



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

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

**PROGRAMME: CERTIFICATE III/IV IN ELECTRICAL ENGINEERING-STAGE 2**

**UNIT CODE: EEC326**

**TITLE: MATERIAL SCIENCE FOR TRADE**

**FINAL EXAMINATION – QUARTER 3, 2019**

**Marks: 100**

**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**

(20 MARKS)

In each of the following statements one of the suggested answers is correct. Write the identifying letters beside the question numbering in your answer sheet.

**MULTIPLE CHOICE**

1. Materials with lots of free electrons are called\_\_\_\_\_.
  - a. Conductors
  - b. Insulators
  - c. Semi-conductors
  - d. Filters
  
2. Which kind of matter has no definite shape or volume?
  - a. liquids
  - b. gases
  - c. solids
  - d. fluids
  
3. The unit of electrical charge is the
  - a. coulomb
  - b. joule
  - c. volt
  - d. watt
  
4. When matter changes its state, what happens to its mass?
  - a. it increases
  - b. it decreases
  - c. it remains the same
  - d. it gets hotter
  
5. The conductance of an 8 ohms resistance is
  - a. 12.5 mS
  - b. 8 mS
  - c. 12 S
  - d. 125 mS
  
6. A material that does not allow current under normal conditions is a(n):
  - a. insulator
  - b. conductor
  - c. semi-conductor
  - d. valence

7. Which phase of matter has molecules and atoms packed most tightly together?
- liquid
  - gas
  - solid
  - ice
8. Three hundred joules of energy are consumed in 15 s. the power is
- 2000 W
  - 2 W
  - 20 W
  - 200 W
9. A liquid is poured from a cylinder into a bowl. What happens to its volume?
- it doubles in size
  - it is halved
  - it doesn't change
  - it changes phase
10. Friction can be reduced by:
- using more effort.
  - decreasing the area of contact between two objects.
  - using a lubricant.
  - all of the above
11. What force is involved when a rubber comb attracts small pieces of paper after being rubbed with a cloth?
- Magnetic force.
  - Gravitational force.
  - Friction.
  - Electrostatic force.
12. A ball is given a push in outer space. How far will the ball travel before it stops moving?
- 100 miles unless it hits something.
  - Until it meets an opposing force of the same size and opposite direction.
  - Until the force of friction stops it.
  - Until its weight brings it to earth.
13. When converting 7000 nA to microamperes, the result is
- 0.007  $\mu\text{A}$
  - 0.7  $\mu\text{A}$
  - 700  $\mu\text{A}$
  - 7  $\mu\text{A}$

14. The elastic limit of a material is reached when:
- it breaks.
  - it stretches.
  - it can't return to its original shape and size.
  - it can't be stretched any further.
15. A change in temperature will cause a substance to:
- change its mass.
  - change its weight.
  - change its volume.
  - change its coefficient of expansion.
16. Which of the following metal burns with a bright yellow flame when heated?
- zinc
  - silver
  - sodium
  - magnesium
17. The formula to find  $I$  when the values of  $V$  and  $R$  are known is
- $I=VR$
  - $I=R/V$
  - $V=IR$
  - $I=V/R$
18. The kinetic energy of a liquid increases when:
- its mass changes.
  - its temperature increases.
  - it contracts.
  - it freezes.
19. When a substance expands, it will expand:
- equally in all directions.
  - downward or upward depending on gravity.
  - until it freezes.
  - towards the centre.
20. Which of the following is not an electrical quantity?
- voltage
  - current
  - distance
  - power

**SECTION B****(10 MARKS)**

Write down the question numbers in your answer booklet and beside it write the word(s) that best completes the statement.

- A. Any good conductor has large numbers of free \_\_\_\_\_1\_\_\_\_\_. Free \_\_\_\_\_2\_\_\_\_\_ makes current possible.
- B. The study of the \_\_\_\_\_3\_\_\_\_\_ acting upon objects at rest and the conditions under which these objects will remain at rest is called \_\_\_\_\_4\_\_\_\_\_.
- C. The resistivity of \_\_\_\_\_5\_\_\_\_\_ and \_\_\_\_\_6\_\_\_\_\_ decrease with increase in temperature.
- D. Friction is a \_\_\_\_\_7\_\_\_\_\_ that resists the relative \_\_\_\_\_8\_\_\_\_\_ of surfaces.
- E. Whenever the \_\_\_\_\_9\_\_\_\_\_ force system acting upon an object is zero, the object is in \_\_\_\_\_10\_\_\_\_\_.

**SECTION C****(30 MARKS)**

1. Define the following:
- Relative Permeability
  - Malleability
  - Resistivity
- (3 Marks)
2. Outline the four factors that affect thermal conductivity. (4 Marks)
3. List three characteristics of ionic compound AND three characteristics of covalent compound. (6 Marks)
4. Name three (3) insulators and three (3) conductors used in the electrical industry. (6 Marks)
5. State four electrical properties of a material. (4 Marks)
6. Describe the three (3) laws of friction. (3 Marks)
7. Outline the reactions and explain the changes that take place when magnesium is heated strongly with oxygen. (4 Marks)

**SECTION D****(40 MARKS)**

1. A stone is dropped from an aeroplane. Determine
  - (a) Its velocity after 2 s.
  - (b) The increase in velocity during the third second, in the absence of all forces except that due to gravity.

(6 marks)
2. A body of mass 200 kg lies on a horizontal surface. Find the work done in sliding this body for a distance of 12 m over the surface if the coefficient of friction between the surfaces in contact is 0.35.

(3 marks)
3. A water tank of 3.5 m diameter contains 8 m depth of water. What is the pressure exerted by the water on the base of the tank? ( $\rho = 1000\text{kg/m}^3$ )

(3 marks)
4. The field windings of a generator has a resistance of  $480\ \Omega$  at a temperature of  $60\ ^\circ\text{C}$ . What will be the resistance of the windings when the machine temperature rises on full load to  $85\ ^\circ\text{C}$ ? ( $\alpha_0 = 0.00427$ )

(4 marks)
5. How many units of heat energy are created by a  $25\ \Omega$  resistor connected to a 240 V supply if the supply is left switched on for one hour?

(4 marks)
6. During a research project deep sea photographs were made at a depth of 4 kilometers. (Density of sea water is  $1025\text{kg/m}^3$ ). Calculate the:
  - a. Pressure at this depth.

(3 marks)
  - b. Force on the plane surface of the window of the camera enclosure that measured  $0.45\text{m} \times 0.25\text{m}$ .

(3 marks)
7. An equipment consists of a motor that uses 2 KW of power and a lamp. If the equipment voltage is 240 volts and the current drawn is 3.75 amperes calculate the rating of the lamps in watts.

(2 marks)
8. A 6 KW electric motor is operating at 1200 rpm. Calculate the:
  - a. torque exerted
  - b. efficiency of the motor if the losses were 400 W.

(6 marks)
9. A force of 200N is required to move a box 2.4m along a horizontal surface in 12 seconds. Calculate the amount of work done and the power used.

(2 marks)
10. A certain marble landmark has a mass of 6.2 tonnes cools down from  $85\ ^\circ\text{C}$  to  $30\ ^\circ\text{C}$  and in doing so gives out 2.8 mega joules of heat. What is the specific heat of this marble?

(4 marks)

**THE END**