Name………………………………………..ADM No……………. Class………………..

**448/1**

**ELECTRICITY**

**MARKING SCHEME**

**Paper 1**

**(THEORY)**

**AUGUST-SEPTEMBER 2022**

**Time: 2 ½ hours**

**MECS CLUSTER JOINT EXAMINATION**

**FORM FOUR END YEAR EXAMINATION 2022**

**ELECTRICITY**

**INSTRUCTIONS TO CANDIDATES**

1. *Write your name, admission number and class in the spaces provided*
2. *Each candidate should have the following:*

* *Drawing paper,****A4***
* *Drawing instruments*
* *Electronic calculator*

*3. This paper has two sections;* ***A*** *and* ***B***

*4. Answer* ***ALL*** *the questions in section* ***A*** *and* ***ANY FOUR*** *in section* ***B***

*5. All measurements are in millimeters unless it is stated otherwise .*

*This paper consists of* ***11*** *printed pages, a certain that all pages are printed and no questions are missing*

**SECTION A** (48marks)

*Answer all the questions in this section in the spaces provided*

1. (a) List **four** insulating materials used in electrical installations. (2 marks)

***-PVC***

***-bakelite***

***-Polychloroprene***

***-rubber***

(b) State **two** advantages of PVC sheathed cables over tough rubber sheathed. (2 marks)

***It is the cheapest system***

***It is easy and quick to install***

***P.v.c. is impervious to many chemicals and free from ageing***

1. (a) State Lenz’s law of electromagnetic induction. (2 marks)

***The direction of induced emf is such that itopposes the change that causes it***

(b) Name **four** applications of electromagnets. (2 marks)

***DC machines***

***AC machines***

***Measuring instruments***

***Moving coil loud-speaker***

1. (a) Name **four** National Polytechnics in Kenya. (2 marks)

***Eldoret, kabete, Kisumu, Meru, Nyeri***

(b) List **two** business opportunities in the field of electricity. (1 mark)

***Electrical/ Electronics parts seller***

***Electronics repair shop***

***Electronics waste disposal***

***Cyber café shop***

1. (a) State how each of the following electrical material waste should be disposed safely:
2. Burnt fluorescent tubes; (½ mark)

***Take to hazardous waste collection centre***

1. Damaged computers. (½ mark)

***Donated to community as second or third grade computers***

(b) State the application of each of the following types of extinguishers:

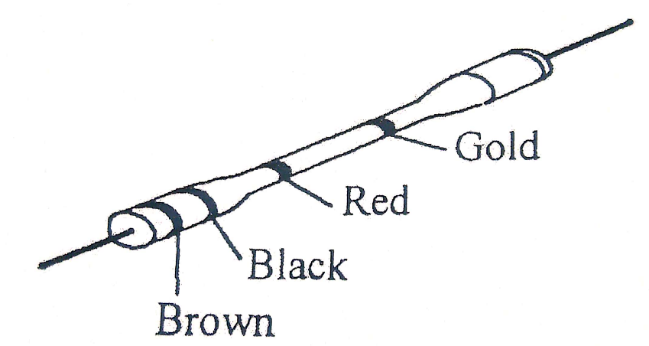
1. Carbon dioxide; (1 mark)

***Extinguish electric fires***

1. Water.

***Extinguish solid fuel and fluid fuel fires*** (1 mark)

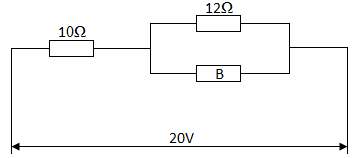
1. (a) **Figure 1** shows a carbon resistor with color codes. Determine the value of the resistor given, (2 marks)

****

**1 0 x 102 ±5%**

**1KΩ**

1. **Figure 2** shows a resistive circuit.

****

Determine the:

1. Value of the resistor **B** if the total circuit resistance is 20Ω; (4 marks)

***2B=120***

***B=60Ω***

1. Total circuit current. (2 marks)

***I=***

1. (a) Name **four** parts of a fluorescent fitting. (2 marks)

