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

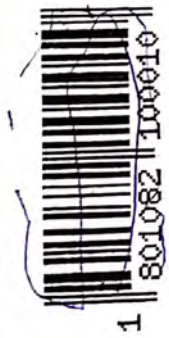
082

ELECTRICAL ENGINEERING SCIENCE
(For Both School and Private Candidates)

Time: 3 Hours **Monday, 12th November 2018 p.m.**

Instructions

1. This paper consists of sections A, B and C with a total of **sixteen (16)** questions.
2. Answer **all** questions in sections A and B and **three (3)** questions from section C.
3. All writings must be in blue or black ink **except** drawings which must be in pencil.
4. All communication devices and any unauthorized materials are **not** allowed in the examination room.
5. Non programmable calculators may be used.
6. Write your **Examination Number** on every page of your answer booklet(s).



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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 in the answer booklet provided.

(i) In D.C. generators the lamination of the core is generally made of

A cast iron. B carbon. C silicon steel.
D stainless steel copper. E iron steel.

(ii) What will be the frequency for a one cycle of an a.c. waveform that occurs in every two milliseconds?

A 1000Hz B 500 Hz C 50Hz
D 100 Hz E 60 Hz

(iii) The total luminous flux required in any lighting scheme is inversely depends on

A illumination. B surface area. C utilization factor.
D space/height ration. E candela.

(iv) Which of the following factors is to be considered when determining the power factor of an alternator?

A Speed B Excitation C Powerful engine
D Prime mover E Load

(v) If two 4 Ω resistors are connected in parallel, the effective resistance of the circuit is:

A 2 Ω. B 4 Ω. C 8 Ω.
D 1 Ω. E 5 Ω.

(vi) The readings from a repulsive moving iron instrument used in A.C. circuits are known as:

A Equivalent d.c. values of currents
B R.M.S. value of a current.
C Peak value of a current.
D Mean value of a current.
E Average value of a current.

(vii) Which of the following is the application of a DC series motor?

A It is suitable for high starting torque.
B Used to control the wide range of speed.
C It is suitable for driving machine tools
D Acceptable where low starting torque is required.
E It is best suited for driving cranes and hoists.

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(viii) Mutual inductance between two magnetically-coupled coils depends on
A permeability of the core.
B the number of their turns.
C cross-sectional area of their common core.
D coupling conductance.
E resistance of coils.

(ix) Most electrical cables are constructed in three parts which are
A insulation, copper and aluminium.
B conductor, insulation and flexible cord.
C conductor, insulation and sheath.
D Inner sheath, outer sheath and protection.
E conductor, insulation and neutral.

(x) Eddy current losses in a transformer-core can be reduced by
A reducing air gap in the magnetic circuit.
B increasing the air gap in the magnetic circuit.
C increasing the thickness of laminations.
D reducing the thickness of laminations.
E reducing the number of turns in the secondary winding.

SECTION B (30 Marks)

Answer **all** questions in this section.

2. List three effects of an electric current.

3. (a) State Lens's law of electromagnetism.
(b) A coil of 500 turns is limited by a flux of 0.4 mWb. If the flux is reversed in 0.01 second, find t e.m.f induced in the coil.

4. (a) Give two advantages of doing modification of a simple primary cell.
(b) Name the instrument used to measure specific gravity of the battery.

5. Give the meaning of the following terms as used in electrical networks:
(a) Branch
(b) Node
(c) Circuit

6. State two laws of illumination.

7. (a) Give the major function of a transformer in electrical system.
(a) List two types of transformer test commonly used in electrical works.

8. Mention three areas where shaded pole motors can be used.

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9. (a) What type of DC generator is suitable for constant voltage applications?
   (b) A 220 V (dc) 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.

10. Convert 212 °F into degree Celsius.

11. Outline three essential requirements in which conductor and insulator should possess.

SECTION C (60 Marks)

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

12. (a) Give three ways on which cells of batteries may be connected. **(03 marks)**

    (b) A primary cell with e.m.f of 2.0 V and internal resistance of 2 Ω is connected to a circuit of 0.7 Ω; Calculate the current in the circuit. **(02 marks)**

    (c) (i) Mention two methods of charging lead acid batteries.
    (ii) Twenty nickel-cadmium cells each of discharge capacity of 50 A for 6 hours are to be charged at constant current for 7 hours. If the supply is 250 V (d c), calculate the value of the variable charging resistance required. Consider 80% ampere hour efficiency of nickel cadnium and back e.m.f of each cell at the beginning and the end of charging to be 1.35 V and 1.7 V respectively. **(15 marks)**

13. (a) Define the following illumination terminologies used in electrical engineering science:
    (i) Luminous flux
    (ii) Luminous intensity **(04 marks)**

    (b) The series connected neon-outline of a sign has a total length of 18 m. The length and diameter per tube is 3 m and 15 mm respectively. If the lumens per watt is 12.5 and the lamp carries a current of 35 mA with a power factor of 0.8; assuming the voltage drop per pair and for 15 mm diameter to be 300 V and 400V respectively, determine:
    (i) the secondary voltage of the step-up transformer
    (ii) its output power in volt-amperes
    (iii) power in watts
    (iv) the total lumens **(16 marks)**

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14. (a) Mention three different types of electrical measuring instruments according to the utility. **(03 marks)**

(b) A moving coil element with resistance of 5 Ω requires a potential difference of 75 mV D.C to give full scale deflection. Calculate:

(i) The shunt resistance which enable the instrument to work as an ammeter giving a full scale deflection of 20 A.

(ii) The series resistance which allow the instrument to work as a voltmeter with a full scale deflection of 240V. **(17 marks)**

15. Three equal impedances each of resistance 25 Ω and reactance 40 Ω are connected in star to a 400 V, 3-phase, 50 Hz system, calculate the:

(a) line current

(b) power factor

(c) power consumed. **(20 marks)**

16. (a) (i) List three methods of transferring heat from one body to another.

(i) For each method you listed in (i), state how the heat is transferred. **(06 marks)**

(b) A storage heater contains 0.1 m^3 of water. The 240 V heating element produces a temperature rise of 85 ^0C in 1½ 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. **(14 marks)**

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