THE UNINTED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION AND CULTURE

FORM TWO SECONDARY EDUCATION EXAMINATION, 1992

0081 ELECTRICAL INSTALLATION

Time: 2:30 Hours **ANSWERS** **.**

Instructios:

1. this paper consists of sections A, B and C with total of eleven questions
2. answer all questions in section A and B, and one question in section C.
3. All answers must be written in spaces provided.

1. To measure electrical power you should use:
A. a kilowatt-hour meter
B. an ammeter
C. a voltmeter
D. a wattmeter
Answer: D. a wattmeter
Explanation: A wattmeter is a device specifically designed to measure the rate at which electrical energy is used in a circuit. It directly measures the power (in watts) consumed or generated in a system.

2. A fuse is used in a circuit to:
A. make an easy connection
B. allow the current to flow freely
C. protect the circuit from excessive current
D. act as a switch
Answer: C. protect the circuit from excessive current
Explanation: A fuse is a safety device that protects electrical circuits by melting and breaking the circuit when the current exceeds a certain threshold, preventing damage to appliances or wiring.

3. A filament lamp is rated 15W, and the current passing through the lamp is 0.5A. The voltage drop across the lamp is:
A. 50V
B. 75V
C. 20V
D. 30V
Answer: A. 50V
Explanation: Using the power formula, $P = V \times I$, we can calculate voltage as $V = P / I$.
$V = 15W / 0.5A = 50V$. The voltage drop across the lamp is therefore 50V.

4. To forward bias a p-n junction, the negative terminal of the supply is connected to:
A. n-type material
B. p-type material
C. p-n type material
D. n-p type material
Answer: B. p-type material
Explanation: In a forward-biased p-n junction, the negative terminal is connected to the p-type material and the positive terminal to the n-type material. This reduces the potential barrier, allowing current to flow.

5. The opposition to current flow which an inductor gives in an AC circuit is called:
A. capacitance
B. resistance
C. inductive reactance
D. impedance

Answer: C. inductive reactance
Explanation: Inductive reactance is the opposition offered by an inductor to the flow of alternating current. It depends on the frequency of the AC signal and the inductance of the inductor.

6. Electric bells are devices which work on the principle of electromagnetism.
When current flows through the coil of an electric bell, it creates a magnetic field that attracts a metal hammer to strike the bell, producing sound.

7. The point of connection of the consumer's conductors to the supply authority meter is called the service connection point.
- This is the point where the utility's distribution system connects to the consumer's wiring, allowing for energy metering and supply.

8. A saddle is a fitting used on conduit systems to secure and support conduits in place.
- Saddles prevent conduits from moving or becoming loose, ensuring the wiring system remains stable and properly aligned.

9. For proper operation of a transistor, forward-bias the emitter-base junction and reverse-bias the collector-base junction.
- This biasing ensures that the transistor operates in the active region, allowing it to amplify signals.

10. What is the equivalent capacitance of two 2000μF capacitors connected in parallel?
Answer: For capacitors in parallel, Ctotal = C1 + C2.
Ctotal = 2000μF + 2000μF = 4000μF.
Explanation: In parallel, the total capacitance is the sum of individual capacitances, increasing the overall capacity to store charge.

11. Mention four types of wiring systems:
Answer:
(i) Cleat wiring: Uses porcelain cleats to hold wires in place.
(ii) Conduit wiring: Wires are enclosed in conduits for protection.
(iii) Batten wiring: Wires are fixed on wooden battens using clips.
(iv) Casing and capping wiring: Wires are enclosed in PVC casing and covered with caps.

12. A voltmeter is a combination of three instruments: ammeter, galvanometer, and resistor.
- A voltmeter includes a galvanometer for detecting current, a resistor to limit the current, and an ammeter to measure it indirectly as voltage.

13. Name three types of electrical joints:
Answer:

(i) Twist joint: Used for joining two conductors by twisting them together.
(ii) Western union joint: Provides strong mechanical and electrical connection.
(iii) Married joint: Used for splicing wires in heavy-duty applications.

14. What is the resistance of a resistor if a voltage of 4.5V between its ends causes a current of 1.5mA to flow through it?
Answer: Using Ohm's Law, R = V / I:
R = 4.5V / 0.0015A = 3000Ω or 3kΩ.
Explanation: Resistance is calculated by dividing voltage by current using Ohm's Law.

