| QUALIFICATION :   **BACHELOR OF SCIENCE HONOURS** | |
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| QUALIFICATION CODE: **08BOSH** | LEVEL: **8** |
| COURSE: **MATERIALS PHYSICS** | COURSE CODE:  **MAP821S** |
| DATE: **NOVEMBER 2024** | SESSION: **1** |
| DURATION:  **3 HOURS** | MARKS: **100** |

## SECOND OPPORTUNITY/SUPPLEMENTARY: QUESTION PAPER

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| **EXAMINER:** | Professor Dipti Ranjan Sahu |
| **MODERATOR:** | Dr Zivayi Chiguvare |

### INSTRUCTIONS

1. Answer all questions on the separate answer sheet.
2. Please write neatly and legibly.
3. Do not use the left side margin of the exam paper.  This must be allowed for the examiner.
4. No books, notes and other additional aids are allowed.
5. Mark all answers clearly with their respective question numbers.

### PERMISSIBLE MATERIALS:

1. Non-Programmable Calculator

**This paper consists of 3 pages including this front page**

**QUESTION 1:**                                                                 **[20 MARKS]**

1.1     What is the difference between engineering stress and true stress in a tensile test?     (4)

1.2     Classify various engineering materials     (5)

1.3     What is dislocation, explain various types of dislocation     (8)

1.4     A cylindrical specimen of steel having an original diameter of 12.8 mm is tensile     (3)
        tested to fracture. If its cross-sectional diameter at fracture is 10.7 mm, determine
        the ductility in terms of percent reduction in area


**QUESTION 2:**                                                                 **[20 MARKS]**

2.1     How optical materials are classified, mention different type optic materials     (4)

2.2     The attenuation in optical fiber is 3.6dB/Km. What fraction of its initial intensity remain
        after 1.5Km     (6)

2.3     How do porosity and grain size affect the tensile strength of ceramic materials?     (4)

2.4     Define Laser and mention three application of laser     (6)


**QUESTION 3:**                                                                 **[20 MARKS]**

3.1     Which factors affect thermal shock resistance     (4)

3.2     Which of a linear polyethylene (Mn = 450,000 g/mol) and a lightly branched polyethylene
        (Mn = 650,000 g/mol) has the higher thermal conductivity? Why?     (4)

3.3     The thermal conductivity of a plain carbon steel is greater than for a stainless steel.
        Why is this so?     (4)

3.4     Explain thermal stresses phenomenon     (6)

3.5     A blacksmith fixes iron ring on the rim of the wooden wheel of a bullock cart. The
        diameter of the rim and the iron ring are 5.243 m and 5.231 m respectively at 27 °C.
        To what temperature should the ring be heated so as to fit the rim of the wheel?     (2)

**QUESTION 4:**                                                      **[20 MARKS]**

4.1     What is space charge polarisation, explain                              (6)

4.2.    Calculate the saturation magnetization for Ni ferrite. The lattice parameter of a cubic
        unit cell of Ni ferrite is 0.835nm and the magnetic moment per unit cell is $18.4\mu_B$.     (4)
        Given Bohr magneton $9.27 \times 10^{-24}$.

4.3     Why is $BaTiO_3$ used for high-value, small, flat-disk capacitors? How is the         (6)
        capacitance of $BaTiO_3$ capacitors varied? What are the four major stages in the
        manufacture of a flat-disk ceramic capacitor?

4.4     Explain hysteresis behaviour in ferromagnetic materials                  (4)


**QUESTION 5:**                                                      **[20 MARKS]**

5.1     What are the different types of polymers?                              (3)

5.2     Give one example of
        (a) addition polymer, (b) condensation polymer, (c) copolymer          (3)

5.3     Define the glass transition temperature.                              (2)

5.4     Distinguish between traditional and engineering ceramic materials and give examples of
        each.                                                              (6)

5.5     What are the functions of a matrix in a composite        ?              (6)

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**END OF QUESTION PAPER**