



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 (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. In the structure of the atom the negatively charged particle is the:
 - a. electrons
 - b. protons
 - c. neutrons
 - d. nucleus

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. In dead mild steel the carbon content is deliberately kept as low as possible so that the steel will have:
- high ductility
 - high strength
 - more resistance
 - greater capacity.
8. Brass alloys are alloys of:
- copper and tin
 - copper and zinc
 - tin and zinc
 - all of the above
9. The property of any material by which it opposes the flow of electric current is known as:
- voltage
 - capacitance
 - inductance
 - resistance
10. Any good conductor would have large numbers of:
- conduction
 - resistivity
 - protons
 - free electrons
11. The rate of change in velocity is known as:
- speed
 - acceleration
 - density
 - pressure
12. The ability of a material to suffer indentation or penetration without fracture is known as:
- brittleness
 - ductility
 - softness
 - hardness
13. _____ contains very few or no free electrons.
- conductors
 - insulators
 - semi-conductors
 - All of the above

14. The best conductors of heat are:
- liquids
 - gases
 - plastics
 - 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. The rate of change of velocity is known as:
- gravity
 - velocity
 - acceleration
 - motion
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

SECTION B

MATCHING

(10 MARKS)

Match Column A with Column B

Write down the correct identifying alphabet of column B alongside the numbers of column A

Column A

1. Power
2. Mixtures
3. Ceramics
4. Ductility
5. Gas
6. Oxidation
7. Di-electric strength
8. Deceleration
9. Covalent compound
10. Losses in a machine

Column B

- A. The ability of a material to be drawn out to a small cross section.
- B. neither have definite volume nor shape.
- C. the addition of oxygen to a substance.
- D. ability of an insulating material to withstand physical breakdown.
- E. slowing down of an object.
- F. friction and windage
- G. composed of molecules
- H. inorganic materials e.g. porcelain high voltage insulators.
- I. Hetrogeneous and homogeneous.
- J. is the rate of doing work.

SECTION C**(30 MARKS)**

1. Define the following:
 - Dielectric Strength
 - Conductivity(2 Marks)
2. Outline four factors that affect the resistance of a conductor AND also explain relationship with reference to resistance.
(4 Marks)
3. List three characteristics of ionic compound AND three characteristics of covalent compound.
(6 Marks)
4. Name FOUR (4) insulators and their specific applications in the electrical industry.
(6 Marks)
5. Outline four main groups of ceramic materials.
(4 Marks)
6. What are the three (3) factors which governs the rate of corrosion?
(3 Marks)
7. List down the four (4) physical properties of materials.
(4 Marks)

SECTION D **(40 MARKS)**

1. Three forces acting at a point are spaced 120° apart from each other. $F_1 = 55\text{N}$, $F_2 = 65\text{N}$ and $F_3 = 75\text{N}$, find the resultant force acting at a point.
(6 Marks)
3. Calculate the uniform acceleration of a sports car which:
 - (a) Starts from rest and reaches a speed of 20 m/s in 8 sec .
 - (b) Changes its speed from 25 m/s to 35 m/s in 3 sec
 - (c) Starts from rest and goes a distance of 100m in 10 sec
 - (d) Starts from rest and travel a distance of 25m during the fifth (5th) sec of its motion.
 - (e) Slows down from a speed of 66m/s and comes to rest in 12 sec .(8 marks)
3. The field windings of a generator has a resistance of $145\ \Omega$ at a temperature of 20°C . What will be the resistance of the windings when the machine temperature rises on full load to 80°C ? ($\alpha_0 = 0.00427$)
(4 Marks)
4. A solid block $300\text{mm} \times 250\text{mm} \times 200\text{mm}$ is immersed in water; calculate the buoyant force acting on the block. (Density of water 1000kg/m^3)
(3 Marks)
5. During a research project deep sea photographs were made at a depth of 7 kilometers. (Density of sea water is 1025kg/m^3). Calculate the:

- a) Pressure at this depth
- b) force on the plane surface of the window of the camera enclosure that measured 0.14m x 0.14m

(5 marks)

6. A stone is thrown vertically upwards with a velocity of 3m/s .Find:

- a) The maximum height reached.
- b) Time taken to reach the maximum height
- c) Total time of the flight
- d) Time taken to reach 10m above the ground on its way down
- e) What will be the velocity of the stone as it strikes on its way down?

(5 Marks)

7. A 3 KW electric motor is operating at 1200rpm. Calculate the:

- a. torque exerted
- b. The efficiency of the motor if the losses were 250W.

(5 marks)

8. A certain marble landmark has a mass of 2.8 tonnes (2800 kg) cools down from 50 °C to 30 °C and in doing so gives out 1.5 mega joules of heat. What is the specific heat of this marble?

(4 marks)

The End