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 **Thursday, 09th November 2017 p.m.**

Instructions

1. This paper consists of sections A, B and C with a total of **sixteen (16)** questions.
2. Answer **all** the questions in sections A and B and **three (3)** questions from section C.
3. Cellular phones and any unauthorised materials are **not** allowed in the examination room.
4. Non programmable calculators may be used.
5. Write your **Examination Number** on every page of your answer booklet(s).
6. Whenever necessary use the following constants:
   - Resistivity of copper may be taken as 17.45 $\mu\Omega$ mm.
   - The specific heat capacity of water is 4187 J/kg^{0}C.

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) Which of the following is the maximum operating temperature of the Poly-vinyl Chloride (PVC) insulated cable?
A 90^0C. B 45^0C. C 85^0C D 100^0C. E 65^0C.

(ii) As far as tariff is concern in electricity charging systems, the fixed charge refers to
A standing costs B unit charge C running costs
D fuel and water costs E power consumption charges.

(iii) In a d.c generator, the generated e.m.f is directly proportional to the
A number of commutator segments. B field current C the pole flux
D number of armature parallel path D number of dummy coils.

(iv) An effect of 3-phase squirrel cage induction motor having an open phase is called
A Short circuiting B Single phasing C Split phasing
D Synchronizing E Open circuiting.

(v) Which of the following is a suitable insulator for elements of electric iron?
A Insulation tape. B Rubber. C PVC.
D Mica. E Lead alloy.

(vi) The main function of a reamer is
A to clean dirty in plastic conduits B to join two pieces of conduits
C to clip metal and plastic conduits D to drill holes on metal conduit surfaces
E to remove sharp edges from metal conduit.

(vii) What is a *first aid*?
A A permanent treatment to a victim of an accident.
B A first aid box with medicine for treating victims of accidents.
C A first aid kit given to accident victims.
D A temporary measure given to an accident victim before sent to a skilled person.
E A box with medicines that is kept in a workshop.

(viii) The choice of wiring system for a particular installation should be based on
A education level of electrician undertaking the job
B technical, economical and environmental considerations of the installation
C TANESCO rules and regulations
D availability of power supply
E the type of equipment to be used in undertaking the job.

(ix) The range of a voltmeter can be extended by
A connecting a resistor known as shunt across the voltmeter
B connecting a resistor known as multiplier in series with the voltmeter
C connecting a voltmeter in parallel with load
D connecting a voltmeter in series with load
E recalibrating the voltmeter.

(x) What is the main purpose of carrying insulation resistance test in an installation?
A To make sure there is no possibility of leakage currents.
B To make sure there is no open circuit between insulated conductors.
C To make sure there is no fuses or switches connected to live wire.
D To make sure all switch gears and fuses are connected to live wire.
E To make sure the resistance of earth continuity conductor is properly obtained.

SECTION B (30 Marks)

Answer **all** questions in this section.

2. Outline essential requirements which conductor and insulator should possess. Give three requirements for each case.

3. Give three reasons for carrying out earthling tests.

4. (a) Mention three types of tariffs for domestic and other small consumers.
(b) Give three costs incurred in producing electric power which varies with the operation of the plant.

5. Give three disadvantages of a low power factor in a generating power plant.

6. Explain how to carry out tests for determining copper losses and iron losses of a transformer.

7. Briefly explain three classes of injuries caused by electric shock.

8. Show how the respective meters can be connected in Figure 1 to measure;
(a) Voltage across the load.
(b) Current through the load.
(c) The power dissipated by the load.

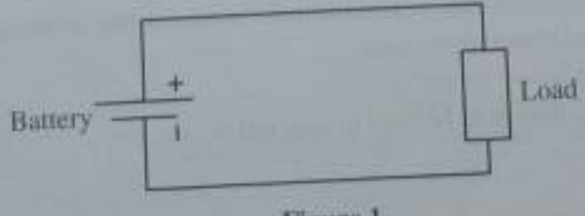

Figure 1

9. Why parallel circuits are more used in electrical lighting systems than series circuits. Give three reasons.

10. (a) Mention two main parts of an alternator.
    (b) Give two advantages of a stationary armature alternator over the rotating armature alternator.

11. Briefly explain the function of the following tools which are used by an electrician in performing electrical installation work:
    (a) Megger insulation tester.
    (b) Hacksaw blade.
    (c) Electrician's Knife.

SECTION C (60 Marks)

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

12. (a) Draw a well labeled circuit diagram of a three-point starter of a d.c shunt motor. **(10 marks)**

    (b) A d.c shunt motor is rated at 250 V and 50 A. The field resistance is 250 Ω and the armature resistance is 0.01 Ω. Calculate; **(10 marks)**
    (i) The field current.
    (ii) The armature current.
    (iii) The mechanical power developed (neglect rotational losses).
    (iv) The efficiency of the motor.

13. (a) A 230 V, 50 Hz, 18 kW single phase load; operating at a power factor of 0.8 is supplied by a 50 m long, 35 mm^2 copper cable. Calculate;
    (i) The voltage drop along the cable (Neglect the reactance of a cable).
    (ii) The power lost in the cable. **(10 marks)**

    (b) A 50 kW balanced 3-phase load operating at a power factor of 0.8 lagging is supplied from a 415 V 3-phase supply by a 120 m long cable. The allowable voltage drop is 2.5% of nominal voltage. Neglect the reactance of the cable and calculate;
    (i) The line current.
    (ii) The allowable phase voltage drop.
    (iii) Resistance per core of the cable.
    (iv) The cross-sectional area of the cable in mm^2. **(10 mark)**

14. (a) What is the recommended size of cable and the current rating of the protective device for a domestic lighting circuit? **(02 marks)**

    (b) (i) What is a cooker control unit?
    (ii) Draw the circuit diagram of a cooker control unit. **(12 marks)**

(c) Apply diversity as allowed by IEE regulations and find the minimum current rating of the cable required to power a 240 V, 8 kW single phase cooker. **(06 marks)**

15. (a) Differentiate between conduit and trunking. **(02 marks)**

(b) (i) Give four advantages and three disadvantages of metallic conduit wiring system.
(ii) Mention two areas where conduit wiring is most applicable. **(08 marks)**

(c) Explain five basic methods of securely fixing conduits in an electrical installation. **(10 marks)**

16. (a) Briefly explain three methods of transferring heat from one body to another. **(03 marks)**

(b) Draw a complete labeled electric iron circuit. **(07 marks)**

(c) A storage heater contains 0.1 m^3 of water. The 240 V heating element produces a temperature rise of 85^{0}C in 1 ½ hours and the efficiency of the device is 82%. Calculate
(i) The rating of heater in kilowatts.
(ii) The resistance of the heating element in ohms. **(10 marks)**