***Starter***

***Electrodes***

***Tube***

***choke***

1. List four marking out tools used in fabricating sheet metal casing. (2 marks)

***Scriber***

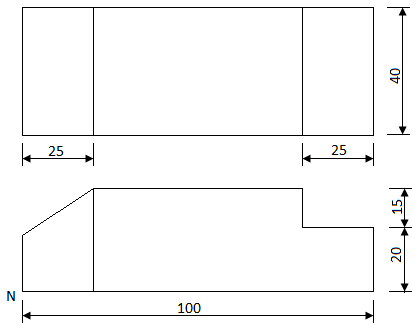
***Steel rule***

***dividers***

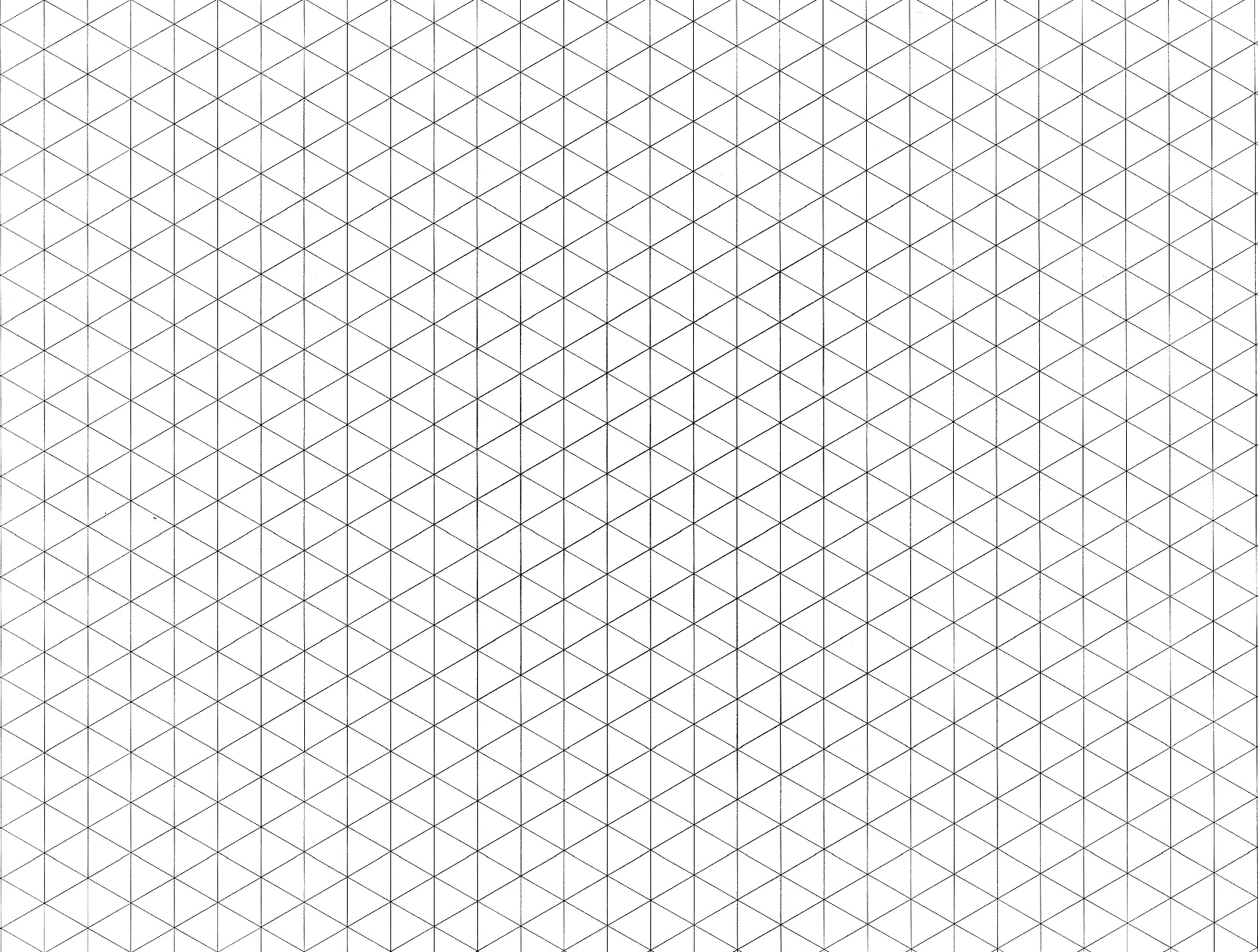
***try square***

***centre punch***

1. (a) **Figure 3** shows two views of an object drawn in third angle projection.



