THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

082 ELECTRICAL ENGINEERING SCIENCE

(For Both School and Private candidates)

Time: 3 Hours **Year: 2021**

Instructions

1. This paper consists of section **A**, **B** and **C** with total of f**ourteen (14)** questions.
2. Answer **all** questions in section **A** and **B**, and **three (3)** questions from section **C.**
3. Section **A** carries **ten (10)** marks , section **B** and **C** carry **forty five (45)** marks each.
4. Cellular phones, and any unauthorized materials are **not** allowed in the examination room.
5. Write your **Examination Number** on every page of your answer booklet (s).

SECTION A (10 Marks)

Answer **all** questions in the section

1. Choose the correct answer from the given alternatives A to E and write its letter in the answer booklet provided:

i) What is the name given to the two sets of deflection coils in the cathode ray tube?

A. Scanning coils

B. Focussing coils

C. Electrostatic coils

D. Brightness coils

E. Reflection coil

ii) Which of the following is the effect of electric current?

A. Electrical effect

B. Mechanical effect

C. Heating effect

D. Potential effect

E. Current effect.

iii) What is the term used to represent alternating current generators?

A. Silent pole generators

B. Shielded pole generators

C. Dynamometer

D. Alternators

E. Dynamos.

iv) What is the major function of a rectifier circuit in electrical devices?

A. To convert a.c to d.c

B. To rectify d.c to a.c

C. To change single phase to 3 phase

D. To step up voltage and current

E. To step up current.

v) How can the range of the voltmeter be extended?

A. By connecting a parallel resistor

B. By connecting a shunt resistor

C. By connecting a series resistor

D. By connecting a low value resistor

E. By connecting a load resistor.

vi) What will be the relationship between voltage and current when a.c voltage is applied across a pure resistor?

A. Voltage and current will be out of phase.

B. Current will lead voltage by 90º.

C. Voltage will lead current by 90º.

D. Voltage and current will be in phase.

E. Angle between voltage and current will be 90º

vii) Which laws are associated with electromagnetic induction?

A. Ohms' law and Faraday's law

B. Faraday's law and Lenz's law

C. Lenz's law and Newton's law

D. Joule's law and Faraday's law

E. Faraday's law and Kirchhoff's laws

viii) What is a characteristic of a material that is negatively charged?

A. Has more proton than electrons.

B. Has more neutrons than electrons.

C. Has more number of neutrons.

D. Has more electrons than protons.

E. Has equal number of protons and electrons.

ix) Which one is the basic requirement for an e.m.f to be induced in a coil?

A. The magnetic flux should link the coil.

B. Current of the coil should be constant.

C. The coil to be induced should form a loop.

D. The flux density near the coil should be less

E. The magnetic flux linking the coil should change

x) Why permanent magnet moving coil current ammeters have a uniform scale?

A. It reduces eddy current damping.

B. They have full deflection torque

C. Its speed is constant.

D. They are spring controlled

E. Their deflection torque is equal to unit

SECTION B (45 Marks)

Answer **all** questions from this section

2. (a) Outline two necessary conditions to be considered when selecting a cable for a particular circuit.

   (b) How is the resistance of the following materials affected by the increase in temperature?

   (i) Conductor

   (ii) Insulator

3. Determine the value of resistance required to be connected in series with a 600 W kettle to cause voltage falling from 240 V to 220 V.

4. Give five reasons for electrical engineers to concentrate much on improving power factor of A.C circuit.

5. A flux of 25 mWb links with a 1500 turns coil when a current of 3A passes through the coil. Calculate:
   (a) The inductance of the coil
   (b) The energy stored in the magnetic field
   (c) The average induced e.m.f if the current falls to zero in 150 ms
6. A 70 cm long conductor carrying a current of 200 A lies perpendicular to the magnetic field strength of 3000 AT/m in air. If the conductor moves against this force, what will be the value of the following parameters?
7. (a) What does it imply when a material is said to have positive temperature coefficient?
   (b) A coil has a resistance of 10 Ω when its mean temperature is 20ºC and it is 20 Ω when its mean temperature is 50ºC. Find the temperature coefficient of the coil at 0ºC
8. (a) Give the meaning of the term "armature reaction" as applied in D.C machines.
   (b) Why ammeter reaction is not suitable on d.c machine? Give two reasons.
   (c) Why is it not recommended for the d.c series motor to be switched ON at no load?
9. A load of 30 KVA at unity power factor is used to supply primary voltage of 3300 V. if the step down transformer ratio is 15:1; Calculate:
   (a) Secondary voltage.
   (b) Primary current.
   (c) Secondary current.
10. (a) A lamp rated 230 V gives an illumination of 6000 lux and takes 1.5 A from the mains. Calculate the efficiency of the lamp.
    (b) A school electrical technician wants to fix fluorescent lamps in a new classroom. He decided to use startles method in starting the lamps. Why does

the technician decided to use startles method? Give two reasons.

SECTION C (45 Marks)

Answer any **three (3)** questions from this section

11. (a) Identify two types of tests which must be carried out in transformer and for each type give reason for carrying such a test.

(b) When tested, a 20 kVA transformer was found to have 600 watts iron losses, and 700 watts copper losses when supplying full load at unity power factor. Calculate;

(i) The efficiency of a transformer at unity p.f on full load.

(ii) Output power on half load.

(iii) Copper loss at half load.

12. Three coils, each having a resistance of 15 Ω and an inductance of 10 Ω, connected in star at a 400V, 3 phase 50Hz supply.

(a) Sketch a circuit for 3 phase star connected coils showing the position of phase and line voltages.

(b) Calculate:

(i) The line current.

(ii) Power factor.

(iii) Power supplied.

13. (a) Briefly describe three types of torques required for operation of indicating measuring instruments.

(b) A voltage coil of a dynamometer type wattmeter is connected across the load side and reads 200 W. If the load voltage is 245 V and the resistance of the voltage being 3612 Ω. Calculate the following:

(i) True power across the load.

(ii) Percentage error due to wattmeter connection.

14. Calculate the flux density in the iron, absolute permeability of iron, relative permeability of iron and resistance of the magnetic circuit consisting of an iron ring of mean circumference of 80 cm with a cross sectional area of 12 cm2 throughout, if a current of 1 ampere in the magnetizing coil of 200 turns produced a total flux of 1.2 mWb in the core.