



COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY (CEST)

SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING

CERTIFICATE IV IN ELECTRONICS ENGINEERING – STAGE -1

EEE302 - ELECTRICAL PRINCIPLES 1

FINAL EXAMINATION – PENSTER 1, 2017

DAY/DATE: as per timetable. TIME: 2 HOURS 10 MINUTES

ROOM: as per timetable. MAXIMUM MARKS: 100

INSTRUCTIONS TO STUDENTS

1. *You are allowed 10 minutes Extra reading time during which you are NOT to write.*
2. *Begin each section on a fresh page and use both sides of the sheet.*
3. *Write your candidate-number at the top of each attached sheet.*
4. *Insert all written foolscaps, graph paper, drawing paper, etc. in their correct sequence and secure with string.*
5. *For all sheets of paper on which rough/draft work has been done, cross it though and you MUST ATTACH to your answer scripts.*
6. *Write clearly the number(s) of the question(s) attempted on the top of each sheet.*
7. **ANSWER ALL QUESTIONS.**
8. *Show all workings where necessary.*
9. *Do not use programmable calculators, especially the ones that does the conversions of number systems.*
10. ***ALWAYS CHECK YOUR WORK BEFORE YOU LEAVE THE EXAM ROOM!***

SECTION A

MULTIPLE CHOICE QUESTIONS

[20 MARKS]

1. What determines an atom's identity as a unique element?
 - A. Number of neutrons in an atom's nucleus
 - B. Number of electrons in an atom's nucleus
 - C. Number of protons in an atom's nucleus
 - D. Number of protons and electrons in an atom's nucleus

2. 2 kWh is equal to
 - A. 7.2×10^5 J
 - B. 7.2×10^6 J
 - C. 7.2×10^7 J
 - D. 7.2×10^8 J

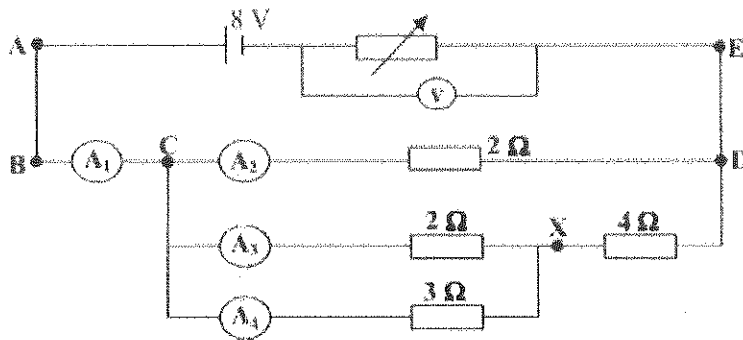
3. Material that obeys Ohm's Law is called
 - A. Linear conductor
 - B. Potential difference
 - C. Copper
 - D. Insulator

4. In an experiment, several wires of the same length, L , and metal with different cross-sectional areas, A , were chosen. For each wire, the resistance, R , and the cross-sectional area, A , were measured.
The relationship between R and A can be stated that
 - A. R is independent of A
 - B. R is directly proportional to A
 - C. R is inversely proportional to A
 - D. there is a logarithmic relationship between R and A

5. Copper is a conductor of electricity because
 - A. no energy gaps exist
 - B. large energy gaps of 3 eV to 6 eV exist
 - C. electrons can jump band gaps of about 0.7 eV to 1 eV
 - D. electrons move easily to higher energy levels and travel through the solid

6. What is the conservative threshold value for dangerous voltage in industries?
 - A. 20 volts
 - B. 30 volts
 - C. 40 volts
 - D. 50 volts

7. Injuries from electricity can include which of the following?
- Electric shock that may or may not result in electrocution.
 - Falls.
 - Burns.
 - All of the above.
8. Which of the following is most likely to cause muscle tetanus?
- Direct current
 - Alternating current
 - High voltage
 - High resistance
9. The following set-up was used to study the laws of electrical circuits.



A_1 , A_2 , A_3 and A_4 represent ammeters in the circuit.

