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

081

ELECTRICAL INSTALLATION
(For Both School and Private Candidates)

Time: 3 Hours **Friday, 13th November 2015 p.m.**

Instructions

1. This paper consists of sections A, B and C.
2. Answer **all** the questions in sections A and B and **three** (3) questions from section C.
3. Non programmable calculators may be used.
4. Cellular phones 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 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 in the answer booklet provided.

(i) A d.c shunt motor is applied to run constant speed machines such as
A electric drills B cranes and hoists C conveyors
B centrifugal pumps E electric locomotives.

(ii) A double wound transformer having 120 V in primary winding consists 600 turns. The value of volts per turn will be
A 0.5 V/turn. B 0.2 V/turn. C 5 V/turn.
D 0.02 V/turn E 2 V/turn.

(iii) Two 2 – way switches and one intermediate switch can be used in a domestic lighting circuit to control lights from
A four positions B two positions C three positions
D one position E five positions.

(iii) When measuring load current, an ammeter is always connected in
A series without load B series-parallel with load C parallel with load
D series with load E parallel without load.

(iv) The purpose of carrying polarity verification test in an installation is to make sure that
A insulation of the conductor is strong
B no leakage current occurs in an installation
C all fuses and switches are connected to live wire
D the resistance of earth continuity conductor is properly measured and obtained
E there is no short circuit between the current carrying conductors.

(v) The term efficacy as used in lighting system refers to
A the ratio of mounting height of the lamp to area of the illuminated room
B the ratio of lamp output in lumens to lamp power in watts
C the ratio of illumination output to mounting height of the lamp
D the ratio of the lamp output luminous intensity to lamp output lumens
E the lamp rating in candelas to the expected illumination in lux.

(vi) Why is it important to study workshop safety rules and precautions?
A In order to maintain workshop discipline.
B In order to prevent accidents in the workshop.
C In order to be familiar with job descriptions of the workshop.
D In order to create students' confidence in the workshop.
E In order to know various workshop rules and regulations.

(vii) What is the recommended cable size for supplying a domestic installation in Tanzania?

A A 16mm^2 twin armoured cable.
B A 25 mm^2 twin armoured cable.
C A 6 mm^2 twin armoured cable.
D A 4 mm^2 twin armoured cable.
E A 2.5 mm^2 twin armoured cable.

(viii) Armature reaction in an a.c generator affects

A rotor speed
B terminal voltage per phase
C frequency of armature
D generated voltage per phase
E frequency of generated voltage.

(ix) A *grid system* is defined as

A a parallel operation of generators at high voltage
B a three phase 4 - wire distribution system
C a number of power stations connected together at high voltage
D a parallel operation of transformers at high voltage
E a parallel operation of switch gears at high voltage.

SECTION B (30 Marks)

Answer **all** questions in this section.

2. Name two physical properties and one chemical property of a good insulator.

3. Mention three functions of the main switch gear in an electrical installation.

4. (a) Briefly explain why is it necessary to
   (i) use high voltage for transmission and distribution of electrical energy?
   (ii) balance the loads on a three phase system?

   (b) Why single-core armoured cable should not be used to carry a.c current?

5. Explain the precaution that should be taken when the metallic conduit system is being installed to prevent each of the following:
   (a) High resistance joints in the system.
   (b) Rusting of conduit and threads.
   (c) Conduit blockages after erection.

6. Define the following terms as used in consumer circuits:
   (a) Final sub circuit.
   (b) Domestic ring circuit.
   (c) Spur of a ring circuit.

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7. (a) Explain how the following can be measured:
   (i) current through a lighting point.
   (ii) voltage across a lighting point.

   (b) Give one application of a clamp meter.

8. (a) How does the speed of a compound motor can be varied?

   (b) Give two applications of an a.c universal motor.

9. (a) What is the main purpose of inspecting and testing an electrical installation?

   (b) What is the main objective of performing the following testes in an electrical installation?
   (i) Continuity test.
   (ii) Insulation resistance test.

10. Mention three domestic and three industrial applications of electric heating.

11. (a) What type of d.c generator is suitable for constant voltage applications?

   (b) A 220 V d.c generator has an armature resistance of 0.5 Ω. If the full load armature current is 20 A; find the induced e.m.f. of the generator.

SECTION C (60 Marks)

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

12. (a) Define the following terms:
   (i) Resistivity.
   (ii) Temperature coefficient of a resistance. **(02 marks)**

   (b) Give three reasons why aluminium conductors are largely used in overhead transmission of electrical power. **(03 marks)**

   (c) A PVC twin copper cable 50 m long has a total voltage drop of 8 V when it is carrying a d.c current of 40 A at 20 °C. The resistivity of copper is 1.754 μΩcm at this temperature. Calculate
   (i) The resistance of the cable
   (ii) Cross-sectional area of the cable (in cm)
   (iii) Current density of the cable
   (iv) Power lost along the cable
   (v) Power lost along the cable when the temperature rises to 50°C, take the temperature coefficient of resistance for copper as 0.0043 at 0°C. **(15 marks)**

13. A 20 kVA transformer was found to have 600 W iron losses and 700 W copper losses when supplying full load at 0.8 power factor. Calculate the efficiency on
    (a) full load **(07 marks)**
    (b) half load **(13 marks)**

14. By using two 2 – way switches, one intermediate switch and two bulbs. Draw the following circuits for bright light.
    (a) Single line diagram. **(08 marks)**
    (b) Schematic diagram. **(05 marks)**
    (c) Wiring diagram **(07 marks)**

15. (a) Describe three main types of tariffs. **(06 marks)**

    (b) Explain the meaning of the following terms as applied to electric tariffs. In each case give two examples.
    (i) Standing costs.
    (i) Running costs. **(04 marks)**

    (c) The power consumer with constant maximum demand throughout a year is offered the following tariff: TZS 2,500/= per kVA of maximum demand plus TZS 150/= per unit. Given that his annual maximum demand is 250 kW at a power factor of 0.7 and his annual consumption is 350,000 units. Calculate
    (i) The annual cost.
    (ii) Average price per unit. **(10 marks)**

16. (a) Briefly explain how to reverse the direction of rotation of each of the following types of motor.
    (i) Three phase induction motor.
    (ii) Single phase, splint-phase induction motor.
    (iii) Single phase universal motor. **(03 marks)**

    (b) Draw the circuit of a capacitor - start single phase induction motor. **(05 marks)**

    (c) A three phase star connected motor takes 8 kW power at a power factor of 0.8 lagging from a 460 V, 3-phase supply. Calculate
    (i) Line current
    (ii) Phase current
    (iii) Phase voltage
    (iv) Impedance per phase
    (v) Resistance per phase. **(12 marks)**