THE NATIONAL REPBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL
CERTIFICATE OF SECONDARY EDUCATION EXAMINATIONS

082 **ELECTRICAL ENGINEERING SCIENCE**
(For Both school and Private Candidates)

Time: 3 Hours **Friday, 03rd 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** question in sections A and B and **three (3)** questions from section C.
3. Non programmable calculators may be used.
4. Cellular phones and any unauthorized materials 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 constants.

   Permitivity of free space, $\mu_o = 4\pi \times 10^{-7} \left(H/m\right)$.

   Resistivity of copper may be taken as 0.0173μΩ.mm.

   Specific heat capacity of water = 4.20kJ/kg°K.

   Temperature coefficient of copper is 0.004Ω per °C.

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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 in the answer booklet provided.

(i) Which one of the following is the other name for an alternating current generators?
A Silent pole generators B Shaded pole generators C Dynamometers
D Alternators E Dynamos.

(ii) What is the term used to represent the difference between the synchronous speed and the actual speed of the rotor of a.c motor?
A Frequency B Slip C Motor speed
D Maximum speed E Angular speed

(iii) The unit used to measure flux density is
A weber B kg/m^3 C weber/m
D tesla E weber $/m^3$.

(iv) Which of the following is the effect of electrical current?
A Electrical effect. B Mechanical effects. C Heating effect.
D Potential effect. E Current effect.

(v) The main particles of an atom are
A Molecules, protons and electrons. B Protons, neutrons and electrons.
C Neutrons, electrons and molecules. D Electrons, molecules and charges.
E Charges, protons and neutrons.

(vi) Which of the following electrical machines operates in most similar way to the principle of operation of a 3 phase induction motor?
A Synchronous motor B Repulsion start induction motor
C Transformer with a shorter secondary D Capacitor start induction run motor
E Series motor.

(vii) The basic devices found in every electrical measuring instruments are
A integrating, recording and operating B controlling, damping and integrating
C operating, controlling and damping D operating, indicating and recording
E damping, recording and integrating.

(viii) Which statement is the most correct among the following?
A The quantity of heat depends on mass only.
B The quantity of heat depends on mass, nature of material only.
C The quantity of heat depends on temperature, nature of material and mass.
D The quantity of heat depends on temperature only.
E The quantity of heat depends on its dielectric material.

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(ix) Which one of the following is the correct definition of a "neutral point" in relation to magnetic effect?
A A place where there is no resultant magnetic field.
B A place where there is a resultant magnetic field.
C A place where the production of magnetic field is traced.
D A place where the magnetic field is constant.
E A place where the magnetic field cuts the flux.

(x) The necessary condition for resonance to occur in an a.c circuit is
A inductive reactance to be equal to capacitive reactance
B inductive reactance to be less than one
C capacitive reactance to be greater than inductive reactance
D supply frequency to be equal to capacitive reactance
E capacitance to be equal to inductance.

SECTION B (30 Marks)

Answer **all** questions in this section.

2. (a) State Ohm's law.
(b) What voltage should be applied across 2200 Ω resistor in order for a current of 10 mA to flow through it?

3. Briefly describe three methods of transferring heat from a body.

4. Define the following terms:
(a) Electromagnetic induction
(b) Reluctance
(c) Coefficient of coupling.

5. Briefly explain how you can extend the range of:
(a) an ammeter
(b) a voltmeter.

6. Briefly describe two common faults in leclanche cells.

7. A coil has a resistance of 18 Ω when its mean temperature is 20° C and 20 Ω when its mean temperature is 50 °C. Find its temperature coefficient at 0 °C.

8. (a) State the Lambert's cosine law of illuminations.
(b) A lamp giving a 95.5 candela in all directions is suspended 8 m above the working plane. Calculate the illumination directly under the lamp on the working plane.

9. Draw the circuit for a single phase half-wave rectifier.

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10. Define the following terms as used in a.c current:
    (a) Frequency
    (b) Amplitude
    (c) Root mean square.

11. A three phase system supplies a line current of 72.16 A and line voltage of 250 V when it is delta connected. Calculate:
    (a) phase current
    (b) phase voltage.

SECTION C (60 Marks)

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

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12. Two similar coils have a coupling coefficient of 0.25 when they are connected in series with total inductance of 80 H. Calculate:
    (a) self inductance
    (b) mutual inductance
    (c) the total inductance when the coils are connected in series opposing.

13. (a) An ammeter has a full scale deflection of 15 mA and a resistance of 50 Ω. The instrument is to be converted to a voltmeter with a full scale deflection of 240 V. Calculate;
        (i) the value of multiplier required.
        (ii) the total resistance of the voltmeter.

    (b) If a moving coil instrument has a full scale current of 20 mA and coil resistance of 10 Ω; Calculate the value of shunt resistor to enable the instrument to measure up to 1 A.

14. (a) Define the following terms as applied in electrical conductors:
        (i) Electrical potential
        (ii) Potential difference
        (iii) One volt
        (iv) Electric current.

    (b) Twelve cells each of e.m.f 1.5 volts and internal resistance of 0.2 Ω are arranged four in series per row, three rows in parallel. When the external resistance is 4 Ω, calculate;
        (i) circuit total resistance.
        (ii) the circuit current.
        (iii) the terminal potential difference.
        (iv) power dissipated in external resistance.

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15. (a) What is the effect of heat on pure metal or conductor?

(b) (i) Mention four factors which determine the resistance of pure conductors.
(ii) Briefly describe the relationship between each factor and its resistance.

(c) The resistance of copper wire coil at 0 °C is 100 Ω. Calculate:
(i) the resistance of the coil at 30 °C.
(ii) the resistance of coil if temperature rises from 30 °C to 50 °C.

16. A two conductor distributor AB, 1400 meters long is fed at end A at 220 V. The loads are as follows; 60 A at 200 meters, 40 A at 700 meters and 80 A at 1000 meters from the feeding end point. The resistance of cable is 1.1 Ω/1000 meters. With the aid of a simple sketch diagram, calculate:
(a) the total current fed in distributor.
(b) the current in each section of the cable.
(c) the total resistance in each section of the cable.

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