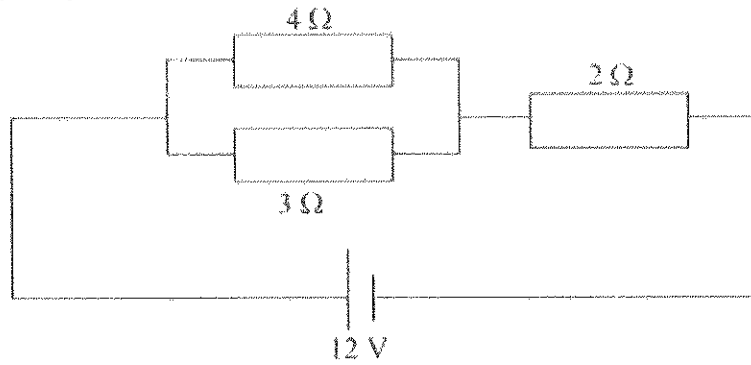
The readings were as follows:

A_1	A_2	A_3	A_4
1.8 A	1.3 A	0.3 A	0.2 A

If another ammeter is connected at point X, what would it read?

- 0.2 A
- 0.4 A
- 1.5 A
- 0.5 A

10. The diagram given below shows an electrical circuit.



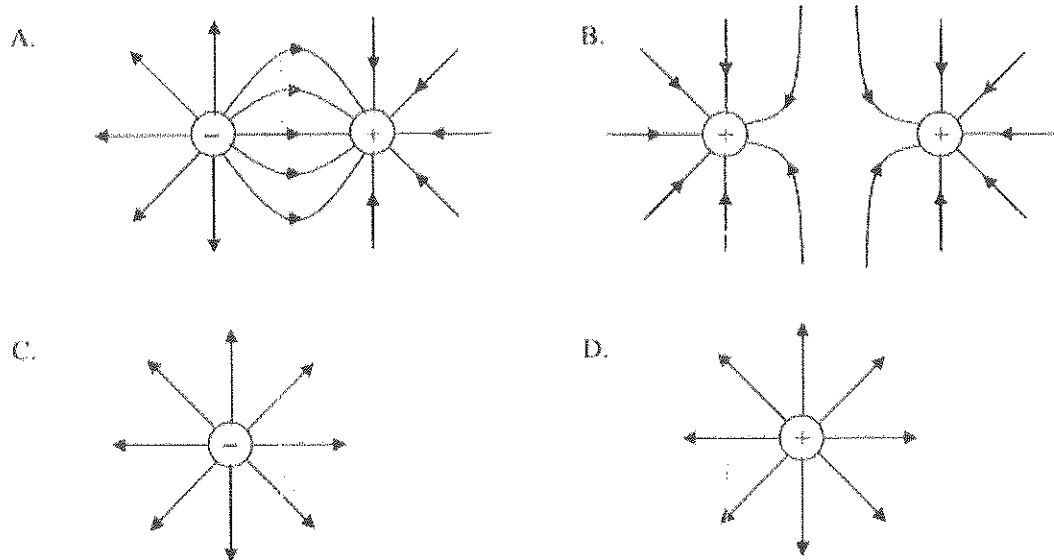
The total resistance of the circuit is

- A. 1.71 Ω
- B. 3.71 Ω
- C. 7.71 Ω
- D. 9.71 Ω

11. According to Kirchhoff's Voltage Law, the total voltage around a closed loop must be

- A. 0
- B. 1
- C. 2
- D. 3

12. Which of the following electric field line patterns is correct?

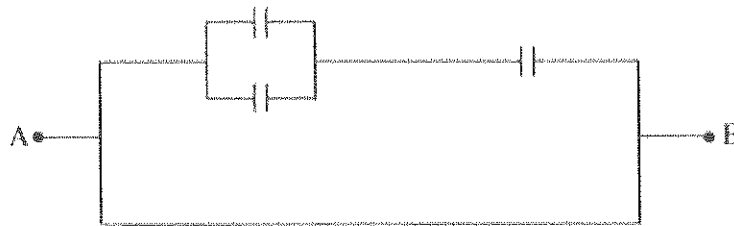


13. The capacitor shown below is classified as



- A. plastic film
- B. tantalum
- C. ceramic
- D. electrolytic

14. Capacitors are connected as shown below.



If all the capacitors are identical and have a capacitance of $1\mu\text{F}$ each, the effective capacitance of the combination between A and B is

- A. $\frac{1}{3}\mu\text{F}$
 - B. $3\mu\text{F}$
 - C. $\frac{3}{2}\mu\text{F}$
 - D. $\frac{2}{3}\mu\text{F}$
15. Two long parallel wires carry equal currents in the same direction. The magnitude of the force between the wires separated by distance, d . If the separation of the wires is doubled, the force (F) between the wires is of magnitude
- A. $F/2$ and attractive
 - B. $F/2$ and repulsive
 - C. $F/4$ and attractive
 - D. $F/4$ and repulsive
16. The earth's magnetic field is of the order of
- A. 0.01 T
 - B. 0.001 T
 - C. 0.0001 T
 - D. 0.00001 T

