

**THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL
CERTIFICATE OF SECONDARY EDUCATION EXAMINATION**

082

**ELECTRICAL ENGINEERING SCIENCE
(For Both School and Private Candidates)**

TIME: 3 Hours

Wednesday afternoon 10/10/2007

Instructions

1. This paper consists of sections A, B and C.
2. Answer **all** questions in sections A and B and **three (3)** questions from section C.
3. Electronics calculators are **not** allowed in examination room
4. Cellular phones are **not** allowed in examination room.
5. Write your **Examination Number** on every page of your answer booklet(s).

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This paper consists of 5 printed pages.

SECTION A (10 marks)

Answer all questions in this section.

1. For each of items (i) – (x) choose the correct answer from among the given alternatives and write its letter beside the item number.
- (i) The following material is suitable for making filament of incandescent lamps.
- A. Brass
 - B. Tungsten
 - C. Argon
 - D. Copper
 - E. Mercury
- (ii) The unit used to measure luminous intensity is
- A. lumen/m²
 - B. candela
 - C. lux
 - D. lumen
 - E. candela/m²
- (iii) Normally a transformer is laminated in order to
- A. reduce power factor
 - B. reduce armature reaction
 - C. increase power loss
 - D. reduce eddy current.
 - E. increase eddy current.
- (iv) The instrument that is used to measure both A.C and D.C is known as
- A. money iron instrument
 - B. moving coil instrument
 - C. clamp meter
 - D. tacho metre
 - E. current meter.
- (v) The type of light source are
- A. Discharge and incandescent lamps
 - B. Generators and incandescent lamps
 - C. Batteries and incandescent lamps
 - D. Magnetism and incandescent lamps
 - E. Batteries and magnetism

(vi) The extra low voltage for dc supply is

- A 30 V
- B 50 V
- C 240 V
- D 10 V
- E 25 V

(vii) Usually a rectifier is made by using the following components:

- A Transistors
- B Capacitors
- C Diodes
- D Resistors
- E Thyristor

(viii) Torque is the turning moment produced by a force about an axis or centre of rotation which is measured by the following unit:

- A Nm
- B Wb
- C W
- D m/s
- E Wb/m.

(ix) The unit of the reluctance, s , of a magnetic circuit is

- A V/d
- B N/t
- C $\frac{m.m.f}{flux}$
- D V/A
- E $\frac{m.m.f}{t}$

(x) Which of the following instruments is used for testing high voltage?

- A Galvanometer
- B Potential meter
- C Multimeter
- D Voltage transformer
- E Voltmeter

SECTION B (30 marks)

Answer all questions in this section.

2. ✓ Define the term "armature reaction" of a DC machine.
3. ✓ Mention the main parts of an AC machine.
4. Calculate the illumination of a working plane at a point G, 4 m vertically below a lamp emitting 800 cd. The surface is at right angles to the light source.
5. Why are transformers rated in KVA?
6. ✓ Write down the instruments used to measure the following quantities:
 - (a) Illumination
 - (b) Resistance
 - (c) Electric energy.
7. ✓ Explain the meaning of the word "polarization" then mention the instrument used to measure the specific gravity of a battery.
8. ✓ The frequency of an oscillating quantity is 60 Hertz. What is the period of oscillation?
9. ✓ List down **three (3)** methods which can be used to improve low power factor.
10. ✓ Write down **six (6)** methods that are used to generate electricity.
11. Mention **three (3)** types of discharge lamps.

SECTION C (60 marks)

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

12. ✓ Find the efficiency of water heater which heats 140 litres of water from 10°C to 60°C in 3 hours. The water is heated by a 3 kilowatts element.
13. ✓
 - (a) By using a neat diagram explain how you can extend the range of a voltmeter.
 - (b) A moving coil instrument gives a full scale deflection (FSD) with a current of 30 mA and a voltage of 90 mV. Calculate the value of a resistor to be connected with the instrument so that it can be used to read 0 – 100 volts.

14. The resistance of a shunt winding of dc machine is measured before and after a run of several hours. The average values are $55\ \Omega$ and $63\ \Omega$. Calculate the rise in temperature of the winding. Assume the room temperature of 15°C . (Temperature coefficient of resistance of copper is $0.00428\ \%/^\circ\text{C}$)
15. Two capacitors A and B of capacitance 2 microfarads and 4 micro farads respectively are connected in series to a dc supply charge stored by each capacitor of 0.16 mC.
Determine the
- (a) potential difference across each capacitor
 - (b) energy stored by each capacitor
 - (c) effective capacitance of series combination
 - (d) total energy stored.
16. (a) What is a pure inductive circuit ?
- (b) A circuit consists of inductor, capacitor and resistor of 10 ohms, 4 ohms and 8 ohms respectively. If the components are connected in series across 240 volts and 50 Hz, calculate the current of a circuit.
- (c) Draw the vectorial (phasor) relationship between voltage and current of the above circuit.