NESA NATIONAL EXAMINATION AND SCHOOL INSPECTION AUTHORITY

FOP – Basics Engineering Sciences

T016

Friday, 30/7/2021

08:30 – 11:30 AM

Names: .....

Index number: .....

TVET NATIONAL EXAMINATION, RTQF LEVEL 5, 2020-2021

QUESTIONS and ANSWERS BOOKLET

OPTION/TRADE: **FOOD PROCESSING**

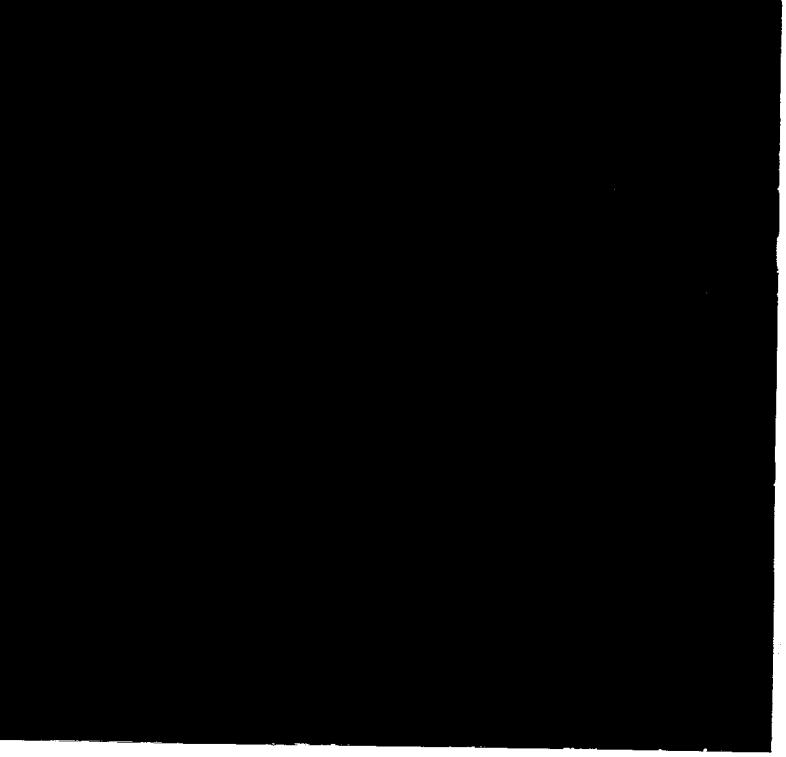
SUBJECT: **Basics Engineering Sciences**

ACADEMIC YEAR: **2020-2021**

Read carefully the instructions on page (i) & (ii).

FOR EXAMINER'S USE ONLY

QUESTIONS	1	2	3	4	5	6	7	8	9	10	Total
Marks											
QUESTIONS	11	12	13	14	15	16	17	18	19	20	Total
Marks											
QUESTIONS	21	22	23	24	25	26	27	28	29	30	Total
Marks											



TVET NATIONAL EXAMINATION, RTQF LEVEL 5, 2020-2021

INSTRUCTIONS TO CANDIDATES: PART I (Answer Booklet)

1. A candidate should fill in the actual names and the index number on the cover of this questions and answer booklet on the provided place (Black Box).

2. It is illegal for a candidate to write any of his/her names, index number or a school name inside the answer booklet.

3. A candidate should check if all pages of the answer booklet are complete. No candidate should remove or tear any pages or part of it from the answer booklet.

4. A candidate should answer in the language in which the examination is set. (See page ***(ii)***)

5. A candidate should sign on the sitting plan when submitting the answer booklet. He/she has also to check if the answer booklet is well sealed.

6. No extra paper is allowed in the examinations room. If a candidate is caught with it his/her results will be nullified.

7. No candidate is allowed to write answers not related to the subject being sat for, otherwise it will be considered as a cheating case.

8. Write your answers on the 12 lined pages (From page 1 of 12 to page 12 of 12).

9. Use the last non-lined pages as draft.

10. Results for any candidate who is caught in examination malpractices are nullified. The cheating can be recognized during examinations administration, marking exercise or even thereafter.

