

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 8<sup>th</sup> October 2003 p.m.

Instructions

This paper consists of sections A, B and C.

Answer all questions in sections A and B, and three (3) questions from section C.

Cellular phones are not allowed in the examination room.

Electronic calculators are not allowed in the examination room.

Write your Examination Number on every page of your answer booklet(s).

This paper consists of 5 printed pages.

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SECTION A (10 marks)

Answer all questions in this section.

1. From each of the items (i) – (x) choose the correct answer among given alternatives and write its letter beside the item number.

(i) Neutron is a particle of an atom with

- A negative charge
- B positive charge
- C no charge
- D negative and positive charges
- E positive ion.

(ii) Which one of the following is a correct conversion?

- A  $15 \mu\Omega = 150 \text{ m}\Omega$
- B  $3.2 \text{ mA} = 0.0032 \text{ A}$
- C  $40 \text{ kW} = 400 \text{ W}$
- D  $250 \text{ mV} = 25 \text{ V}$
- E  $15 \text{ k}\Omega = 150 \Omega$

(iii) The lowest resistance in an electric circuit is obtained when the resistors are connected in

- A series-parallel circuit
- B series
- C compound
- D parallel
- E parallel series to the load.

(iv) The measuring instrument that is used to measure both a.c. and d.c. electrical quantities is the

- A moving iron type
- B moving coil type
- C galvanometer type
- D metal rectifier type
- E dynamometer type.

(v) Which of the following is the correct formula applied in the calculation of turn ratio of a transformer?

- A  $\frac{N_2}{N_1} = \frac{V_1}{V_2}$     B  $\frac{V_2}{V_1} = \frac{I_2}{I_1}$     C  $\frac{N_1}{N_2} = \frac{I_1}{I_2}$   
D  $\frac{V_1}{V_2} = \frac{I_1}{I_2}$     E  $\frac{N_1}{N_2} = \frac{I_2}{I_1}$

- (vi) Local action in batteries and cells can be explained as
- A the formation of bubbles gas of hydrogen in the carbon electrode (electrode)
  - B the situation whereby electrolyte attacks the carbon electrode
  - C the process of sal-ammonia solution attacking the glass container
  - D the process of electrolyte attacking the impurities in the zinc (-ve electrode)
  - E charging of zinc plate using carbon plate.
- (vii) What will happen to a carbon material when it is exposed to high temperature?
- A Its resistance will decrease
  - B Its resistance will increase
  - C Its resistance will remain constant
  - D It will soften
  - E It will harden
- (viii) Which of the following will affect the capacitance of a capacitor?
- A Permeativity, number of turns and maximum flux
  - B Area, number of parallel plates, insulation material and distance between the plates
  - C Cross-sectional area, resistivity, length and temperature
  - D Permeability, length and cross-sectional area
  - E Resistivity, dielectric material, number of plates and cross-sectional area
- (ix) The effective value in an a.c. circuit is called
- A peak value
  - B average value
  - C minimum value
  - D form factor value
  - E root mean square value.
- (x) Which of the following motors is not recommended to be started without a load?
- A Shunt
  - B Accumulative compound
  - C Differential compound
  - D Series
  - E Squirrel cage

**SECTION B (30 marks)**

Answer all questions in this section.

2. Why is series wound motor known as a universal motor?
3. Give three (3) advantages of three phase system over a single phase system.
4. An area  $10 \text{ m} \times 2.5 \text{ m}$  is to be illuminated to a level of  $150 \text{ lux}$ . How many lumen must reach the area?
5. Explain the meaning of the word **AMPACITY** as applied in conductors and cables.
6. A power transformer has  $415 \text{ V}$  at no load and  $405 \text{ V}$  at full load. Calculate the voltage regulation.
7. Give two (2) differences between moving coil instrument and moving iron instrument.
8. A force on a conductor carrying current of  $25 \text{ A}$  is  $12 \text{ N}$  and lies at right angle to a magnetic field density of  $1.6 \text{ T}$ . Calculate the length of a conductor.
9. Give three (3) practical applications of chemical effect of electric current.
10. Deduce the behaviour of current in series and parallel connected loads.
11. Find the internal resistance of a cell having an e.m.f. of  $1.8 \text{ V}$ , potential difference of  $1.2 \text{ V}$  and circuit current of  $0.6 \text{ A}$ .

**SECTION C (60 marks)**

Answer three (3) questions from this section.

12. Three coils are connected in delta to a 3-phase 3-wire  $415 \text{ V}$ ,  $50 \text{ Hz}$  supply. They take line current of  $5 \text{ A}$  at  $0.8$  power factor lagging. Calculate the
  - (a) resistance of a coils
  - (b) inductance of a coils
13.
  - (a) What is the difference between motor and generator?
  - (b) A d.c. shunt generator has an induced e.m.f. of  $300 \text{ V}$  when the armature current is  $80 \text{ A}$  and terminal voltage is  $274 \text{ V}$ . Assuming a brush voltage drop of  $2 \text{ V}$ , calculate the
    - (i) armature resistance
    - (ii) terminal voltage for armature current of  $60 \text{ A}$ .