



**COLLEGE: COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY (CEST)**

**SCHOOL: SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING**

**PROGRAMME: CERTIFICATE IV IN ELECTRONICS ENGINEERING-STAGE 1**

**UNIT CODE: EEE302**

**TITLE: ELECTRICAL PRINCIPLES 1**

**FINAL EXAMINATION – TRIMESTER 1, 2016**

**ROOM: AS PER TIMETABLE  
TIME: 2 HOURS 10 MINUTES**

**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 a string.
5. For all sheets of paper on which rough/draft work has been done, cross it 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. Use of programmable calculator(s) is prohibited.
8. **ANSWER ALL QUESTIONS**
9. Show all working where necessary.
10. **ALWAYS CHECK YOUR WORK BEFORE YOU LEAVE THE EXAM ROOM.**

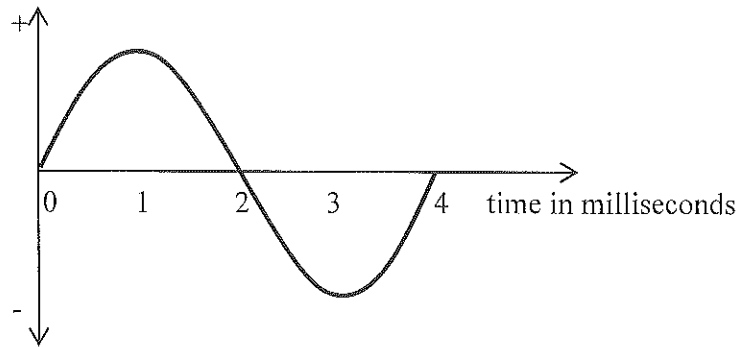
**SECTION A****MULTIPLE CHOICE****(20 MARKS)**

Circle the *letter* of the best *choice* in the **Answer Sheet** provided.

1. Which of the following has a positive charge?
  - a) neutron
  - b) electron
  - c) proton
  - d) molecule
  
2. 1 kWh is equivalent to:
  - a) 3.6 MJ
  - b) 1000 KJ
  - c) 1000 MJ
  - d) 360 MJ
  
3. Which of the following colour codes describes a resistance of  $10\Omega \pm 10\%$ ?
  - a) brown, red, yellow, silver
  - b) brown, black, black, silver
  - c) yellow, violet, gold, gold
  - d) brown, red, black, brown, red
  
4. What is the magnetomotive force in a 150-turn coil of wire with 2A flowing through it?
  - a) 300 At
  - b) 75 At
  - c) 152 At
  - d) 13.33 m At
  
5. What is the capacitance of a ceramic capacitor with 103 stamped on it?
  - a) 103pF
  - b) 10nF
  - c) 1pF
  - d) 10pF
  
6. Which of the following determines the capacitance of a capacitor?
  - a) Plate area, thickness, and Temperature coefficient
  - b) voltage rating, dielectric constant, and temperature coefficient
  - c) Plate area, voltage rating, and plate separation
  - d) Plate area, Type of dielectric between plates, and plate separation
  
7. Which of the following magnetic poles will attract each other?
  - a) North and South
  - b) North and North
  - c) East and West
  - d) Positive and Negative

8. With what simple instrument can you measure the specific gravity of an electrolyte?
- Hydrometer
  - Voltmeter
  - Anemometer
  - Ammeter
9. How much voltage is developed across a resistor of  $220\text{k}\Omega$  that has a current of  $11\mu\text{A}$  flowing through it?
- 24.2 Volts
  - 2.42 Volts
  - 2420 Volts
  - None of the above
10. \_\_\_\_\_ is a renewable energy resources derived from the carbonaceous waste of various human and natural activities.
- Biomass
  - Geothermal
  - Hydropower
  - Wave energy
11. The unit of Magnetic Flux is
- Weber
  - Tesla
  - Beta
  - Weber per cubic meter
12. What is the part that electrically connects armature to stator for an alternator?
- Rotor
  - Stator Winding
  - Armature Winding
  - Brush
13. The capacity of a battery is also known as:
- C/10 discharge
  - Current rating
  - Ampere-hour rating (Ah)
  - Voltage rating
14. Which type of battery is used in computer laptops and cell phones?
- Lithium-Ion battery
  - Zinc Carbon battery
  - Lead Acid battery
  - Alkaline battery

