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 **Monday, 15th October 2012 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. 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).
6. Whenever necessary use the following constant:
   - Specific heat capacity of water is 4.2 kJ/kgK.
   - Specific heat capacity of air is 1000 J/kg^{0}C
   - Resistivity of copper may be taken as 17.8 μΩ mm.
   - The density of air is 1.28 kg/m^{3}
   - 1kWh = 3.6 MJ

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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 efficiency of d.c shunt generator is maximum when
A magnetic losses are equal to mechanical losses
B armature copper losses are equal to constant losses
C field copper losses are equal to constant losses
D stray losses are equal to copper losses
E constant losses are equal to variable losses.

(ii) A d.c series motor should never be switched on at no load because
A the field current is zero
B the machine will run with less efficiency
C the speed becomes dangerously high
D it will take too long to accelerate
E it will draw high armature current.

(iii) The function of transformer oil in a transformer is to
A provide insulation and cooling
B provide protection against lighting
C provide protection against short circuiting
D lubricate the moving parts
E clean the moving parts of the transformer.

(iv) In thermal power plants, the pressure in the working fluid is developed by
A condenser
B super heater
C feed water pump
D turbine
E boiler chimney.

(v) A circuit breaker is a device for
A correcting power factor
B neutralizing the effect of transients
C correcting wave form
D interrupting current
E neutralizing magnetic field effect.

(vi) Which type of power plant has the least running cost per kWh of energy generated?
A Hydro-electric plant
B Thermal power plant
C Nuclear power plant
D Diesel power plant
E Coal power plant.

(vii) The insulation resistance of cables is usually measured in terms of
A micro-ohms
B ohms
C kilo-ohms
D giga-ohms
E mega-ohms

(viii) The Wheatstone bridge can be used to measure
A low value of current
B high value of current
C high value of voltage
D low value of voltage
E medium value of resistance.

(ix) Overhead bus bar trunking is most suited to
A high rise buildings
B electric train railways
C crossing highways and roads
D industrial installations
E laboratories and school workshops.

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(x) The earthing fault loop impedance can be measured by the use of

A continuity tester B insulation resistance tester C ohmmeter
D RCD tester E phase – earth loop tester.

SECTION B (30 Marks)

Answer **all** questions in this section.

2. (a) Outline two insulation tests recommended by the I.E.E regulations that have to be carried out in a completed installation.
   (b) During a flash test, a voltage of 20 kV is applied to a cable with an insulation resistance of 5 mega-ohms. What will be the earth leakage current?

3. A primary cell with e.m.f of 1.5 V and internal resistance 0.2 Ω is connected to a circuit of 20 Ω resistance. Calculate the
   (a) current flowing in the circuit.
   (b) current in the circuit if supplied from ten similar cells connected in series.

4. (a) Give two differences between a stranded conductor and a bunched conductor.
   (b) Why indicator boards are necessary in bell circuits.

5. (a) Name two type of protection which should be provided in a d.c motor starter.
   (b) A 460 V direct current shunt motor, running on load has an armature resistance of 0.12 Ω. Calculate the value of the back e.m.f when the current in the armature is 150 A.

6. (a) Give the name of the instruments for making the following tests:
      (i) Insulation resistance test between conductors.
      (ii) Verification of polarity.

   (b) The wire used to supply electricity to an electric iron through a socket has a cross-sectional area of 2.5 mm^2. What is the diameter of this wire?

7. (a) What is the armature reaction?
   (b) Give two effects of armature reaction magnetic fields.

8. A generating station has a connected load of 43,000 kW and a maximum demand of 20,000 kW, the average power being 7020W for the year. Calculate the load factor and demand factor for this case.

9. (a) Define regulation of a transformer.
   (b) The primary winding of a 25 kVA transformer has 200 turns and is connected to 230 V, 50 Hz supply. Calculate full load primary current.

10. Compare between neutral and earth wire (give three points).

11. During electrical installation, metallic or plastic conduits can be used to accommodate a number of wires. Briefly explain three advantages of metallic conduits.

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SECTION C (60 Marks)

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

12. (a) Define the following terms:
    (i) Simmerstat
    (ii) Monotimer. **(02 marks)**

    (b) A room has dimensions 4 m x 6 m x 2.5 m. Electric heaters are to be provided to produce an average temperature of 8^{0} C. Calculate the rating of the heaters required, assuming two changes of air per hour and that 40 % of their output is wasted. **(08 marks)**

    (c) A 2.0 mm^2 twin core cable feeds a heater which takes a current of 20 A. If the cable is 100 m long,
    (i) calculate the voltage drop in it, and the p.d. across the heater if the supply voltage is 240 V.
    (ii) what must be the cross-sectional area of a replacement cable if the voltage drop is not to exceed 6 V? **(10 marks)**

13. (a) Define the following terms
    (i) Utilization factor
    (ii) Maintenance factor. **(02 marks)**

    (b) (i) Explain with the aid of a phasor diagram the meaning of the power factor in the alternating current circuit

    (ii) Electrical energy supplied at a poor power factor is more costly to the supply authority than the same energy supplied at or near unity power factor. Justify the statement by giving five reasons. **(08 marks)**

    (c) (i) Briefly explain four factors which determine the value of coefficient of utilization of a new lighting scheme.
    (ii) A living room 6 m long by 5 m wide is to be illuminated with 100 W tungsten filament lamps to a level of 100 lm/m^2. The lamps have an efficiency of 10 lm/W. The coefficient of utilization is 0.8 and the maintenance factor is 0.7. How many 100 W lamps will be required? **(10 marks)**

14. (a) Mention five properties which must be possessed by transmission cable that is to be buried underground. **(05 marks)**

    (b) Underground system of an electric power transmission is better compared to overhead system. Justify the statement by giving six factors. **(06 marks)**

    (c) Two conductors, one of copper and the other of iron, are connected in parallel and carry equal currents at 25^{0}C. What proportion of current will pass through each if the temperature is raised to 100^{0}C? The temperature coefficients of resistance at 0^{0}C are 0.0043/^{0}C and 0.0063/^{0}C for copper and iron respectively. **(09 marks)**

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15. (a) (i) Enumerate four advantages of digital meter over analogue meter.
(ii) Mention four human errors which can be made during measurements.
(iii) Explain two ways in which human errors can be avoided.
(iv) Differentiate between accuracy and precision. **(10 marks)**

(b) A moving coil instrument has a resistance of 8 Ω and gives a full scale deflection with a current of 5 mA. Calculate the value of a
(i) series resistor so that the instrument can measure up to a value of 100V.
(ii) shunt resistor so that the instrument can measure up to a value of 10A. In each case, show the circuit appropriately labeled. **(10 marks)**

16. (a) A 3-phase load consists of three similar inductive coils each of resistance 50 Ω and inductance of 0.3 H. The supply is 415 V, 50 Hz and the load is star connected. Draw the circuit diagram and calculate the following:
(i) Line current
(ii) Power factor
(iii) Total power **(13 marks)**

(b) In a series circuit containing pure resistance and a pure inductance, the current and the voltage are expressed as $i(t) = 5Sin\left(314t + \frac{2\pi}{3}\right)$ and $V(t) = 155in\left(314t + \frac{5\pi}{6}\right)$. Calculate the:
(i) impedance of the circuit
(ii) value of resistance
(iii) power factor **(07 marks)**

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