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

081

ELECTRICAL INSTALEATION
(For Both School and Private Candidates)

Time: 3 Hours *Friday*, **October 21, 2005 a.m.**

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. Electronic calculators are not allowed in the examination room.
4. Cellular phones are not allowed in the examination room.
5. Write your Examination Number on every page of your answer booklet(s).

MANTASIA

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This paper consists of 4 printed pages.

SECTION A (10 marks)

Answer **all** questions in this section.

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

(i) For remote control of a direct on line contactor starter, start buttons are wired in

A series and stop buttons are also wired in series
B parallel and stop buttons are also wired in parallel
C series and stop buttons are wired in parallel
D parallel and stop buttons are wired in series
E series parallel to stop buttons.

(ii) The ratio of true power to apparent power is used to find

A reactive volt ampere
B load factor
C energy
D power factor
E current ratio

(iii) The rotating field produced by the stator of a 3 phase induction motor travels at

A a speed above a synchronous speed
B a speed below a synchronous speed
C the same speed as the rotor
D a synchronous speed
E high speed.

(iv) In a d.c. motor, the back e.m.f. is given by

A $E = V - I_a R_a$
B $E = V + I_a R_a$
C $E = V \mp I_a R_a$
D $E = V \times I_a R_a$
E $E = I_a R_a - V$

(v) A short circuit test in a transformer determines

A copper losses
B iron losses
C constant losses
D mechanical losses
E power losses

(vi) A double wound transformer delivers 500 V to a load taking 500 kVA. The current taken by the load is

A 100 A
B 500 A
C 1000 A
D 5000 A
E 50 mA

(vii) Balancing single phase loads on a three phase, four wire system ensures that

A minimal neutral current flows
B line voltages are all equal
C star point is maintained all the time
D circuit fuses operate efficiently
E current flows to neutral conductor.

(viii) In a three phase star connected circuit, the ratio of line voltage ÷ $\sqrt{3}$ gives

A the voltage to neutral
B the voltage across two lines
C the permissible voltage drops
D neutral/earth voltage
E earth leakage voltage.

(ix) The permissible voltage drop on consumer's installation supplied by 110 V is

A 6 V
B 5.25 V
C 2.75 V
D 1.33 V
E 4 V

(x) In an induction motor, per unit slip(s) is/are found by the expression

A $S = (N_R - N_S) \times N_S$
B $S = (N_S - N_R) \div N_S$
C $S = (N_S + N_S) - N_R$
D $S = (N_S - N_R) \div N_R$
E $S = \left(\frac{N_S}{N_R}\right) N_R$

SECTION B (30 marks)

Answer **all** questions in this section.

2. What is the difference between a flexible cable and a flexible cord?
3. What types and how many switches are required to control lights from four different stations?
4. What are the reasons for fitting a protective switch-gear in an installation? State **three (3)** reasons.
5. What are the methods of reducing stroboscopic effect? State **three (3)** methods.
6. Why do we get dim light from the series connected bulbs? State **two (2)** reasons.
7. State **three (3)** types of fuses fitted in electrical switch gears.
8. What is the purpose of a polarity test in a new installation?
9. Express **two (2)** laws of illumination by formula.

10. Differentiate the following electrical accessories:

    (i) joint box

    (ii) junction box.

11. How can you reverse the direction of rotation of a 3 phase a.c. induction motor?

SECTION C (60 marks)

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

12. A 60 kVA 3 phase transformer is immersed in a tank containing 2000 litres of insulating oil. The efficiency of a transformer at full load is 97 %. Calculate the average rise in temperature of the oil in degrees Celcius after 3 hours of running at full load and unity power factor, assuming that 60 % of heat energy loss in a transformer is expanded in heating oil. The specific heat capacity of oil is 2140 J/kgk°. Density of oil is 898 kg/m^3.

13. The power input to a six pole, 3 phase, 50 Hz induction motor is 42 kW, the speed is 970 rev/min. The stator losses are 1.2 kW and the friction and windage loss is 1.8 kW. Calculate the:

    (a) synchronous speed
    (b) slip in percent
    (c) brake horse power
    (d) rotor copper loss
    (e) efficiency

14. A 220V shunt motor takes a total current of 80 amperes and runs at 500 rev/min. The shunt field resistance is 50 ohms and the armature resistance is 0.1 ohm. Calculate:

    (i) field current
    (ii) armature current.
    (iii) back e.m.f.
    (iv) power input to the motor.

15. A four-pole shunt generator with lap-connected armature, supplies a load of 200 amperes at 100 V. The shunt field resistance is 50 ohms and armature resistance is 0.05 ohms. Calculate the:

    (i) field current.
    (ii) armature current.
    (iii) electromotive force generated if the voltage drop across brushes is 2 volts.
    (iv) power output generated.

16. The cost of electrical power to a consumer is Tsh. 600 per annum per kVA of maximum demand plus Tsh. 50 per unit. A consumer maximum demand is 450 kW at 0.72 p.f. lagging and his annual consumption is 720,000 kwh. Calculate the:

    (i) kVA of maximum demand.
    (ii) annual cost of the maximum demand
    (iii) overall cost of the year
    (iv) average price per unit.