SIR ARTHUR LEWIS COMMUNITY COLLEGE

ENGINEERING AND THE CIRCULAR ECONOMY

ACADEMIC YEAR (2024/2025) – SEMESTER ONE

END OF SEMESTER EXAMINATION

TUTOR (S)	**:**	**Mr. Arnaldo Sanchez Rojo**
PROGRAMME TITLE	**:**	**Electrical Installation**
COURSE TITLE	**:**	**Principles and Technology I**
COURSE CODE	**:**	**ELE121**
LEVEL	**:**	**Associate Degree/Year Two**
PAPER	**:**	**One (1)**
DATE	**:**	**Friday, 20th December 2024**
COMMENCEMENT TIME	**:**	**1:00p.m.**
DURATION	**:**	**2 Hours**
INVIGILATOR(S)	**:**	**H. Scott (Chief), T. Saiwak-William, D. Boulogne, V. Gustave-Lorde, D. Jn Baptiste**
ROOM(S)	**:**	**CEH-1R-02**
STUDENT ID	**:**	

GENERAL INFORMATION AND INSTRUCTIONS

- This paper consists of **Three (3)** Sections (**A, B and C**). You are required to answer **ALL** questions. **Sections A and B must be answered on the question paper**. **Section C must be answered on the foolscap provided.**
- **Section A** consist of Thirty-three (33) Multiple Choice Questions. **One mark is awarded for each correct answer. (33 marks)**
- **Section B** consist of ten (10) fill in the blanks. **(Mark 10 marks**
- **Section C** consist of Three (3) questions. 15 marks are awarded for each question. **(45 marks)**
- **Calculators are needed.**
- Students must sign **IN** and **OUT** on the examination class list.
- Students must **not** write their names on their answer sheets, only their ID number
- **Note: Bags, Books as well as writing paper not given by the invigilator should be deposited at the front of the examination room or as otherwise indicated.**
- **All cell phones must be turned off during the exam**

DO NOT TURN THIS COVER SHEET UNTIL YOU ARE TOLD TO DO SO!!

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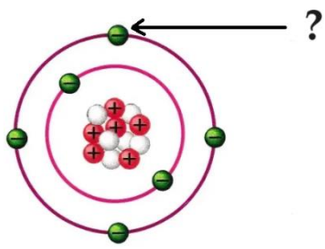
SECTION A - Multiple Choice Questions

Choose the most appropriate answer.

(One mark is awarded for each correct answer.)

1. The following figure shows the structure of an atom; which part of the atom is being pointed out?



(A) Protons

(B) Electrons

(C) Neutron

(D) Nucleolus

2. An atom becomes an ion when:

(A) It gains one or more electrons.

(B) It loses one or more electrons.

(C) It gains or loses one or more electrons.

(D) None of the above

3. Which of the following is the formula of ohms' law?

(A) V =I / R

(B) R = V / I

(C) I =V + R

(D) All the above

4. In Ohm's Law _____ is indirectly proportional to resistance?

(A) Voltage

(B) Current

(C) Inductance

(D) All the above

5. The following symbol represents:

(A) A magnet

(B) A capacitor

(C) An Inductor

(D) A resistor

6. The electric potential difference per unit charge between two points in an electric field is:

(A) Current

(B) Voltage

(C) Resistance

(D) Power

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7. The intensity of the current is measured in:
   (A) Ohms (Ω)
   (B) Volts (V)
   (C) Amperes (A)
   (D) Watts (W)

8. The measure of the opposition to current flow in an electrical circuit is:
   (A) AC Current
   (B) Resistance
   (C) Voltage
   (D) Resistivity

9. The electrical current, in which the direction of the flow of electrons switches back and forth at regular intervals or cycles is:
   (A) DC Current
   (B) AC Current
   (C) Pulsating current
   (D) Eddy Current

10. What is the property of the material itself that describes the extent to which a material opposes the flow of electric current through it?
   (A) Voltage
   (B) Resistance
   (C) Current
   (D) Resistivity

11. Materials that present high resistance and restrict the flow of electrons are:
   (A) Insulator
   (B) Conductors
   (C) Semiconductors
   (D) All the above

12. Witch of this material is NOT a conductor?
   (A) Copper
   (B) Glass
   (C) Aluminum
   (D) Silver

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13. A potential difference of 220 V is applied across a conductor whose resistance is 50 ohms. What is the value of current flowing through it?
    (A) 0.23 A
    (B) 4.40 A
    (C) 220 A
    (D) 11.0 kA

14. An electrical bulb draws 1.5 A current when connected to a 230 V wall outlet, the resistance of bulb is:
    (A) 20.8 Ω
    (B) 50.4 Ω
    (C) 153.3 Ω
    (D) 345 Ω

