(*Knowledge for Development*)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2021/2022 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER

MAIN EXAMINATION

FOR THE DEGREE OFBACHELOR OF SCIENCE AND BACHELOR OF EDUCATION

COURSE CODE: STA 321

COURSE TITLE: TEST OF HYPOTHESIS

DATE: 31/08/2022   **TIME**: 9:00 AM – 11:00 AM

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

QUESTION ONE COMPULSORY (30 MARKS)

a. Define a statistical Hypothesis. (2 marks)

b. Distinguish a simple hypothesis from a composite hypothesis. (3 marks)

c. State and explain two types of errors encountered in statistical testing of Hypothesis. (4marks)

d. If $x \geq 1$ is the critical region for testing $H_0: \theta = 2$ against the alternative $H_0: \theta = 1$, on the basis of single observation from the population
$$f(x, \theta) = \theta e^{-\theta x}, x \geq 0$$
Obtain,

   i. The values of type I and type II errors. (9 marks)

   ii. The power of this test. (4 marks)

e. The specifications of a certain kind of ribbon call for a mean breaking strength of 185 Newtons. If five pieces randomly selected from different rolls have breaking strengths of $171.6, 191.8, 178.3, 189.9$ and 189.1 Newtons, test the null hypothesis $\mu = 185$ Newtons against the alternative hypothesis $\mu < 185$ Newtons at the 0.05 level of significance. (8 marks)

QUESTION TWO (20 MARKS)

A product developer is interested in reducing the drying time of primer paint. Two formulations of the paint are tested; formulation 1 is the standard chemistry and formulation 2 has a new drying ingredient that should reduce the drying time. From experience, it is known that the standard deviation of drying time is 8 minutes, and this inherent variability should be unaffected by the addition of the new ingredient. 10Specimens are painted with formulation 1 and another with formulation 2. The two sample average drying times are $\bar{x}_1 = 121$ minutes and $\bar{x}_1 = 112$ minutes, respectively.

   i. Formulate suitable Hypothesis to test the effectiveness of the new ingredients in reducing the paint drying time. (11 marks)

   ii. Obtain the $p - value$ for this test (5 marks)

   iii. Basing on what is got in $2(ii)$ above, what conclusions can the product developer draw? (4 marks)

QUESTION THREE (20 MARKS)

State and prove the Neyman- Pearson's lemma (20 marks)

QUESTION FOUR (20 MARKS)

Two catalysts are being analyzed to determine how they affect the mean yield of a chemical process. Specifically, catalysts 1 is currently in use, but catalyst 2 is acceptable. Since catalyst 2 is cheaper, it does not change the process yield. A test is run in the pilot plant and results are as shown in table below;

Observation No.	Catalyst 1	Catalyst 2
1	91.50	89.19
2	94.18	90.95
3	92.18	90.46
4	95.39	93.21
5	91.79	97.19
6	89.07	97.04
7	94.72	91.07
8	89.21	92.75

Is there any difference between the mean yields? Perform the test at 0.05 level of significance. (20 marks)

QUESTION FIVE (20 MARKS)

(a) Use the data shown in the following table below to test at 0.01 level of significance whether a person's ability in pure mathematics is independent of his or her interest in statistics (10 marks)

Ability in pure mathematics

		Low	Average	High
Interest in Statistics	Low	6	42	15
	Average	58	61	31
	High	14	47	29

(b) In comparing the variability of the tensile strength of two kinds of structural steel, an experiment yielded the following results: $n_1=13$, $s_1^2=19.2$, $n_2=16$ and $s_2^2=3.5$, where the units of measurement are grams per square cm. Assuming that the measurements constitute independent random samples from two normal populations, test

$$H_0 : \sigma_1^2 = \sigma_2^2$$
against
$$H_0 : \sigma_1^2 \neq \sigma_2^2$$

$at,,, \alpha = 0.02$ level of significance (10 marks)