

Reg. No. :

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Question Paper Code : 82029

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2025.

Second Semester

Mechanical Engineering

PH 3251 — MATERIALS SCIENCE

(Common to : Aerospace Engineering/Automobile Engineering/
Industrial Engineering/Industrial Engineering and Management/
Manufacturing Engineering/Marine Engineering/Mechanical Engineering
(Sandwich)/Mechanical Engineering (Specialised in Automobile)/Mechanical
Engineering (Specialised in Smart Manufacturing)/Production Engineering/
Safety and fire Engineering)

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is a Crystal defect?
2. Define Burger vector.
3. Give two postulates of classical free electron theory of metal.
4. What is electrical conductivity?
5. Write about the mobility of charge carriers.
6. What is Fermi level?
7. What are Optical materials?
8. Mention the principle of working of a solar cell.
9. Define Quantum confinement.
10. Write the types of Carbon nanotubes.

PART B — (5 × 16 = 80 marks)

11. (a) What is packing factor? Explain about Packing factor for SC, BCC and FCC Structure.

Or

- (b) (i) Explain edge dislocations and screw dislocations.
(ii) Discuss the grain and twin boundaries in crystals.
12. (a) (i) Derive an expression for thermal conductivity using classical free electron theory. (8)
(ii) Distinguish Dia, Para and Ferro magnetic materials with examples. (8)

Or

- (b) Explain an expression for density of energy states for a conducting material.
13. (a) (i) What is intrinsic semiconductor? Describe an expression for the carrier concentration in intrinsic semiconductor. (12)
(ii) Differentiate intrinsic and extrinsic semiconductors. (4)

Or

- (b) (i) Discuss the variation of Fermi level with temperature in an intrinsic semiconductor. (6)
(ii) What is Hall effect? Describe an experimental arrangement to measure the Hall coefficient. (10)
14. (a) (i) With neat diagram, explain the construction and working of the solar cell. (8)
(ii) Describe the working of laser diode with necessary diagrams. (8)

Or

- (b) (i) Discuss the working of OLED. (6)
(ii) Explain the principle, construction and working of LED. (10)
15. (a) (i) Discuss in detail about the density of states in quantum well and quantum wire structures. (8)
(ii) Explain the working of Resonant Tunneling Diode. (8)

Or

- (b) (i) Describe the construction and working of Single Electron Transistor with the help of diagrams. (8)
(ii) Explain the operation of carbon nanotube transistor. (8)