



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF PURE & APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR:

BACHELOR TECHNOLOGY IN INDUSTRIAL MICROBIOLOGY AND

BIOTECHNOLOGY

AAB 4302: BIOSTATISTICS & EXPERIMENTAL DESIGNS REGULAR PAPER

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2016

TIME: 2 HOURS

DATE: Pick Date Select Month Pick Year

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **FIVE** questions. Attempt question ONE (Compulsory) and any other TWO questions.

Do not write on the question paper.

Question ONE

(a) Differentiate between the following

- (i) Nominal and ordinal data **(2 marks)**
- (ii) Discrete and continuous variables **(2 marks)**
- (iii) Type I and Type II error **(2 marks)**
- (iv) One-tailed and two-tailed test **(2 marks)**

(b) A set of 100 pods, each containing 4 peas, was examined to see how many of the peas were good. The following were the results.

No. of good peas in pod	0	1	2	3	4
No. of pods (f)	7	20	35	30	8

- Find the (i) Mean **(2 marks)**
- (ii) Median **(2 marks)**
- (iii) Mode **(2 marks)**
- (iv) Comment on the distribution of the frequency **(1 marks)**

(c) The number of organic particles suspended in a volume $V \text{ cm}^3$ of a certain liquid follows a poisson distribution with mean $0.1 V$.

Find the probability that a sample of $V=1 \text{ cm}^3$ of the liquid will contain

- (i) at least one organic particle **(2.5 marks)**
- (ii) exactly one organic particle **(2.5 marks)**

(d) The number of times Y an adult human breathes per minute is approximately normal with mean equal to 16 and standard deviation equal to 4. If a person is selected at random and the number of Y breathes per minute while at rest is recorded, what is the probability that Y will

- (i) exceed 22 **(2 marks)**
- (ii) between 12 and 24 **(2 marks)**
- (iii) almost 21 **(2 marks)**

(e) Twenty randomly selected maize farms yielded a mean of 15 bags per acre. Assuming that the yield per acre is normally distributed with a variance of 150, construct a 95% confidence interval estimate for the true mean yield per acre. **(4 marks)**

Question TWO

(a) In a fishing competition, the total catches of 40 anglers has masses (kg) as given below

Mass (kg)	0.3- 0.7	0.8- 1.2	1.3- 1.7	1.8- 2.2	2.3- 2.7
Frequency	8	12	8	8	4

- (i) Draw a histogram of these data. **(2 marks)**
- (ii) Obtain the mean and median. Which will you consider to be more appropriate and why. **(4 marks)**
- (iii) Calculate the standard deviation of the distribution **(4 marks)**

(b) In order to determine whether or not a particular heat treatment is effective in reducing the number of bacteria in skim milk. Observations were made before and after treatment on twelve samples of skim milk. The results are recorded below in logarithms of direct microscopic counts.

Sample	Before Treatment	After Treatment
1	6.98	6.95
2	7.08	6.94
3	8.34	7.17
4	5.30	5.15
5	6.26	6.28
6	6.77	6.81
7	7.03	6.59
8	5.56	5.34
9	5.97	5.98
10	6.64	6.51
11	7.03	6.84
12	7.69	6.99

(i) State the null and alternative hypothesis. (2 marks)

(ii) Test the hypothesis in (i). Use $\alpha = 0.05$. (5 marks)

(iii) Distinguish between situation requiring a two-sample t-test and a paired sample t-test. (3 marks)

Question THREE

(a) A large number reserve has a mosaic of habitats including willow scrub, birch scrub, reed swamp and grassland. Each year the owner recruits conservation volunteers to create new ponds throughout the reserve. A biologist investigates productivity in the ponds by collecting cope pods and other planktonic invertebrates by means of standardized open-water sweeps with a plankton net. One, two and three old ponds are selected at random in each of the four habitats. Net contents are dried and weighed to produce 12 observations of biomass (gms), given below:

Age	Habitat			
	Willow	Birch	Reed	Grass
One	3.0	2.7	4.5	1.5
Two	3.3	4.2	6.3	3.7
Three	5.2	6.8	9.7	4.7

(i) Complete the an analysis of Variance table. (4 marks)

(ii) Test if there are significant difference in biomass between the pond ages. (Use $\alpha = 0.05$) (5 marks)

(iii) Test if there are significant difference in biomass due to habitat. (Use $\alpha = 0.05$) (5 marks)

(b) Suppose that you suspect acid rain is lowering the pH of your favorite fishing spot and you wish to determine whether the pH is less than 7.5. Suppose that a random sample of 30 water specimen gave pH readings with mean 7.3 and standard deviation of 0.2.

(i) State the null and alternative hypothesis (1 mark)

(ii) Conduct a statistical test of the null hypothesis and state your conclusion. (Use $\alpha= 0.05$) (5 marks)

Question FOUR

(a) Briefly explain the importance of randomization and replication in design of experiments. (6 marks)

(b) The following data on x (lead concentration in water) and y (lead concentration in Blood of patients drinking the water) is available

x	5.6	7.7	8.8	5.1	6.8	4.5
y	2.0	1.4	2.0	1.2	1.6	1.5

(i) Calculate the correlation coefficient between x and y and test its significance at $\alpha= 0.05$. (7 marks)

(ii) Fit the regression line of y on x . (5 marks)

(iii) Estimate the value of y when $x= 7.0$ (2 marks)

Question FIVE

(a) A clinical trial was carried out to investigate whether there is any evidence of a difference in the effects of melatonin drug and the placebo. 10 patients were observed for one night with the drug and one night with the placebo. The hours of sleep on each are shown in the table below

Patient	Hours of Sleep	
	Drug	Placebo
1	5.2	5.9
2	7.0	7.9
3	8.2	3.9
4	6.6	4.7
5	5.5	5.3
6	7.4	5.4
7	5.3	5.5
8	6.7	6.1
9	7.4	3.8
10	5.8	6.3

(i) Write down the null and alternative hypothesis for this trial. (2 marks)

(ii) Use an appropriate test statistic to test the hypothesis in (a). (Use $\alpha= 0.05$) **(7 marks)**

(iii) What assumptions have you made in carrying out this test? **(3 marks)**

(iv) What conclusions do you draw from these data. **(3 marks)**

(b) A company wishes to examine whether there is an association between accident proneness and colour blindness. The results for a group of 80 drivers are as given below

	Colour blindness	
	NO	YES
Accidents during last five years	22	5
	38	15

Is there any evidence of an association between colour blindness and accident proneness? (Use $\alpha= 0.05$)

(5 marks)