



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

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

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

**UNIT CODE: EEE325**

**TITLE: MATERIAL SCIENCE FOR ELECTRICIANS**

**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**

**(40 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.

1.    Subdividing water molecules produces two different materials called:
  - a.    atoms
  - b.    molecules
  - c.    elements
  - d.    H<sub>2</sub>O
  
2.    When substances are intermingled without being chemically combined they form:
  - a.    elements
  - b.    chemical
  - c.    matter
  - d.    mixtures
  
3.    Most organic compounds do not dissolve in:
  - a.    water
  - b.    mixtures
  - c.    solutions
  - d.    alcohol
  
4.    One characteristic of metals is that it has:
  - a.    tendency to gain or share electrons
  - b.    gas
  - c.    tendency to lose electrons
  - d.    all of the above
  
5.    The atoms in a \_\_\_\_\_ more readily move in relation to one another and vibrate at a speed dependent on temperature:
  - a.    molecule
  - b.    solids
  - c.    liquids
  - d.    gas
  
6.    Materials such as sand rocks, gravels, metals clays and ceramics are known as:
  - a.    Inorganic materials
  - b.    Organic materials
  - c.    ceramics
  - d.    insulator
  
7.    The instrument best suited to be used to measure voltage across a component:
  - a.    multimeter
  - b.    ammeter
  - c.    megger
  - d.    voltmeter.

8. Brass alloys are alloys of:
  - a. copper and tin
  - b. copper and zinc
  - c. tin and zinc
  - d. all of the above
  
9. The property of any material by which it opposes the flow of electric current is known as:
  - a. voltage
  - b. capacitance
  - c. inductance
  - d. resistance
  
10. Any good conductor would have large numbers of:
  - a. conduction
  - b. resistivity
  - c. protons
  - d. free electrons
  
11. The rate of change in velocity is known as:
  - a. speed
  - b. acceleration
  - c. density
  - d. pressure
  
12. The ability of a material to deform under load and return to its original size and shape when the load is removed.
  - a. brittleness
  - b. ductility
  - c. elasticity
  - d. hardness
  
13. One method of preventing corrosion is by.
  - a. washing
  - b. heating
  - c. cooling
  - d. galvanising
  
14. The best conductors of heat are:
  - a. liquids
  - b. gases
  - c. plastics
  - d. metals

15. \_\_\_\_\_ is the term used to denote the effect of a force producing or tending to produce rotation of a body about a point.
- friction
  - torque
  - tenacity
  - work
16. The area under the velocity –time graph gives:
- acceleration
  - average speed
  - time spent
  - distance covered
17. The ratio of the power output to the power input as a percentage is:
- machine loss
  - power input
  - power output
  - efficiency
18. Plain carbon steel is defined as alloys of iron and \_\_\_\_\_ both combined at all times.
- carbon
  - zinc
  - copper
  - lead
19. The density of a liquid is defined as its:
- distance per time
  - volume per weight
  - mass per unit area
  - Mass per unit volume.
20. Pressure within a body of liquid depends upon two factors:
- distance and depth
  - density and depth
  - voltage and current
  - type of material and density
21. Which of the following pure metals is the best conductor of electricity:
- copper
  - Gold
  - Silver
  - Aluminium
22. Which of the following statements represent ohm's law?
- Current / potential difference = constant
  - Potential difference / current = constant
  - Potential difference = current / resistance
  - = resistance x potential difference

23. The unit of current is:
- Ampere
  - watt
  - voltage
  - coulomb
24. The potential difference required to pass a current 0.3 A in a wire of resistance 30W is
- 90V
  - 100V
  - 3V
  - 30V
25. The resistance of an electric bulb drawing 3A current at 240 V is
- 100W
  - 50W
  - 80W
  - 120W
26. The unit of resistivity is:
- ohm/meter
  - ohm and meter
  - ohm
  - meter
27. Two resistances of 2 ohms and 8 ohms are connected in parallel. The overall resistance will be:
- 16 ohms
  - 10 ohms
  - 1.0 ohms
  - 1.6 ohms
28. According to the kinetic-molecular theory, particles of matter are in motion in:
- gas
  - liquid
  - solid
  - water
29. Suppose you take a trip that covers 180 km and takes 6 hours to make. Your average speed is:
- 60km/h
  - 30km/h
  - 3km/h
  - 6km/h