On the grid provided, make a free hand isometric sketch with corner N as the lowest point. (3 marks)



(b) Outline **two** ways that can be used to troubleshoot a faulty television. (2 marks)

***Test working of fuse plug***

***Test capacitor at the input***

1. (a) With the aid of sketches, distinguish between P-N-P and an N-P-N transistor. (3 marks)

(b) **Name four** applications of a P-N junction diode. (2 marks)

***Power rectification***

***In smoothing circuits***

***In photo diodes***

***In light emitting diodes***

***In zener diodes***

1. (a) State three advantages of digital instruments over analogue instruments. (3 marks)

***Easy to read***

***More accurate***

***Less expensive***

(b) An ideal transformer connected to a 240V mains supplies a 12V, 120W lamp. Calculate the:

1. Transformer’s turns ratio; (3 marks)

1. Current taken from the supply. (3 marks)

(c) With the aid of diagram describe *'armature reaction'* in **d.c** motors (3mks)

***This is the distortion and weakening of the main magnetic field in a dc machine due the field’s reaction with the armature’s magnetic flux.***

Normal axis

Shifted Neutral axis

Direction of rotation

N

S

**SECTION B** (*52 marks*)

*Answer any four questions in the spaces provided.*

1. (a) (i) Convert 2310 to binary. (2 marks)

***1112***

(ii) Convert 110112 to decimal. (2 marks)

***2710***

(b) state seven types of logic gate;

(4 marks)

***NOT gate, OR gate ,AND gate,NOR gate, the NAND gate, the XOR gate and the XNOR gate***.

(ii) Draw a truth table for the; NAND. (4 marks)

|  |  |  |
| --- | --- | --- |
| *A* | *B* | *F* |
| *0*  *0*  *1*  *1* | *0*  *1*  *0*  *1* | *1*  *1*  *1*  *0* |

(c) Name two applications of logic gates. (1 mark) ***In burglar alarms***

***As switches***

***For computation analysis in circuits***

1. (a) Draw a sine wave and indicate the following:
2. Peak value; (5 marks)
3. Instantaneous value;
4. Cycle.

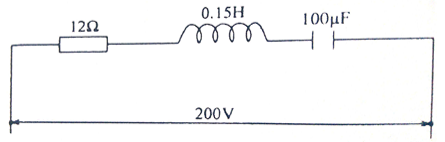
Alternation

Vpp

Vm

Cycle

(b) **Figure 4** shows an RLC circuit. The frequency is 50Hz



Calculate the:

1. Inductive reactance; (2 marks)

**Ω**

.

1. Capacitive reactance; (2 marks)
2. Circuit impedance; (2 marks)

1. Circuit current. (2 marks)

I=

1. (a) State;
2. **Two** advantages of a moving coil instrument. (2 marks)

***It is shielded from magnetic fields***

***Inexpensive compared to moving iron meters***

***Have uniforn scale***

1. **Two** essential features of an analogue instrument. (2 marks)

***Controlling feature***

***Damping feature***

***Deflecting feature***

(b) With the aid of a labelled diagram, explain the Flemmings right hand rule to demonstrate the direction of induced EMF. (6 marks)

**N**

**S**

Coil on former

Battery

I

Magnetic

Flux

(c) show that for two capacitors C1 and C2 connected in series, the total capacitance is given by:

(3 marks)

1. (a) State:
2. **Two** advantages of trunking over steel conduit wiring systems. (2 marks)

***cables are laid in rather than pulled in.***

***can take large number of cables***

1. **Two** advantages of MCBs over rewirable fuses. (2 marks)

***Can be reset after rectifying fault***

***Faulty circuit is indicated by MCB***

***Can be used as a switch***

(b) (i) Draw and label a diagram of a switch start fluorescent fitting. (6 marks)

Fluorescent coating

Iron cored inductor

A.C. supply

Glass tube containing low-pressure mercury vapour and argon gas

Oxide coated lamp electrode

Fluorescent coating

P.f. Correction capacitor

Glow starter with R.I.S. capacitor

L

N

(ii) Outline **three** tests carried out in a completed electrical installation. (3 marks)

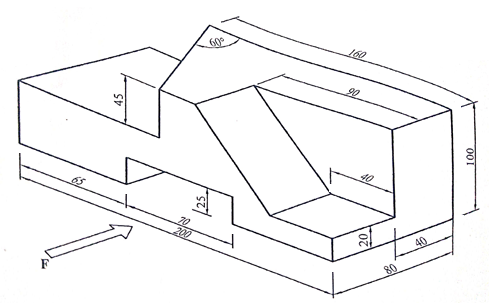
***Earthing tests***

***Ring circuit continuity test***

***Insulation resistance tests***

***Verification of polarity tests***

1. **Figure 5** shows a machine block drawing of an isometric projection.



Draw the following views in **full size** in first angle projection:

1. Front elevation in the direction of arrow **F**:
2. Plan;
3. Indicate **six** dimensions. (13 marks)

***Solution-3mks mks***

***Accuracy-3mks***

***Neatness-2mks***

***Dimensions-4mks***

***Borderline-1mk***

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