



FIJI NATIONAL UNIVERSITY

COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY (CEST)

SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING

CERTIFICATE IV IN ELECTRONIC ENGINEERING

EEE302 – ELECTRICAL PRINCIPLES 1

FINAL EXAMINATION – PENSTER 3, 2017

DATE: As per timetable

TIME: As per timetable

TIME ALLOWED: 2 HOURS

INSTRUCTIONS

1. *You are allowed 10 minutes extra reading time during which you are NOT to write.*
2. *Begin each section on a new 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 each one through and ATTACH these 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 working clearly where necessary.*
9. *Programmable calculators are not allowed.*
10. *Check your work before you leave the examination hall.*

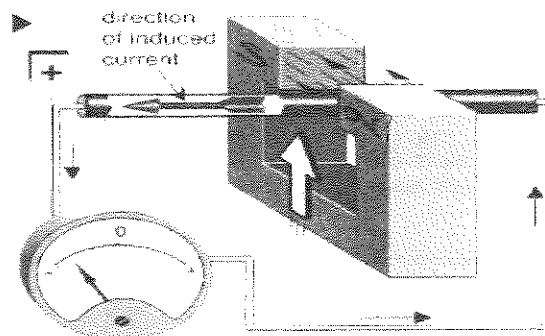
Section A – Multiple Choice

[20 marks]

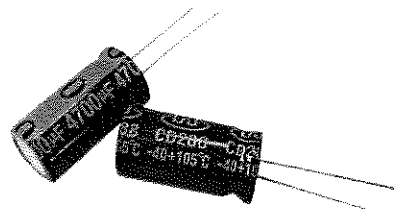
Choose the appropriate answer from each question by writing the alphabet beside the question number in your answer booklet.

1. If the value of a four band resistor is $10\text{K}\Omega \pm 5\%$, what is the color of the multiplier band?
 - A. Brown
 - B. Red
 - C. Orange
 - D. Gold
2. Which of the following determines the capacitance of a capacitor?
 - A. Plate area, thickness, and plate separation
 - B. Voltage rating, dielectric constant, and temperature coefficient
 - C. Plate area, dielectric constant, and plate separation
 - D. Temperature coefficient, plate area, and plate separation
3. What is the engineering notation form of 0.0035 amperes?
 - A. 0.0035A
 - B. 3.5mA
 - C. 0.35mA
 - D. 3.5×10^{-3} mA
4. If a current of $120\mu\text{A}$ flows for a time of 15s, determine the amount of charge transferred.
 - A. 1.8mC
 - B. 1.8A
 - C. 1.8mV
 - D. $1.8\mu\text{C}$
5. The unit for potential difference is;
 - A. Ampere
 - B. Coulomb
 - C. Ohm
 - D. Volt
6. Which of the following magnetic poles will repel each other?
 - A. North and South
 - B. North and North
 - C. East and West
 - D. Positive and Negative

7. The direction of induced current in figure below with a moving conductor in direction shown is determined using;

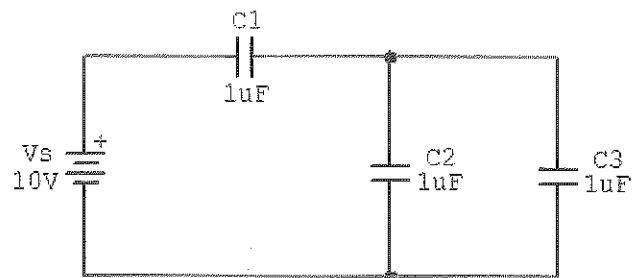


- A. Flemings Right Hand Rule
 - B. Right Hand Grip Rule
 - C. Magnetism
 - D. Multimeter
8. Material that obeys Ohm's Law is called;
- A. Linear conductor
 - B. Potential difference
 - C. Copper
 - D. Insulator
9. In an experiment, several wires of the same length, L , and metal with different cross-sectional 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
10. The type of capacitor shown is a;
- A. plastic film capacitor
 - B. tantalum capacitor
 - C. ceramic capacitor
 - D. electrolytic capacitor



11. The total capacitance for the circuit shown is;

- A. $1\mu\text{F}$
- B. $1.5\mu\text{F}$
- C. $3\mu\text{F}$
- D. 1.5C



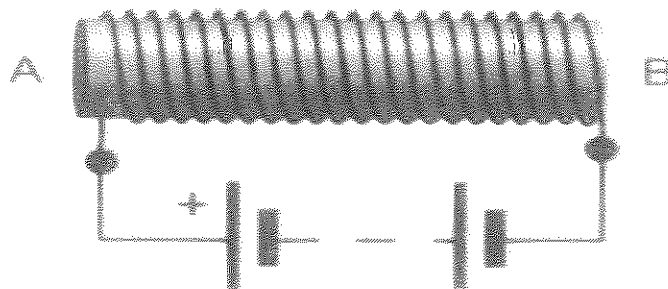
12. The smallest particle of any element that still retains the characteristics of that element is known as;

