Candidate's Examination No.....

THE UNITED REPUBLIC OF TANZANIA
MINISTRY OF EDUCATION AND VOCATIONAL TRAINING
FORM TWO SECONDARY EDUCATION EXAMINATION, 2009

0084 **ELECTRICAL ENGINEERING**

TIME: 2½ HOURS

INSTRUCTIONS

1. This paper consists of sections A and B.
2. Attempt **ALL** questions in section A. In section B answer **ALL** questions from the area of your specialisation.
3. **ALL** answers should be written in the spaces provided.
4. **ALL** writing must be in blue or black ink **EXCEPT** drawings which must be in pencil.
5. Write your examination number at the top right hand corner of every page.
6. Cellphones and calculators are not allowed in the examination room.

FOR EXAMINER'S USE ONLY		
QUESTION NUMBER	SCORE	INITIALS OF EXAMINER
1		
2		
3		
4		
5		
6		
7		
8		
TOTAL		

This paper consists of 13 printed pages.

Candidate's Examination No. .....

SECTION A

GENERAL (60 MARKS)

1. Choose the correct answer and write its corresponding letter in the box provided.

(i) The first step to assist a shocked person is to:
A. call an ambulance
B. give the victim cold water
C. give the victim a mouth to mouth resuscitation
D. remove the victim from accident place by hand.

(ii) The electrician's head is protected from falling objects by using:
A. a cap
B. a protective mask
C. a safety helmet
D. safety goggles.

(iii) The SI unit of electromotive force is:
A. coulomb
B. farad
C. joule
D. volt.

(iv) The central part of an atom consists of:
A. ions and electrons
B. electrons and protons
C. neutrons and electrons
D. protons and neutrons.

(v) The colour of a live wire in a 3-wire cable is:
A. black
B. blue
C. orange
D. red.

(vi) The purpose of a transformer is to:
A. change magnetic field
B. change the voltage
C. convert a.c to d.c
D. generate electrical power.

(vii) When two bodies of like charges are brought close to each other:
A. there will be no reaction
B. the bodies will attract each other
C. the bodies will be discharged
D. the bodies will repel each other.

(viii) Two resistors each having resistance of 2 Ω can be connected in series or in parallel. What is the difference in terms of equivalent resistance between connections which are in series and in parallel?
A. 1 Ω
B. 3 Ω
C. 4 Ω
D. 5 Ω

(ix) Which of the following is the best fuse for an electric cooker rated 240 V, 4.5 kW?
A. 1.8 A
B. 5.3 A
C. 18.5 A
D. 53.3 A

(x) When the cross-section area of an electric conductor is increased, its resistance will:
A. be negligible
B. decrease
C. increase
D. remain the same.

2. (a) (i) Define a cell.

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(ii) Mention three differences between a cell and a battery.

	Cell	Battery
(1)		
(2)		
(3)		

(iii) A primary cell with an e.m.f of 1.4 V and internal resistance of 0.1 Ω is connected to a circuit of resistance 0.4 Ω. Calculate the current in the circuit.

$E = N\left(\frac{\Delta\Phi}{t}\right)$

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(b) (i) Define a magnet.

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(ii) Name two types of magnet.

(1) .....

(2) .....

(iii) Calculate the rate of change of flux which is required to induce an e.m.f. of 20 kV in an ignition coil consisting of 1200 turns.

$e.m.f = N \times \frac{\Delta\Phi}{t}$

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(c) (i) List down three important features of a current measuring instrument.

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(1) .....

(2) .....

(3) .....

(ii) Electric current produces chemical, magnetic and heating effects. Give two examples which are found in our daily life for each of the above cases.

Chemical effects:

(1) .....

(2) .....

Magnetic effects:

(1) .....

(2) .....

Heating effects:

(1) .....

(2).....

(iii) Briefly describe the construction of a moving coil instrument.

(d) (i) Calculate the minimum allowable cross-section area of a PVC copper cable which will supply a 240 V distribution fuse board,50 m from the supply point if the total load is 50 A. Take resistivity of copper to be 1.7 μΩcm.

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(ii) A heating element can boil 16 litres of water from 10 °C to 70 °C in 2 hours. Find its rating if its working efficiency is 60%. Assume the specific heat capacity of water is 4187 J/kg °C.

Data given
$\theta_1 = 10°C$
$\theta_2 = 70°C$
time = 2 hrs
$\eta = 60\%$
SHC = 4200 J/kg °C
16 litres.

