y. **(3 marks)**
- d) Construct a regression model between X and Y. **(5 marks)**
- e) Use the regression to determine:
 - (i) The value of Y when X is 21 **(2 marks)**
 - (ii) The residue when X is 60 **(2 marks)**