15. What is the resistance of a resistor if a voltage of 4.5 V between its and causes a current of 1.5 mA to flow through it?
Solution:
To calculate the resistance of a resistor, we use Ohm's Law:
R = V / I
Where:
R = Resistance (in ohms)
V = Voltage (in volts) = 4.5 V
I = Current (in amperes) = 1.5 mA = 0.0015 A
Substitute the values into the formula:
R = 4.5 / 0.0015 = 3000 Ω
16. The three forms of Ohm's law are:
Answer:
(i) V = IR: Voltage is the product of current and resistance.
(ii) I = V / R: Current is the ratio of voltage to resistance.
(iii) R = V / I: Resistance is the ratio of voltage to current.

17. Three materials used for battery separators are:
Answer:
(i) Rubber: Provides insulation and prevents short circuits.
(ii) PVC: Lightweight and durable for battery applications.
(iii) Fiberglass: Heat-resistant and commonly used in industrial batteries.

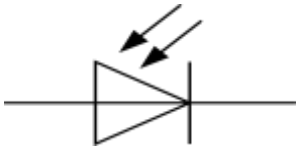
18. Mention four types of cables:
Answer:
(i) Coaxial cable: Used for data and television signals.
(ii) Fiber optic cable: Transmits data using light.
(iii) Twisted pair cable: Used in telecommunication systems.
(iv) Armored cable: Provides protection in harsh environments.

19. State two advantages of using circuit breakers over rewirable fuses:
Answer:
(i) Circuit breakers can be reset after tripping, unlike fuses which need replacement.

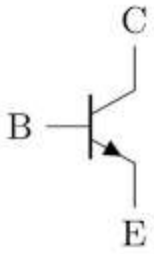
(ii) They provide faster and more accurate protection against overcurrent or short circuits.

20. Draw the symbol of the following devices:
(i) Zener diode: A diode symbol with two slanted lines at the cathode.

(ii) Photo diode: A diode symbol with arrows pointing toward it, representing light detection.



(iii) NPN transistor: A symbol with an arrow pointing outward from the emitter terminal.



NPN

21. A conductor 500mm long is situated in a uniform magnetic field of flux density 1.2T. Determine the force on the conductor when the current flowing in the conductor is 5A.

Answer:
The force on a current-carrying conductor in a magnetic field is calculated using the formula:
$F = BIL$
Where:
F = Force (in Newtons)
B = Magnetic flux density (in Tesla) = 1.2T
I = Current (in Amperes) = 5A
L = Length of the conductor in the field (in meters) = 500mm = 0.5m

$F = 1.2 \times 5 \times 0.5$
$F = 3N$

The force on the conductor is 3 Newtons.

22. Explain the difference between the coulomb and the ampere.

A coulomb is a unit of electric charge, defined as the amount of charge transported by a current of one ampere in one second.
An ampere is a unit of electric current, defined as the flow of one coulomb of charge per second.

23. A resistor is marked or color-coded as follows:
1st band: Brown
2nd band: Black
3rd band: Orange

What is the value of the resistor?

Answer:
Using the resistor color code:
1st band (Brown) = 1
2nd band (Black) = 0
3rd band (Orange) = Multiplier of 10^3

Resistance = $10 \times 10^3 = 10000\Omega$ or $10k\Omega$

The value of the resistor is $10k\Omega$.

24. (a) Explain the difference between a primary and a secondary cell.

Answer:
A primary cell is a non-rechargeable battery designed for single-use, where the chemical reaction cannot be reversed. Examples include alkaline and dry cells.
A secondary cell is a rechargeable battery, where the chemical reaction can be reversed by applying an external current. Examples include lead-acid and lithium-ion batteries.

(b) A conductor is marked 25/0.14mm. What does this mean?

This indicates that the conductor consists of 25 strands of wire, each with a diameter of 0.14mm. This multi-strand configuration improves flexibility and current-carrying capacity.

25. An electrical appliance is connected to a 220V supply through a one-way switch. Draw a simple circuit to show how you would connect your ammeter and voltmeter to measure current and voltage of the appliance.

In the circuit:
- Connect the ammeter in series with the appliance to measure the current flowing through it.
- Connect the voltmeter in parallel across the appliance to measure the voltage drop.

The wiring diagram includes:
- Power supply (220V) connected to one terminal of the switch.
- The other terminal of the switch connected to the ammeter.
- The ammeter connected to the appliance.
- The voltmeter connected across the appliance terminals.