KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR

Fourth YEAR SECOND SEMESTER
SUPPLIMENTARY EXAMINATIONS

FOR THE DEGREE OF BSC (PHYSICS)

COURSE CODE: SPC 421

COURSE TITLE: MEASUREMENT & INSTRUMENTATION

DURATION: 2 HOURS

DATE: 24/11/2022 TIME: 8:00AM-10:00AM

INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.

Start every question on a new page and make sure question's number is written on each page

Question one carries *30marks* and the rest *20marks* each

This paper consists of **4** printed pages. Please Turn Over

QUESTION ONE

(a). Using a well labeled block diagram, illustrate the elements of a generalized measurement system. (3mks)

(b). State the three forms of ***drift*** in the performance of an instrument. (3mks)

(c). Show that in the Maxwell inductance Bridge, $R_1R_3 = R_2R_4$ and symbols have their usual meaning (4mks)

(d). Ten measurements of the resistance of a resistor gave 101.2 Ω, 101.7 Ω, 101.3 Ω, 101.0 Ω, 101.5 Ω, 101.3 Ω , 101.2 Ω, 101.4 Ω, 101.3 Ω, and 101.1 Ω. Assume that only random errors are present. Calculate:

i. the arithmetic mean (2mks)

ii. the standard deviation of the readings (2mks)

iii. the probable error (2mks)

e) Define the term ***unit of measurement*** and state the SI unit of length. (2mks)

f) What is meant by ***random errors*** and give ***three*** reasons for their occurrence. (5mks)

g) List any four main parts of ***CRT***. (4mks)

h) The length of a chip is ***3.25±0.05mm*** while its width is ***2.00±0.05mm***. Calculate the area of the chip. (3mks)

QUESTION TWO.

(a). Discuss the three advantages of sampling a signal at a rate much higher than the ***Nyquist frequency*** and then digitally filtering to limit it to the signal bandwidth. (5mks)

(b). Distinguish between ***analog*** and ***digital*** instruments? (5mks)

(c). List ***four*** advantages of digital instruments (5mks)

d) Describe ***a function generator***. (5mks)

QUESTION THREE

(a). (i). Define the term ***deflection sensitivity of CRO.*** (1mk)

(ii). What is ***fluorescence***? (1mk)

(b). Give ***four*** useful ***applications of spectrum analyzer***. (4mks)

(c). What is the importance of ***gate time*** in frequency counter. (2mks)

(d). Describe the generation of photocurrent, I_{ph} in a photodiode when illuminated. (5mks)

e) With the aid of a well labeled diagram, discuss the working of ***a sweep frequency generator.*** (7mks)

QUESTION FOUR

(a). Differentiate between international standards and primary standards. (2mks)

(b) (i). What is meant by the term ***standard***? (2mk)

(ii). Discuss the ***different types*** of standards. (10mks)

c) Explain three characteristics of a temperature sensor. (6mks)

QUESTION FIVE

(a) (i). Define the term ***systematic error***? Give two examples. (3mks)

ii) Describe how systematic errors can be reduced using (i) careful instrument design and (ii) method of opposing inputs. (10mks)

iii) Describe the ***Geiger-Müller counters*** operation region. (3mks)

iv) (b). Discuss any four **static characters** of an instrument. (4mks)