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 **2006/10/17 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. 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).

CS_06

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) The unit used to measure an absolute temperature is

A kg/°C
B tesla
C candela
D kelvin
E N/m^{-1}

(ii) The ripples of a radio can be smoothed by using the following component:

A Transistor
B Capacitor
C Tyristor
D Diode
E Resistor.

(iii) Resonance frequency in a series circuit can appear when

A $X_L < X_C$
B $X_C < X_L$
C $X_L^2 > X_C$
D $X_C^2 > X_L$
E $X_L = X_C$

(iv) The current flowing through a no load ac circuit is

A maximum
B 240 A
C 0 A
D half of the maximum current flow
E 220 A.

(v) A circuit connected to a resistor only without capacitor and an inductor is known as pure resistive circuit. The current flowing through it is

A in phase with voltage
B leading
C out of the phase with voltage
D maximum power with voltage
E 90 ° with voltage.

(vi) The maximum voltage in a parallel circuit can be measured by a voltmeter connected

A in series with the load
B across the supply
C in parallel-series with the load
D in series-parallel with load
E there is no answer.

(vii) The expression used to find phase current in three phase star-connected circuit is

A $I_P = I_L$

B $I_P = \frac{\sqrt{3}}{I_L}$

C $I_P = \frac{I_L}{\sqrt{3}}$

D $I_P = \sqrt{3}\, I_L$

E $I_P = VI\ p.f$

(viii) Which of the following is the correct statement?

A A generator is a machine which converts electric energy into mechanical power
B A generator is a machine which converts energy to power
C A generator is a machine which converts current to voltage
D A generator is a machine which converts electromotive force to voltage
E A generator is a machine which converts mechanical power to electrical power.

(ix) The copper loss of a transformer can be obtained by

A $\frac{V^2}{R}$

B VI

C $VI \cos \phi$

D I^2R

E R^2I

(x) The rate of doing work in a straight line is given by

A FV
B FL
C Ft
D wt
E S/J

SECTION B (30 marks)

Answer **all** questions in this section.

2. Mention **three (3)** common sources of electricity used in Tanzania.

3. Give the main types of ac generators.

4. A simple Leclanché cell consists of four components. Mention three of them.

5. Write down **two (2)** units of electric current.

6. Mention **three (3)** effects of electric current.

7. What are the three types of single phase motors?

8. Calculate the illumination on a working plane at a point 8.7 m vertically below a lamp emitting 350 candela. The surface is at right angle to the light source.

9. Define an armature reaction of a dc machine.

10. A three phase star-connected system has 400 V between wires. Estimate the voltage in each conductor.

11. Write down the functions of the following machines:

(a) Motor

(b) Alternator

(c) Transformer.

SECTION C (60 marks)

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

12. An ac system supplies maximum voltage of 225 volts at the terminals of the load when it is not connected.

(a) Calculate the peak to peak voltage of the system.

(b) Calculate the mean value due to the following ordinates:

0.13, 0.383, 0.609, 0.793, 0.924 and 0.991.

(c) Find the root mean square value of the ordinates in 12.(b).

(d) Determine the instantaneous voltage of an ac system whose equation is $V = 10 \sin 349.8\, t$ where t is 0.02 second.

13. Draw a well labelled diagram of a moving coil instrument and explain its principle of operation.

14. (a) Name the function of the following parts of dc machines:

(i) Commutator

(ii) Poles

(iii) Armature.

(b) State with the aid of circuit diagrams, the difference between series, shunt and compound generators.

15. A three phase 415 V, 4 poles, 60 Hz induction motor develops a total torque of 150 Nm. If the frequency of the rotor is 2 Hz, calculate

(a) the slip and rotor speed

(b) the rotor copper loss.

16. A consumer requires an immersion heater for a tank containing 200 litres of water. The water is to be heated from 10 °C to 70 °C in 4 hours. Calculate the nearest element size in kW if the efficiency of the heating system is 80 %. Take specific heat capacity of water to be 4200 J/kgK.