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

082

ELECTRICAL ENGINEERING SCIENCE
(For Both School and Private Candidates)

TIME: 3 Hours *Tuesday November 11, 2003 p.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. Cellular phones are **not** allowed in examination room.
4. Electronic calculators are **not** allowed in examination room.
5. Write your Examination Number on every page of your answer booklet(s).

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) According to the law of electromagnetism, like poles
A attract B attract and repel C repel D intersect
E intersect at 45° angle.

(ii) What is the period of a sinusoidal waveform whose frequency f is 50 Hz?

A $T = 0.02$ s B $T = 0.2$ s C $T = 0.01$ s D $T = 2.0$ s
E $T = 0.22$ s.

(iii) The unit of resistivity of material is

A ohms B ampere-hour C ohm-metre D mega-ohm
E ohms/metre.

(iv) If a 100 W light bulb lights at on an average of 10 hours a day for one week, the weekly consumption of energy will be ..... units

A 7 B 70 C 0.7 D 0.07 E 7.01

(v) On a purely inductive circuit, the current will lag the voltage by an angle of

A 90° B 45° C 120° D 60° E 30°.

(vi) Which of the following connections is best suited for 3-phase, 4 wire service?

A Δ - Δ B Y – Y C Δ - Y D Y - Δ E series-parallel

(vii) The active material in lead acid cells is

A spongy lead B hydrogen gas C calcium carbonate D nitrogen gas
E nickel-cobalt.

(viii) Transformer cores are laminated in order to

A simplify its construction B minimise eddy current C reduce cost
D save core material E reduce hysteryses loss.

(ix) Two heaters rated at 1000 W, 250 V each, are connected in series. 250 V, 50 Hz AC mains is connected across them. The total power drawn from the supply is

A 1000 W B 500 W C 250 W D 2000 W E 1500 W.

(x) Weber is the unit of
A flux density B flux C reluctance D permeability E light intensity.

SECTION B (30 marks)

Answer **ALL** questions in this section

2. A certain wire has a resistance of 50 Ω at 10 °C. Calculate the value of its resistance when the temperature rises to 110°C given that the value of temperature coefficient for the wire is 0.0062 per °C at 0 °C.

3. Two capacitors A and B are connected in series across a 100 V supply and it is observed that the capacitances of A and B are 60 μF and 40 μF respectively. Calculate the potential difference across each capacitor.

4. State any two properties of a good heating element.

5. Calculate the primary current of a 6600/400 V transformer when its secondary current is 200 A.

6. Calculate the total lamp flux required to provide a service value of 100 lux in a room of 7 m x 4 m. The utilization and maintenance factors are respectively 0.6 and 0.8.

7. State three parameters which determine the resistance of a conductor.

8. A moving coil instrument which has a resistance of 10 Ω gives a full-scale deflection with 10 mA. Calculate the resistance required in parallel to enable the instrument to read up to 2 A.

9. State two basic methods of battery charging.

10. Determine the magnetizing force of a coil of 90 turns carrying a current of 5 A on a 0.15 m long magnetic circuit.

11. Calculate the synchronous speed of a two pole machine supplied with 220 V, 50 Hz.

SECTION C (60 marks)

Answer **THREE (3)** questions from this section

12. The primary winding of a single phase transformer is connected to a 230 V, 50 Hz supply. The secondary winding has 1600 turns. If the maximum value of flux is 2 mWb, determine

    (a) the number of turns in the primary winding

    (b) the secondary induced e.m.f.

    (c) the cross sectional area of core if the flux density is 0.5 Tesla.

13. (a) Explain the effect of armature reaction on the flux distribution of the DC machine.

    (b) An eight pole lap connected armature has 96 slots with 6 conductors per slot and is driven at 600 rev/min. The useful flux per pole is 0.09 Wb. Calculate the generated e.m.f.

14. (a) Write the expression for resonance frequency in a circuit consisting of R, L and C in series.

(b) A 15 Ω non-reactive resistor is connected in series with a coil of inductance 0.08 H and negligible resistance. The combined circuit is connected to a 240 V, 50 Hz supply. Calculate

(i) the reactance of the coil

(ii) the impedance of the circuit

(iii) the current in the circuit

(iv) the power factor of the circuit.

15. (a) Write down Kirchhoff's laws.

(b) Two batteries are connected in parallel. The e.m.f. and internal resistance of one battery are 120 V and 10 Ω respectively and the corresponding values for the other are 150 V and 20 Ω. A resistor of 50 Ω is connected across the battery terminals. Calculate

(i) the current through the 50 Ω resistor

(ii) the value and direction of the current through the battery.

Use Kirchhoff's Laws.

16. (a) Define (i) rectifier, (ii) inverter, (iii) generator.

(b) Draw the circuit for a full wave single phase bridge rectifier. If a resistive load is connected in that circuit, draw the input and output voltage and current wave forms for two periods.