- A. Atom
- B. Molecule
- C. Electron
- D. Proton

13. What is the current through a 200-turn coil of wire with a magnetomotive force of 400At ?

- A. 2A
- B. 0.5A
- C. 8A
- D. 80kA

14. Which end of the solenoid shown in figure below is the North Pole?



- A. A
- B. B
- C. Middle
- D. none of the above

15. Imaginary lines used to describe the magnitude and shapes of a magnetic field are called:

- A. relative permeability
- B. magnetomotive force
- C. flux density
- D. flux

16. What is the primary winding (N_p) of a transformer whose secondary winding (N_s) is 100 turns. The voltage applied to the primary is 240V and the secondary voltage is 24V.
- A. 10 turns
 - B. 57.6 turns
 - C. 100 turns
 - D. 1000 turns
17. What's the absolute permeability of transformer iron, if its relative permeability is 5000 at a certain flux density?
- A. 6.3×10^{-3}
 - B. 6.3
 - C. 5
 - D. 63
18. In an atom,
- A. the protons and neutrons orbit the nucleus in opposite direction.
 - B. the protons orbit around the neutrons.
 - C. the electrons and neutrons orbit the nucleus.
 - D. the electrons orbit the nucleus.
19. Joules/Coulombs is equivalent to
- A. Volts
 - B. Joules
 - C. Amperes
 - D. Watt
20. The prefix *pico* means
- A. 10^{-3}
 - B. 10^{-6}
 - C. 10^{-9}
 - D. 10^{-12}

Section B – True or False

(10 marks)

Write True or False for each of the statements below.

(1 mark each)

1. Proton and neutron attract each other.
2. Electric shock causes muscle contraction, seizure, dehydration.
3. Ampere is Coulomb/second.
4. General purpose resistors have a tolerance of 5%.
5. Electric current is the rate of charge flow past a given point in an electric circuit.
6. Kirchhoffs Voltage Law states that the sum of voltages around a closed loop is equal to one.
7. The unit of flux density is Weber.
8. The charge on an electron is equal to 1.602×10^{-19} C.
9. The inverse of resistivity is called permittivity.
10. It is electric current and not voltage that burns tissues, freezes muscles, and fibrillates hearts.

Section C – Short Answers

[20 marks]

1. List the four factors that affect the resistance of a conductor. (2 marks)
2. Briefly explain Electromagnetic Induction. (2 marks)
3. What is Tolerance? (1 mark)
4. With the aid of diagram, explain permanent magnets and ferromagnets? (3 marks)
5. Explain what happens to the current in a circuit when the voltage to the circuit is doubled? (1 mark)
6. The value of the voltage induced in a conductor depends on four things. List two of them. (2 marks)
7. List four main types of capacitors. (2 marks)
8. Briefly explain the four precautions which need to be taken when working with electricity. (2 marks)
9. The intensity of an electric field (number of electrostatic lines of force in a given area) depends on various things. List atleast two of them. (2 marks)
10. Explain the difference between *Self Inductance* and *Mutual Inductance*. (3 marks)

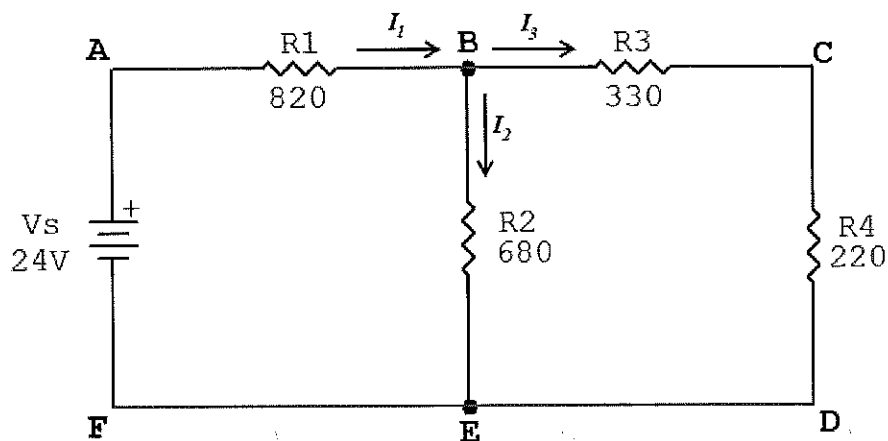
Section D – Calculations & Diagrams

(50 marks)

All questions are compulsory. Show your working clearly.

