Marking Scheme

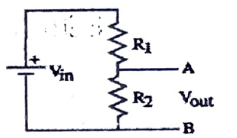
OBAFEMI AWOLOWO UNIVERSITY, ILE-IFE, NIGERIA
DEPARTMENT OF PHYSICS AND ENGINEERING PHYSICS
PHY 203: ELECTRICAL CIRCUITS & ELECTRONICS

2022/2023 Mid-semester Test, Date: 25th Jan., 2024 Time Allowed: ¾ hour Department: .....

NAME: ..... **MATRIC No.** ..... **Sign** .....

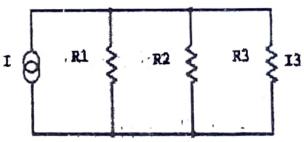
1. Which of the following statements is true about the Kirchoff's laws?
   A. Kirchoff's law is equivalent to Ohm's law
   B. The conservation of energy and conservation of charge when applied to electrical circuits are known as Kirchoff's law
   C. Conservation of energy in an electrical circuit means that the algebraic sum of the voltage drops, $\sum_i V_i = Constant$ around a closed circuit loop (imaginary loop)
   D. Conservation of charge – zero algebraic sum of the currents $\sum_k I_k = Constant$ Ik flowing into a point (total charge in, equals total charge out)
   E. None of the above

Figure 1



2. In Figure 1 below, the voltage across the terminals AB in the voltage divider is
   A. $V_{out} = \frac{R_1}{R_2} V_{in}$ B. $V_{out} = \frac{R_2}{R_1} V_{in}$ C. $V_{out} = \frac{R_2}{R_1 + R_2} V_{in}$
   D. $V_{out} = \frac{R_1}{R_1 + R_2} V_{in}$ E. None of the above

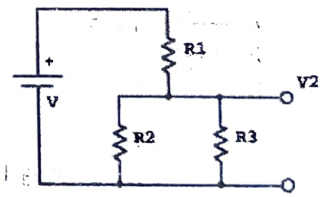
Figure 2



3. In Figure 2 below, the current, I_3, which flows through the resistor, R_3, is
   A. $I_3 = \frac{R_2}{R_1 + R_2 + R_3} I$ B. $I_3 = \frac{R_1 R_2}{R_1 + R_2 + R_3} I$ C. $I_3 = \frac{R_1 R_2 R_3}{R_1 + R_2 + R_3} I$
   D. $I_3 = \frac{R_1 R_2}{R_1 R_2 + R_2 R_3 + R_3 R_1} I$ E. None of the above

4. A combination of elements and Kirchoff's laws can give an equivalent circuit. There are two possibilities. These are:
   A. Ohm's equivalent circuit; Superposition circuit
   B. Thevenin equivalent circuit; Norton equivalent circuit
   C. Superposition circuit; Transformer circuit
   D. Ohm's equivalent circuit; Transformer equivalent circuit
   E. None of the above

Figure 3



5. On the basis of their purpose, a Transformer can be either
   A. A Step up transformer; or A Step down transformer
   B. A core type transformer; or A shell type transformer
   C. A Copper winding transformer; or An Iron winding transformer
   D. A Power transformer; Line transformer
   E. None of the above

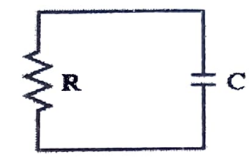
Questions **6** and **7** are based on Figure 3 above,

6. *Given that* $V = 75\ volts, R_1 = R_2 = R_3 = 5\ \Omega$. Calculate the current which flows through the R_3 resistor.
   A. 20 A B. 15 A C. 5 A D. 10 A E. None of the above
7. The voltage, V_2 is
   A. 50 V B. 25 V C. 75 V D. 30 V E. None of the above
8. Which of the following Statements about the transformer is true?
   A. A transformer is an ideal device which has no losses.

B. A transformer is another form of a transistor.
C. A transformer has 50% losses.
D. A transformer has two losses: Core losses and Copper losses
E. None of the above

9. Which of the following Statements is false?
A. The capacitance C between two appropriate surfaces is defined by $VC = \frac{Q}{R}$
B. Since Q and E can be stored a capacitor can be used as a (non-ideal) source of I and V
C. Faraday's law applied to an inductor states that a changing current induces a back EMF that opposes the change.
D. Unlike the capacitor which behaves like an open-circuit in DC circuits, an inductor behaves like a short circuit in DC circuits.
E. None of the above

Figure 4



10. In Figure 4, the current which flows in the circuit is
A. $I(t) = V(0)e^{-t/RC}$ B. $I(t) = I(0)e^{-t/RC}$ C. $I(t) = V(0)e^{-tL/RC}$
D. $I(0) = V(0)e^{-t/RC}$ E. None of the above

11. Metals or good conductors conduct electricity by virtue of ...Free electrons.....
12. In vacuum tube voltmeter, the voltage to be measured is applied at ...grid of the Triode.....
13. At what temperature does a semiconductor behave as a perfect insulator ..Absolute zero.....
14. A meter that can measure resistance, D.C and A.C currents or voltages effectively is ..Multimeter
15. Two major views by which material can be classified are Ionization Potential and Energy bands
16. An impurity atom that produces p-type conductivity by creation of hole is .Acceptor impurity..
17. The use of D.C voltage to eliminate potential barrier and allow flow of current in the circuit of a p-n junction device is .Forward Biasing..
18. A simple electronic component that converts A.C current or voltage to D.C component is .Rectifier.
19. The property of a material that determines whether it is semiconductor or not is .Resistivity.....
20. In practical use, when currents are hindered at p-n junction of an electronic device due to established high potential barrier, a very small current that still flows in the circuit is .Reverse saturation current
21. A transistor operates with a collector current of 100mA and an emitter current of 102mA. Determine the value of base current. 2mA
22. What are the Three basic circuit configurations used for transistor Common Emitter, Common Collector, Common base
23. A bipolar transistor has a common-emitter current gain of 125. If the transistor operates with a collector current of 50mA, determine the value of base current. 400 μA
24. A field effect transistor operates with a drain current of 100mA and a gate source bias of -1V. The device has a gfs (common-source dynamic forward transfer conductance) value of 0.25. If the bias voltage decreases to -1.1V, determine (a) the change in drain current, and (b) the new value of drain current. -25mA 75mA
25. In normal operation an n-p-n transistor connected in common-base configuration has
A. the emitter at a lower potential than the base
B. the collector at a lower potential than the base
C. the base at a lower potential than the emitter
D. the collector at a lower potential than the emitter
E. None of the above