TVET NATIONAL EXAMINATION, RTQF LEVEL 5, 2020-2021

OPTION/TRADE: FOOD PROCESSING

SUBJECT: Basics Engineering Sciences

DURATION: 3 hours

INSTRUCTIONS TO CANDIDATES:PART II (Question paper)

The paper is composed of two (2) main Sections as follows:

Section I: Attempt all the Twelve (12) questions **(60 marks)**

Section II: Attempt any Four (4) questions out of Six (6) **(40 marks)**

Allowed materials:

-Ruler and square

-Calculator

Note:

Every candidate is required to carefully comply with the provided assessment instructions.

Section I: Attempt all the Twelve (12) questions **(60 marks)**

01. Solve the following linear equations. **(5marks)**

a) $3x + 11 = -7$

b) $2(x - 5) + 3x = 4(x - 6) + 1$

02. Solve the inequalities below and write the solution set-in interval notation. **(5marks)**

a) $x - 8 \geq 7$

b) $6t + 3 < 3t + 12$

03. Calculate the modulus of the following complex numbers: **(5marks)**

a) $Z = 1 + i\sqrt{3}$

b) $Z = 4 - 3i$

04. Evaluate the following: **(5marks)**

a) $\lim_{x \to 3} \frac{x^2 - 9}{x - 3}$

b) $\lim_{x \to \infty} \frac{\ln x}{x}$

05. Change degrees into Radians **(5marks)**

30	45	180	270	-90

06. Among the following sources of energy choose which are renewable and non-renewable:

a) Biomass

b) Biogas

c) Crude oil(petroleum)

d) Natural gas

e) Geothermal energy

f) Coal **(5marks)**

07. State any five (5) properties of gravity. **(5marks)**

08. Define the following terms: **(5marks)**

a) Transition metal

b) Oxidation state

c) Valence electron

d) Amplifier

e) Transducer

09. Calculate the volume of 15M H_2SO_4 that would be required to prepare 150cm^3 of 2M H_2SO_4 **(5marks)**

10. What mass of NaOH is required to prepare 500cm^3 of a 0.05M solution? **(5marks)**

11. **a)** What are four (4) classes of organic compounds? **(2marks)**

b) Give the name of the following compounds. **(3marks)**

i. C_3H_6O
ii. C_2H_4O
iii. CH_3OH

12. An optical Fiber is a cable made of glass or plastic used to transmit data in form of light in long distances by using the total internal reflection phenomena. **(5marks)**

a) By using a neat sketch, illustrate the following phenomena:

i. refraction of light

ii. critical angle

iii. total internal reflection

b) Optical Fiber transmits light pulses in very long distances which may lead to the light pulses' signals attenuation.

i. What do you mean by signal attenuation?

ii. Identify three (3) causes of signal attenuation

iii. Identify at least two (2) tangible measures to avoid signal attenuation in optical fiber.

Section II: Attempt any Four (4) questions out of Six (6) **(40 marks)**

13. What are the advantages of digital communications compared to analog communications? **(10marks)**

14. An organic compound contains 31.9% by mass of carbon, 6.8% hydrogen and 18.51% nitrogen and the remaining percentage accounts for oxygen. The compound has the vapor density of 37.5. calculate the molecular formula of that compound. **(10marks)**

15. Draw the electronic configuration of the following elements.

a) Na_{11}:
b) Fe_{26}:
c) K_{19}:
d) Cr_{24}:
e) B_5:

(10marks)

16. **a)** Differentiate mass from weight.

b) A van of mass 2500kg is authorized to carry14 passengers. If the average mass per passenger is 50kg, calculate the:

i. Weight of the van
ii. Weight of all passengers
iii. Total weight of the van and the passengers **(10marks)**

17. **a)** The cost of 3 shirts and 2 jackets is 14400 Frw. If 4 shirts and a jacket cost is 15200 Frw, find the cost of two jackets and a shirt. **(5marks)**

b) Solve and discuss the equation $(2 - 3m)x + 1 = m^2(1 - x)$ **(5marks)**

18. Given the numerical function $f(x)=\frac{x+8}{x+4}$

a) Find:
i. the domain of definition. **(3marks)**
ii. Possible asymptotes. **(4marks)**
b) State whether f(x) is odd or even. **(3marks)**

NESA2021