30. The Ductility is the property of a material due to which it:
- can be drawn into wires
  - breaks with little permanent distortion exactly in the middle
  - can be rolled or hammered into thin sheets.
  - cut another metal
31. Power is the:
- ability to work
  - wanting to work
  - current multiplied by resistance
  - rate of doing work.
32. The ability of an insulating material to withstand physical breakdown is known as:
- di-electric strength
  - conductivity
  - physics
  - insulator
33. Two losses in a machine:
- vibration and noise
  - friction and windage
  - noise and pollution
  - copper and pollution.
34. Two types of mixtures are:
- strong and light
  - strong and dark
  - homogeneous and heterogenous
  - homogenous and strong
35. One of the characteristic of covalent compound is that it is composed of:
- irons
  - solvents
  - water
  - molecules
36. The negatively charged particle of an atom is known as:
- electrons
  - protons
  - neutrons
  - molecules
37. The smallest part of an element is known as:
- molecule
  - atom
  - element
  - all of the above

38. Heat energy required to raise the temperature of a mass of 1kg through one degree Kelvin is known as:
- resistivity
  - specific heat capacity
  - gravity
  - kelvin
39. Whenever we attempt to slide one object over another, our efforts are opposed by the force of:
- repulsion
  - friction
  - attraction
  - wind
40. Materials that conduct electricity quite easily are called:
- insulators
  - semi-conductors
  - conductors
  - all of the above

**SECTION B**

**(60 MARKS)**

- Outline four factors that affect the resistance of a conductor AND also explain relationship with reference to resistance.  
(4 Marks)
- Outline four main groups of ceramic materials.  
(4 Marks)
- Three forces acting outwards from a point are spaced  $120^\circ$  apart from each other.  $F_1 = 55\text{N}$ ,  $F_2 = 25\text{N}$  and  $F_3 = 105\text{N}$ , find the resultant force acting at a point.  
(6 Marks)
- Calculate the uniform acceleration of a sports car which:
  - Starts from rest and reaches a speed of 20 m/s in 8 sec.
  - Changes its speed from 25 m/s to 35 m/s in 3 sec
  - Starts from rest and goes a distance of 100m in 10 sec
  - Starts from rest and travel a distance of 25m during the fifth (5th) sec of its motion.
  - Slows down from a speed of 66m/s and comes to rest in 12 sec.
 (10 marks)
- The field windings of a generator has a resistance of  $145\ \Omega$  at a temperature of  $20^\circ\text{C}$ . What will be the resistance of the windings when the machine temperature rises on full load to  $80^\circ\text{C}$ ? ( $\alpha_0 = 0.00427$ )  
(3 Marks)
- A solid block 300mm x 250mm x 200mm is immersed in water; calculate the buoyant force acting on the block. (Density of water  $1000\text{kg/m}^3$ )  
(3 Marks)

7. Draw the graph of pressure versus temperature (water) and clearly show the following:
- critical point
  - solid state
  - triple point
  - gas state
  - liquid state
- (10 Marks)
8. A stone is thrown vertically upwards with a velocity of 3m/s .Find:
- The maximum height reached.
  - Time taken to reach the maximum height
  - Total time of the flight
  - Time taken to reach 10m above the ground on its way down
  - What will be the velocity of the stone as it strikes on its way down?
- (10 Marks)
9. A 3 KW electric motor is operating at 1200rpm. Calculate the:
- torque exerted
  - The efficiency of the motor if the losses were 250W.
- (6 marks)
10. A certain marble landmark has a mass of 2.8 tonnes (2800 kg) cools down from 50<sup>o</sup>C to 30<sup>o</sup>C and in doing so gives out 1.5 mega joules of heat. What is the specific heat of this marble?
- (4 marks)

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*The End*