NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF SCIENCE AND TECHNOLOGY EDUCATION

DEPARTMENT OF TECHNICAL AND ENGINEERING EDUCATION AND TRAINING

PTE 6247 MATERIAL TECHNOLOGY

Main Examination

November 2024

This examination paper consists of 3 pages

Time Allowed: **3 Hours**

Total Marks: **100**

Examiner's Name: **Mr.T. Muzari**

External Examiner: **Dr. C. Kahanji**

INSTRUCTION AND INFORMATION TO THE CANDIDATE

1. Answer **Question 1(compulsory)** and any other three.
2. Each question is worth 25marks.
3. Use of calculators is permissible.

MARK ALLOCATION

QUESTION	MARKS
1	25
2	25
3	25
4	25
5	25
Total marks attainable by the candidate	100

Question 1

a) Distinguish smart materials from advanced materials. **[4]**

b) Clarify different properties classifications of materials that determine their applicability. **[6]**

c) Describe the components of the discipline of materials science and engineering and their interrelationship. **[5]**

d) With illustrations briefly cite the main differences between ionic, covalent, and metallic bonding. **[5]**

e) Provide the psychological and physical benefits of bionics technology to humanity **[5]**

Question 2

a) Differentiate a cyborg from a robot and cite related functions for each in material technology discourse. **[10]**

b) Describe the genetic engineered human and its technological capabilities. **[15]**

Question 3

a) Define hybrid materials. **[5]**

b) Explain the commonly used methods of classification of hybrids. **[10]**

c) Describe the embedded concept of hybrid material formation. **[10]**

Question 4

a) Describe three general factors that determine the properties of a composite material. **[5]**

b) Differentiate hybrid composite from advanced composite. **[5]**

c) A fiberglass composite consists of a matrix of vinyl ester and reinforcing fibers of E-glass. The volume fraction of E-glass = 30%. The density of the vinyl ester = 0.882 g/cm^3, and its modulus of elasticity = 3.60 GPa. The density of E-glass = 2.60 g/cm^3, and its modulus of elasticity = 76.0 GPa. A section of composite 1.00 cm by 25.00 cm by 200.00 cm is fabricated with the E-glass fibers running longitudinal in the 200-cm direction. Assume there are no voids in the composite.

Determine the

i. mass of vinyl ester in the section **[5]**

ii. mass of E-glass fibers in the section **[5]**

iii. density of the composite **[5]**

Question 5

a) Describe the concept of material emissions and its effects on sustainable environmental management. **[10]**

b) Citing examples, critically examine the role of green chemistry in sustaining the world we all want. **[15]**

END OF EXAMINATION