17. A coil of 500 turns wound around on an iron core which is 60 mm long has a current of 0.3 A passing through the coil. The magnetising force in the core is
- A. 350 At/m
 - B. 3500 At/m
 - C. 250 At/m
 - D. 2500 At/m
18. Which of the following is the unit of inductance?
- A. Ohm
 - B. Ampere
 - C. Henry
 - D. Webers
19. The direction of the current in a magnetic field when a conductor is moved can be determined by
- A. Fleming's left-hand rule
 - B. Fleming's right-hand rule
 - C. Right-hand screw rule
 - D. Right-hand grip rule
20. The value of induced voltage in a conductor depends on
- A. length of conductor, velocity, current, angle
 - B. length of conductor, current, strength of magnetic field, angle
 - C. length of conductor, velocity, strength of magnetic field, current
 - D. length of conductor, velocity, strength of magnetic field, angle

SECTION B**FILL IN THE BLANKS****[10 MARKS]**

Write down the words that best complete the sentence.

voltage	direct current	tolerance	Ohm's Law
permittivity	resistivity	charge	ferrite
unit	self-inductance		

1. _____ deals with the relationship between voltage and current in an ideal conductor.
2. The two most common ferromagnetic materials are iron and _____.
3. _____ is a measure of its capacity to store an electric charge.
4. The inverse of _____ is called conductivity.
5. A _____ is a particular physical quantity, defined and adopted by convention.
6. The property of _____ is a particular form of electromagnetic induction.
7. _____ is never created or destroyed.
8. A _____ is one which always flows in one particular direction.
9. _____ refers to how close the actual value of the resistor is to its marked value.
10. A _____ is induced in the conductor when it moves in a magnetic field.

SECTION C**TRUE OR FALSE****[10 MARKS]**

Write either True or False for the following statements.

1. The unit of measure for EMF is mole.
2. Mica capacitors range from 10 μ F to 10 pF.
3. Lines of flux are continuous loops.
4. Voltage produces an electric field.
5. The directional movement of electrons due to some imbalance of force is known as electricity.
6. Precision resistors have a tolerance of less than 10%.
7. The unit for capacitance is Farads.
8. Neutrons are negatively charged particles.
9. Electric current is the rate of charge flow past a given point in an electric circuit.
10. Electric field is the electric force per unit charge.

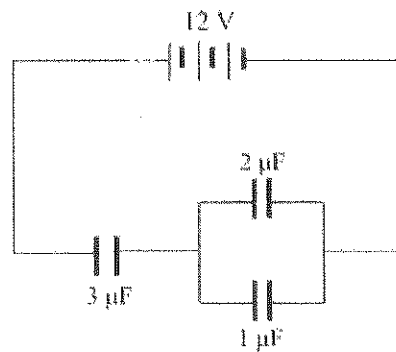
SECTION D**[60 MARKS]**

1. Explain what happens to the current in the circuit when the voltage to the circuit is increased? **[2 marks]**

2. Determine the values from the following colour-coded 4 band resistors:
 - i. Red, Black, Black, Brown **[2 marks]**
 - ii. Violet, Brown, Black, None **[2 marks]**

3. A particular 4-band resistor has its upper range as 65.1Ω and lower range as 58.9Ω . Calculate the following:
 - i. Range **[2 marks]**
 - ii. Preferred value **[2 marks]**
 - iii. Tolerance **[2 marks]**
 - iv. Colour code **[2 marks]**

4. The diagram below shows a combination of capacitors connected to a 12 V power supply.



- i. Calculate the equivalent capacitance for the circuit. **[2 marks]**
 - ii. Calculate the charge across the $3 \mu\text{F}$ capacitor. **[1½ marks]**
 - iii. What is the potential difference across the $3 \mu\text{F}$ capacitor? **[1½ marks]**

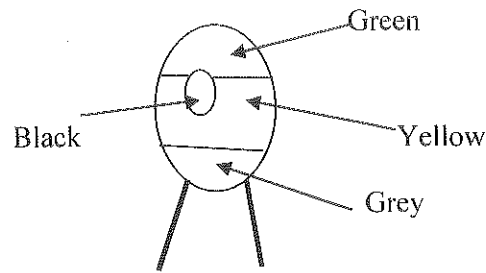
5. Permeability is the ability of a material to conduct magnetic lines of forces. Give two examples of:
 - i. High permeability **[1 mark]**
 - ii. Low permeability **[1 mark]**

6. Determine the capacitance values for:

i. 151 J [2 marks]

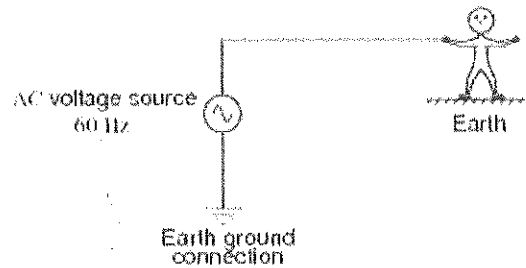
ii. 104 [2 marks]

iii.