15. The frequency of the waveform shown below is:



- a) 0.25 Hz
  - b) 250 Hz
  - c) 2 Hz
  - d) 4 Hz
16. The value of alternating current,  $i$ A, in a circuit, after time  $t$  sec is given by,  $i=25\sin 50\pi t$ .  
What is the frequency?
- a) 50 Hz
  - b) 25 Hz
  - c) 100 Hz
  - d) 0.5 Hz
17. For a pure inductive circuit
- a) Voltage is in phase with current
  - b) Current is out of phase with voltage by  $90^\circ$
  - c) Voltage lags current by  $90^\circ$
  - d) Voltage leads current by  $90^\circ$
18. "→" is used to represent the phasor diagram for:
- a) current
  - b) voltage
  - c) power
  - d) resistance
19. The form factor of a sinusoidal waveform is:
- a) 1.11
  - b) 1.414
  - c) 0.707
  - d) 0.637
20. A solar cell converts \_\_\_\_\_.
- a) heat energy into electrical energy
  - b) solar energy into electrical energy
  - c) heat energy into light energy
  - d) solar energy into light energy

**SECTION B**

**(10 MARKS)**

**PART 1:** Write True or False for the following. **(5 MARKS)**

- I) An electric cell has three components which consist of a positive electrode, a negative electrode and zinc chloride.
- II) Time constant is the time taken for a current or voltage in an RC or RL circuit to reach 63.2% of its final value.
- III) The chemical action of a secondary cell cannot be reversed.
- IV) For a series circuit, the voltage is used as the reference phasor because the voltage is common to all parts of the circuit.
- V) An alternating voltage or current is one that periodically changes its polarity.

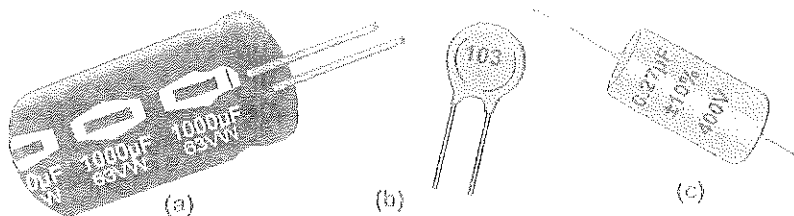
**PART 2:** Fill in the blanks **(5 MARKS)**

**1.5V, Conductance, current, DC, electromagnetic, AC, Susceptance, Reference diagrams,**  
**2.1V, Phasor diagrams, voltage**

- I) The output for lead-sulfuric acid wet cell is .....
- II) Alternators generate electricity by the same principle as ..... generators, namely when the magnetic field around a conductor changes, a current is induced in the conductor.
- III) ..... can be used to represent rms quantities in which case they are frozen in time.
- IV) Impedance is the opposition to ..... in an ac circuit caused by resistance and reactance.
- V) ..... is an expression of the readiness with which an electronic component, circuit, or system releases stored energy as the current and voltage fluctuate.