15. What is the voltage source for a circuit carrying 0.5 A of current through a 9 Ω resistor?
    (A) 1.8 V
    (B) 18 V
    (C) 7 V
    (D) 4.5 V

16. A flashlight bulb consumes 250 mA and is powered by a 9 V battery. What is the power of the flashlight?
    (A) 2.25 W
    (B) 27.78 W
    (C) 36 W
    (D) 2250 W

17. An incandescent light bulb consumes 0.6 A and has a resistance of 250 ohms. How much energy (in kWh) does it consume if it stays on for 3 full days?
    (A) 6480 kWh
    (B) 10.8 kWh
    (C) 6.48 kWh
    (D) 0.104 kWh

18. A tungsten wire has a 10 Ω resistance at 20^{o}C. Find its resistance at 150^{o}C if $\alpha = 0.005$ Ω/oC.
    (A) 8.3 Ω
    (B) 16.5 Ω
    (C) 25.8 Ω
    (D) 33.5 Ω

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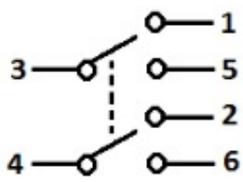
19. What process by which electric current is passed through a substance to effect a chemical change?
    (A) photosynthesis
    (B) electrolysis
    (C) fusion
    (D) evaporation

20. We can label cables using:
    (A) Numbers
    (B) Letters
    (C) Colors
    (D) All the above

21. Which of these is **NOT** an electrical joint?
    (A) The Western Union splice
    (B) The tap splice
    (C) The P splice
    (D) The fixture splice.

22. Which of these is a device to joint electrical wires?
    (A) wire nuts
    (B) screw terminals
    (C) crimp connectors.
    (D) All the above

23. Qualify this switch according to the number of poles and throw.
    (A) SPST
    (B) SPDT
    (C) DPST
    (D) DPDT



24. Which of these factors does not affect the effect of current flow when an electric shock occurs?
    (A) Type of current (AC or DC),
    (B) Path of the current
    (C) Condition of the body (Dry, Wet)
    (D) Time at which the electrical shock occurs (morning, afternoon, evening)

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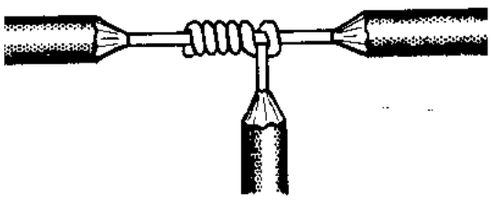
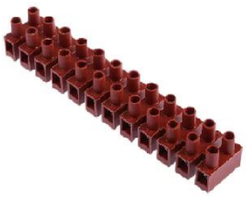
25. Lighting circuits are usually wired with:
    (A) 1.0 mm2
    (B) 1.5 mm2
    (C) 2.5 mm2
    (D) 4.0 mm2

26. Identify type of splice
    (A) The Western Union splice
    (B) The tap splice
    (C) The P splice
    (D) The fixture splice.



27. Identify type of joints
    (A) wire nuts
    (B) screw terminals
    (C) crimp connectors.
    (D) Magnetic connection



28. Which of these is a wiring system?
    (A) Shathed or Clipped
    (B) Conduits
    (C) Ducts
    (D) All the above

29. Identify type of switch
    (A) Lighting switch
    (B) Switches for water heaters
    (C) pull cord
    (D) Dimmer switch

30. Identify type of lamp base
    (A) Bayonet cap
    (B) Edison Screw
    (C) Batten
    (D) None of the above

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31. What type of Socket-Outlet & Plug we use in Saint Lucia?
    (A) Type A
    (B) Type G
    (C) Type I
    (D) Type L

32. The breaker is classified according to their behavior curves, which of these should be used to protect the circuit that supply a motor?
    (A) Type B
    (B) Type C
    (C) Type D
    (D) Type M

33. What size fuse should I use to protect a lighting circuit in my vehicle if my lights draw 8 A?
    (A) 8 A
    (B) 10 A
    (C) 12 A
    (D) 15 A

[**TOTAL 33 MARKS]**

SECTION B - Fill in the Blanks

Choose the most appropriate answer from the list below.

- RCD
- Resistance
- Circuit Breaker
- RCBO
- Fuse
- Switch
- Electrical fire
- Electric shock
- AC Current
- Voltage

1. _____ it is a measure of the opposition to current flow in an electrical circuit.

2. _____ it is a type of electrical current, in which the direction of the flow of electrons switch back and forth at regular intervals or cycles.