1. A solenoid with 180 turns of wire has a resistance of 15Ω .
 - A. What is the magnetomotive force produced by the coil when it is connected to a 10V battery? (2 marks)
 - B. If the solenoid in has 8cm long iron core, what's the value of the magnetising force in the core? (2 marks)
 - C. If the core in the solenoid has an absolute permeability of 0.01, what's the flux density in the core? (2 marks)

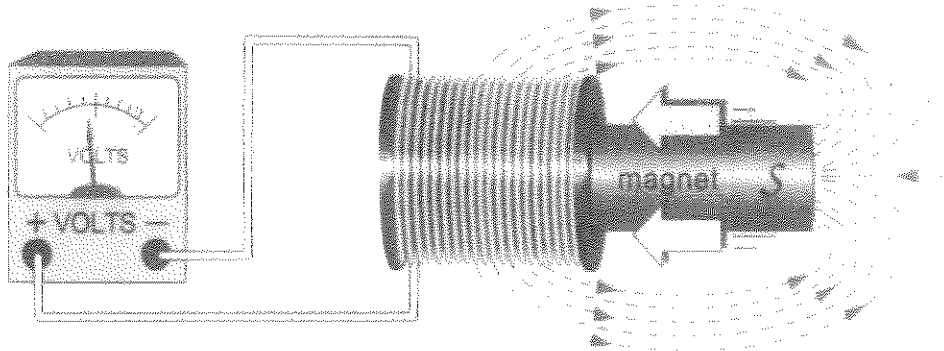
2. For the circuit given below,



- A. Write the KCL equation for node B. (1 mark)
- B. Write the KVL equations in the clockwise direction for loops;
 - i. ABEF (1 mark)
 - ii. BCDE (1 mark)
- C. Calculate the following:
 - i. Total resistance (R_T) of the circuit. (2 marks)
 - ii. Total current (I_T) of the circuit. (1 mark)
 - iii. Current through R_2 and R_3 . (2 marks)
 - iv. Voltage across R_1 , R_2 , R_3 and R_4 . (4 marks)
- D. Prove your KCL equation obtained in part A above using the calculated currents from part C. (1 mark)

3. A 60W electric light bulb is connected to a 240V supply. Determine:
 - A. the current flowing in the bulb (2 marks)
 - B. the resistance of the bulb. (2 marks)

4. The coil in Figure below has 100 turns and the flux from the moving magnet is increasing from zero to 0.03Wb in two seconds. What's the induced EMF?
(2 marks)



5. Two inductors, whose self-inductances are given as 33mH and 47mH respectively, are positioned next to each other on a common magnetic core so that 75% of the lines of flux from the first coil are cutting the second coil. Calculate the total mutual inductance that exists between them. (2 marks)
6. An ideal step-down transformer has 8000 turns on the primary and 200 turns on the secondary. The cross section of the magnetic core measures 20mm x 20mm. If the voltage V_1 applied to the input is 240V at 50Hz, and an indicator lamp of 20Ω resistance is connected to the output. Calculate:
 A. The Secondary voltage. (1 mark)
 B. The primary and secondary currents. (2 marks)
 C. The maximum flux density in the core. (2 marks)
7. Calculate the resistivity of silver if the conductivity, σ is $6.29 \times 10^7 / \Omega\text{m}$. (2 marks)
8. A 4-band resistor has its upper range as 714Ω and lower range as 646Ω . Calculate the following:
 A. Range (2 marks)
 B. Preferred value (2 marks)
 C. Tolerance (2 marks)
 D. Colour code (2 marks)
9. Calculate the value of the following capacitance using codes to the unit as stated in the brackets.
 A. 333 [nF] (1 mark)
 B. 684 [μF] (1 mark)

10. Find the force that should be exerted on a 6m length of a conductor, carrying a current of 600mA situated at right angles in a magnetic field with a flux of 5 Tesla. (2 marks)

11. Sketch the magnetic fields around the two conductors shown below. (2 marks)



Will the conductors attract or repel each other if they are free to move.

12. Find the resistance and tolerance for the following resistors with colour bands;

- A. Yellow, violet, orange, gold
- B. Orange, white, black, brown, red (2 marks)

The End

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