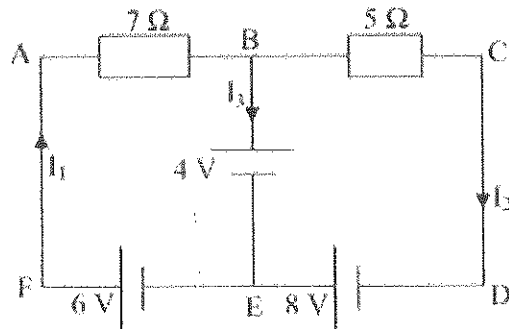
[2 marks]

7. An American researcher named Charles Dalziel performed experiments with both human and animal subjects to determine the effects of electric currents on the body. Assuming a skin contact resistance of 600Ω for a sweaty hand, 1000Ω of resistance for foot-to-ground contact, 50Ω internal body resistance, 70Ω of resistance through the soil from the person's location to the earth ground point, and a male victim. Calculate the amount of voltage necessary to achieve the condition of pain, with voluntary muscle control maintained for the following circuit?



[5 marks]

8. Consider the Dc circuit shown below.



Using Kirchoff's laws:

i. Write an equation relating I_1 , I_2 and I_3 at junction B. [1 mark]

ii. Write an equation representing voltage drops around loops:

1. ABEFA [1 mark]

2. ACDEFA [1 mark]

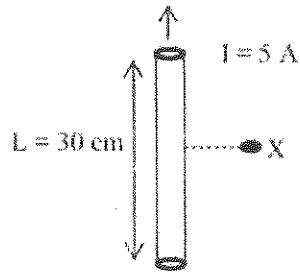
9. Why should you use one hand while working on live power circuits, which hand? [1 mark]

10. A solenoid of radius 2.5 cm has 400 turns and a length of 20 cm.
Determine the:

i. inductance of the solenoid (Use: $L = \frac{\mu_0 N^2 A}{l}$) [2 marks]

ii. rate at which current must change through it to produce an emf of 75 mV. [1½ marks]

11. Shown below is a 30 cm wire carrying a current of 5 A upward as shown.



i. Determine the magnitude of the magnetic field strength at the point X, 4mm from the wire. [1½ marks]

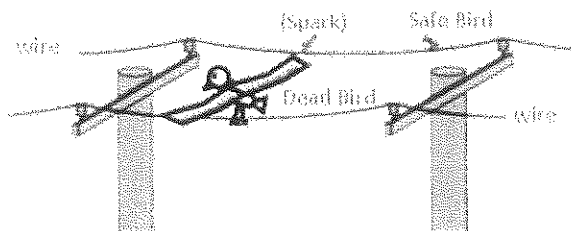
ii. Draw the pattern of the magnetic field around the wire, giving special attention on its direction. [1½ marks]

Another wire of the same length, carrying a current of 6 A but in the opposite direction is placed parallel to and 3 cm away from the first wire.

iii. What value of magnetic force exists between the two conductors? [1½ marks]

iv. Would the conductors repel or attract each other? [1 mark]

12. Explain why birds do not get shocked when they perch on a power line, even if both of their feet touch the wire? Explain why birds become electrocuted if their wings bridge between two different power conductors?



[4 marks]

13. A potential difference of 12 V is found to produce a current of 0.50 A in a 3.6 m length of wire with a uniform radius of 0.40 cm.

Calculate:

i. the resistance of the wire [2 marks]

ii. the resistivity of the wire [2 marks]

14. A transformer on a pole near a residential area steps down voltage from 3400 V to 240V. The transformer is to deliver 1000 kW to a factory at 90 % efficiency.
Find:
- i. the power delivered to the primary [1½ marks]
 - ii. the current in the secondary [2 marks]
15. A square solenoid of 50 turns of wire and sides 5 cm long is placed perpendicular to a magnetic field of strength 0.5 T.
- i. How much flux passes through the coil? [1½ marks]
 - ii. The magnetic field is reduced to zero during a time of 0.1 second.
What is the induced voltage in the solenoid? [2 marks]

...End of Examination Paper...