3. _____ is defined as the electrical potential per unit charge between two points in an electrical circuit r electric field.

4. _____ is a combination of a thermal-magnetic circuit breaker and an RCD that enable both overcurrent protection and earth fault protection to be provided in a single unit for individual circuits, usually but not exclusively in domestic installations.

5. _____ is simply a device that carries a metal element, usually tinned copper, which will melt and break the circuit when excessive current flows.

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6. _____ is a device that operates by opening a switch when the current rises above a certain level. These are modern alternatives to fuses.

7. Protection against overcurrent cannot be provided by a _____.

8. _____ is a device used for changing the course or flow of current in an electrical circuit.

9. _____ occurs when a person comes into contact with an electrical energy source.

10. _____ is a broad term that applies to a fire that was caused by an electrical problem.

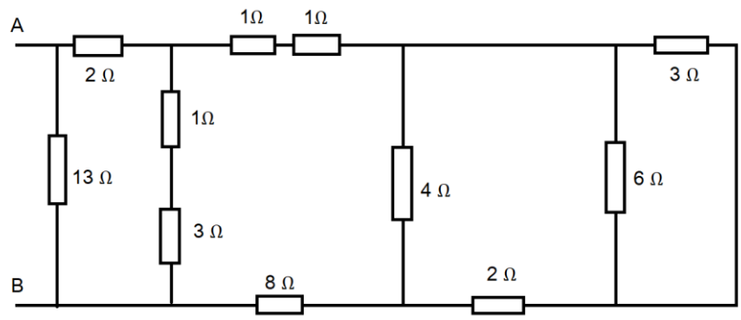
[TOTAL 10 MARKS]

SECTION C - Long Answer Questions

You are required to answer **all** questions on the foolscap provided.

Question One

Find the equivalent resistance between A and B in the following circuit.



Question Two

What's the resistance of a copper wire that is 300 m long and has the diameter of 2.05 mm?

NOTE: resistivity of copper = 1.72×10^{-8} **Ω** m

Question Three

The following cables are to be drawn into a straight 5 m length of conduit with three bends:

- 5 off solid core 1.5 mm2
- 4 off standard 2.5 mm2
- 4 off standard 4.0 mm2

Calculate the conduit size required to accommodate these cables.

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▼ **Table E1** Cable factors for use in conduit in short straight runs

Type of conductor	Conductor cross-sectional area (mm^2)	Cable factor
Solid	1	22
	1.5	27
	2.5	39
Stranded	1.5	31
	2.5	43
	4	58
	6	88
	10	146
	16	202
	25	385

▼ **Table E2** Conduit factors for use in short straight runs

Conduit diameter (mm)	Conduit factor
16	290
20	460
25	800
32	1400
38	1900
50	3500
63	5600

▼ **Table E3** Cable factors for use in conduit in long straight runs over 3 m, or runs of any length incorporating bends

Type of conductor	Conductor cross-sectional area (mm^2)	Cable factor
Solid or Stranded	1	16
	1.5	22
	2.5	30
	4	43
	6	58
	10	105
	16	145
	25	217

The inner radius of a conduit bend should be not less than 2.5 times the outside diameter of the conduit.

▼ **Table E4** Conduit factors for runs incorporating bends and long straight runs

Length of run (m)	Conduit diameter (mm)																			
	16	20	25	32	16	20	25	32	16	20	25	32	16	20	25	32	16	20	25	32
	Straight				One Bend				Two Bends								Four Bends			
1	Covered by Tables E1 and E2				188	303	543	947	177	286	514	900	158	256	463	818	130	213	388	692
1.5					182	294	528	923	167	270	487	857	143	233	422	750	111	182	333	600
2					177	286	514	900	158	256	463	818	130	213	388	692	97	159	292	529
2.5					171	278	500	878	150	244	442	783	120	196	358	643	86	141	260	474
3					167	270	487	857	143	233	422	750	111	182	333	600				
3.5	179	290	521	911	162	263	475	837	136	222	404	720	103	169	311	563				
4	177	286	514	900	158	256	463	818	130	213	388	692	97	159	292	529				
4.5	174	282	507	889	154	250	452	800	125	204	373	667	91	149	275	500				
5	171	278	500	878	150	244	442	783	120	196	358	643	86	141	260	474				
6	167	270	487	857	143	233	422	750	111	182	333	600								
7	162	263	475	837	136	222	404	720	103	169	311	563								
8	158	256	463	818	130	213	388	692	97	159	292	529								
9	154	250	452	800	125	204	373	667	91	149	275	500								
10	150	244	442	783	120	196	358	643	86	141	260	474								

[TOTAL 45 MARKS]