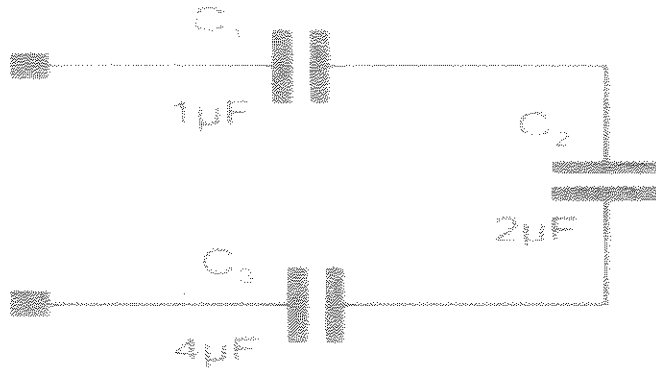
**SECTION C      SHORT ANSWER QUESTIONS      (30 MARKS)**

1. Define the following terms:
  - a) Primary Cell (1 mark)
  - b) Secondary Cell (1 mark)
  - c) Capacitive reactance (1 mark)
  - d) Impedance (1 mark)
  - e) Admittance (1 mark)
2. How could you differentiate between a dry and a wet cell? (2 marks)
3. What value of current can a 6Ah battery supply for 10 hours, if this rating is for a C/10 discharge current? (2 marks)
4. List the four factors that affect the resistance of a conductor. (2 marks)
5. Sketch the phasor diagrams to show the relationship for the voltage and current of a sinusoidal waveform across a:
  - a) Resistor (2 marks)
  - b) Inductor (2 marks)
  - c) Capacitor (2 marks)
6. Identify the types of capacitors shown below: (3 marks)



7. For the circuit shown below, calculate the following:

- a) Total capacitance of the circuit (2 marks)  
 b) How much charge does the circuit take when it's connected to a 50V DC supply? (2 marks)



8. Determine the values and tolerance range of given resistors:

- i). red, yellow, green [4 band] (2 marks)  
 ii). orange, green, red, gold [4 band] (2 marks)  
 iii). blue, red, black, orange, red [5 band] (2 marks)

### SECTION D

### CALCULATIONS

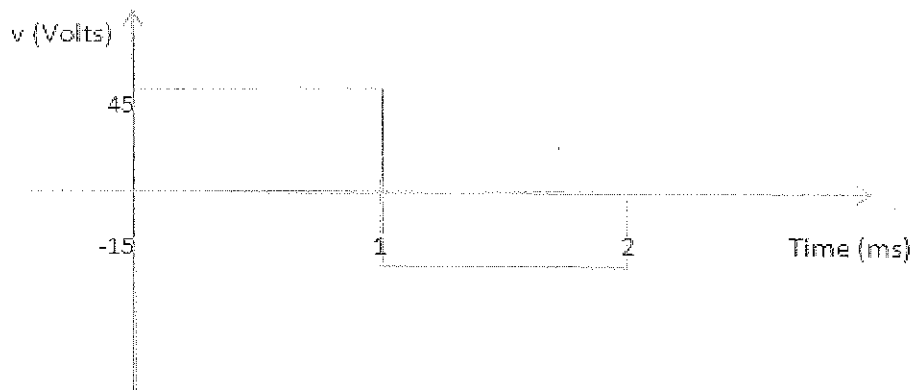
**(40 MARKS)**

1. An alternating voltage is represented by the expression  $v = 25 \sin 314.2t$  volt.

Determine:

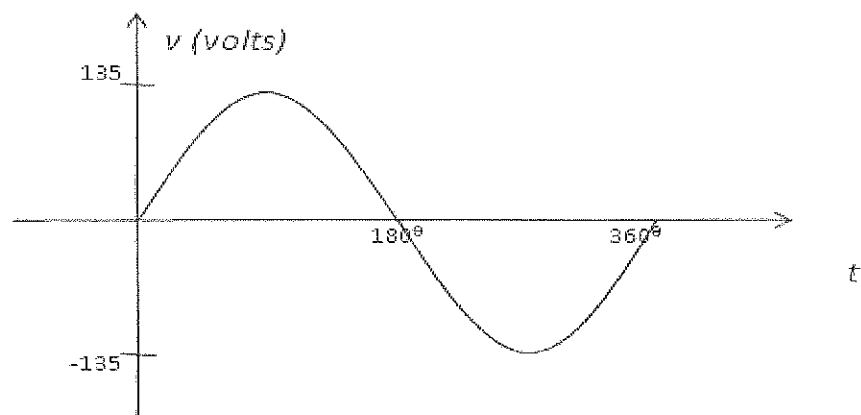
- a) the maximum value (1 mark)  
 b) the frequency (1 marks)  
 c) the period of the waveform (1 marks)  
 d) the value 2.5ms after it passes through zero, going positive (2 marks)

