

MPHE-025

ASSIGNMENT BOOKLET

**M.Sc. (Physics) Programme
(MSCPH)**

MATERIALS SCIENCE

Valid from 1st January, 2026 to 31st December, 2026



**School of Sciences
Indira Gandhi National Open University
Maidan Garhi, New Delhi-110068
(2026)**

Dear Student,

Please read the section on assignments in the Programme Guide for M.Sc. (Physics). A weightage of 30 per cent, as you are aware, has been earmarked for continuous evaluation, **which would consist of one tutor-marked assignment** for this course. The assignment is in this booklet. The total marks for this assignment is 100, of which 40 marks are needed to pass it.

Instructions for Formatting Your Assignments

Before attempting the assignment please read the following instructions carefully:

- 1) On top of the first page of your answer sheet, please write the details exactly in the following format:

ENROLMENT NO.:

NAME:

ADDRESS:

COURSE CODE:

COURSE TITLE:

ASSIGNMENT CODE:

STUDY CENTRE: **DATE:**

PLEASE FOLLOW THE ABOVE FORMAT STRICTLY TO FACILITATE EVALUATION AND TO AVOID DELAY.

- 2) Use only foolscap size writing paper (but not of very thin variety) for writing your answers.
- 3) Leave 4 cm margin on the left, top and bottom of your answer sheet.
- 4) Your answers should be precise.
- 5) **Submit the complete assignment answer sheets containing Part A and Part B, within the due date.**
- 6) The assignment answer sheets are to be submitted to your Study Centre as per the schedule. **Answer sheets received after the due date shall not be accepted. We strongly suggest that you retain a copy of your answer sheets.**
- 7) This assignment is **valid from 1st January 2026- 31st December 2026**. If you have failed in this assignment or fail to submit it by December, 2026, then you need to get the assignment for the year 2027, and submit it as per the instructions given in the Programme Guide.
- 8) **You cannot fill the examination form for this course** until you have submitted this assignment. For any queries, please contact: sgokhale@ignou.ac.in or slamba@ignou.ac.in. Please note that we do not provide answers to the questions asked in this Assignment.

We wish you a good luck.

Tutor Marked Assignment

MATERIALS SCIENCE

Course Code: MPHE-025

Assignment Code: MPHE-025/TMA/2026

Max. Marks: 100

Note: Attempt all questions. The marks for each question are indicated against it.

PART A

1. a) Common types of engineering materials are metals, ceramics, polymers and composites. Compare these four classes on the basis of their composition and any two properties. State one application of each type. (10)
- b) With the help of appropriate diagrams describe the possible ways of accommodating the added alloying elements into a pure metal lattice for the following cases:
 - i) Limited solubility
 - ii) Good solubility. (2+3)
2. a) Explain the difference between chemical vapour deposition and physical vapour deposition. What are the requirements of a material to be used as a holder for the charge in a thermal evaporation system? Mention any three materials used for the purpose. (3+1+1)
- b) Given that the density of molten Ge is 5.60 g cm^{-3} calculate the amount of boron required to obtain 10 kg *p*-type Ge with dopant concentration of 10^{17} cm^{-3} . Take density of boron = 2.34 g cm^{-3} , atomic weight of boron = 10.811 and $k_0 = 0.8$. (5)
- c) What is green compaction in powder processing? How is the porosity of compacted piece reduced? (5)
- d) How do the interactions between the substrate and adsorbate atoms determine the growth mode of thin films? Describe the various modes of thin film growth. (2+3)
3. a) Describe the various methods of creating point defects. Discuss the constructive (positive) effect of dislocations in materials. (3+2)
- b) Write the symmetries associated with the following 2-D defects:
 - i) Grain Boundary
 - ii) Twin Boundary
 - iii) Stacking Fault (3)
- c) In the inclined crystal plane arrange the following sites in the order of increasing possibility of crystal growth site: terraces, kinks, ledges. (2)
- d) What is F centre defect? Why is there a characteristic absorption energy associated with the F centre? If the F centre absorption energy for CsCl is 2.0 eV, what is its characteristic absorption wavelength? (5)

PART B

4. a) Explain Fick's diffusion laws. (5)
- b) The enthalpy of vacancy formation in nickel is 167 kJ mol^{-1} , and its melting point is 1728 K. What is the equilibrium vacancy concentration in nickel at 1000 K ? (5)
- c) Explain Lever rule with appropriate diagram. (5)
5. a) Differentiate between Avrami and Johnson-Mehl models of phase transformations. (5)
- b) Explain the Austenite to Martensite diffusionless transformation with example. (5)
6. a) Describe the method of performing Vicker's hardness test with appropriate diagram. (4)
- b) Why are the metals opaque to visible light and transparent to x-rays and gamma rays? (2)
- c) What is luminescence of a material? Differentiate between fluorescence and phosphorescence. (4)
7. a) Differentiate between ferromagnetism, antiferromagnetism and ferrimagnetism with examples. State the physical significance of magnetic anisotropy. (3+2)
- b) What are Fullerenes? Describe any two applications of Fullerenes. (3+2)
- c) Explain the working of organic LED. (5)