(iii) What is the cost of using an electric iron rated 240 V, 2000 W for 10 hours if the cost of electric energy given by TANESCO is 150/= per unit (1 unit ≈ 1 kWh).

Data given
Voltage = 240 V
Power = 2000W
time = 10 hrs
150 per unit
1 unit = 1kWh

SECTION B

ELECTRICAL INSTALLATION (40 MARKS)

3. (a) State the use of each of the following tools:

(i) Combination plier

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(ii) Side cutter

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(iii) Screw driver

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(iv) Hacksaw

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(b) Sketch a symbol for each of the following accessories

(i) Electric buzzer (iv) Fuse

(ii) One way three gang switch (v) Twin fluorescent

(iii) Main switch

4. (a) (i) Define the term "earth lead".

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(ii) Name one application of an Earth Leakage Circuit Breaker (ELCB).

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(b) (i) What is the use of sheaths in a sheathed wiring system?

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(ii) Briefly explain how catenary wiring is done in residential area.

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5. (a) (i) Give the differences between a conduit and a trunk.

	Conduit	Trunk
(1)	....	....
(2)	....	....
(3)	....	....

(ii) Briefly explain the operation of a bimetallic strip.

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(b) (i) Design a circuit which can operate two lamps independently.

(ii) The resistance of a coil at 20 °C was 20 Ω. What current will it draw from a 10 V supply when operating in a cold room at 0 °C? ($\propto$ = 0.0043/°C).

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Candidate's Examination No. .....

ELECTRONICS, RADIO REPAIR AND TELEVISION SERVICING
(40 MARKS)

6. (a) (i) What is a "heat sink"?

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(ii) What is the importance of using a heat sink?

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(b) Sketch a neat symbol for each of the following:

(i) Photodiode

(ii) Light dependent resistor

(iii) Electrolytic capacitor

(iv) Temperature dependent resistor

7. (a) (i) A certain resistor is identified by its colour code as follows: RED, RED, BLACK, GOLD. What is a working range of the resistor?

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(ii) Write down the actual value of each resistor shown below if F = ±1%, G = ± 2%, J = ± 5%, K = ± 5% and M = ± 20% are tolerances to the resistors.

R33M .....

4R7K .....

6K8F .....

6K8G .....

6K8J .....

(b) (i) Sketch the three transistor configurations:

(1) Common Emitter

(2) Common Base

(3) Common Collector

(ii) Draw a transistor amplifier in CE mode with coupling and decoupling component included.

Candidate's Examination No. .....

8. (a) (i) What type of flux is used in soldering?

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(ii) List two tools used in soldering:

(1).....

(2).....

(iii) Name five materials used in soldering:

(1).....

(2).....

(3).....

(4).....

(5).....

(b) (i) What is a resonance frequency?

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(ii) Calculate the resonance frequency when 2 mH inductor and 80 pF capacitor are connected in series. Use f = 50 Hz.

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$f_r = \frac{1}{2\pi\sqrt{LC}}$

$Z = \sqrt{R^2 + (X_c - X_L)^2}$

$X_L = (2\pi f L)\ \Omega$

$X_c > X_L$

$X_c = \frac{1}{2\pi f C}$

$Z = \sqrt{R^2 + (X_L - X_c)^2}$

$2\pi f L = \frac{1}{2\pi f C}$

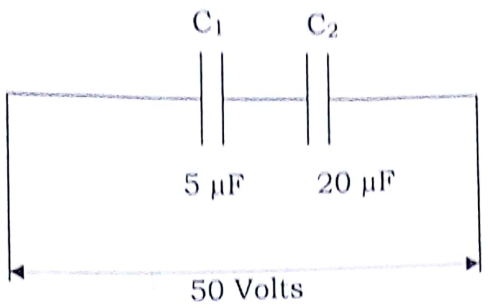
$1 = \frac{2\pi f L \times 2\pi f C}{(2\pi)^2 f_r^2 LC}$

$\frac{1}{2\pi^2 f_r^2} = \frac{(2\pi)^2 f_r^2 LC}{(2\pi)^2 f_r^2 LC}$

$\sqrt{\frac{1}{(2\pi)^2 LC}} = \sqrt{f_r^2}$

$f_r = \frac{1}{(2\pi)^{1/2}}$

(iii) From the circuit shown below, calculate the charge on capacitor C_1 and C_2.



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