2. Calculate the average and rms value of the waveform given below: (4 marks)

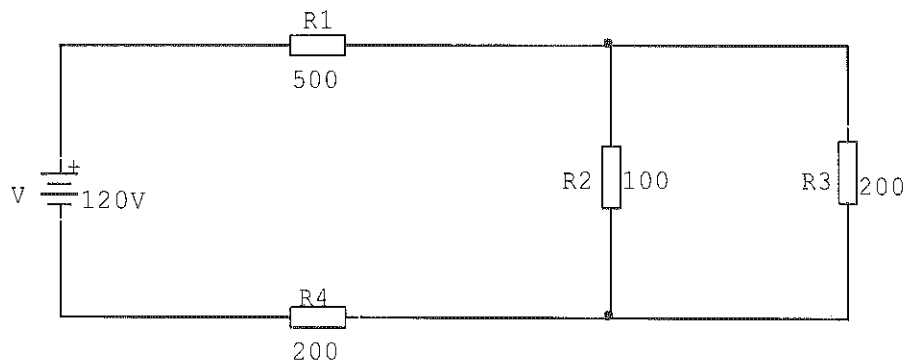


3. Calculate the following for the sinewave shown below:

- a) instantaneous values at  $85^\circ$  and  $215^\circ$  (2 marks)
- b) average value for positive half of the sine wave (2 marks)
- c) peak-to-peak voltage (1 mark)
- d) rms voltage (2 marks)



4.

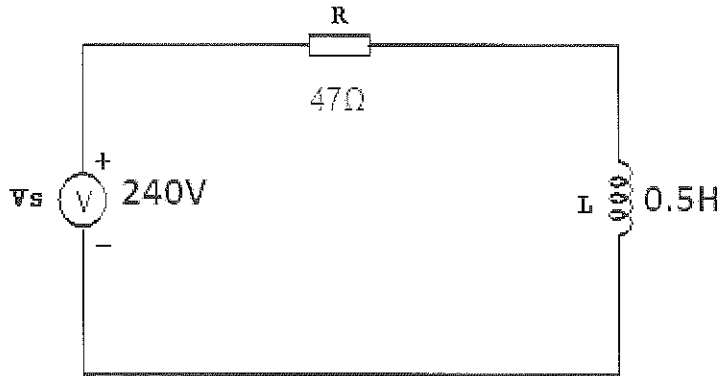


Calculate the following for the circuit shown above:

- a) total resistance of the circuit,  $R_T$  (2 marks)
- b) total current of the circuit,  $I_T$  (1 marks)
- c) current through  $R_2$  (1 marks)
- d) current through  $R_3$  (1 marks)



5. A resistor of  $47\Omega$  is connected in series with a  $0.5\text{ H}$  inductor, across a  $240\text{V}$ ,  $50\text{ Hz}$  supply.



Calculate the:

- inductive reactance (2 marks)
  - impedance (2 marks)
  - the current flowing in the circuit (2 marks)
  - the phase angle between the current and the applied voltage (2 marks)
  - draw the phasor diagram for current and voltage. (2 marks)
6. If  $V_1 = 30 \sin(100\pi t + 35^\circ)$  and  $V_2 = 5 \sin(100\pi t + 10^\circ)$   
Determine:
- the representation of the voltages as phasor domain expression. (3 marks)
  - total voltage ( $V_t = V_1 + V_2$ ) using rectangular form. (2 marks)
  - the expression in part (b) as in phasor domain form. (2 marks)
  - the expression in part (c) as time domain. (2 marks)

\*\*\*\*\*THE END\*\*\*\*\*