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Reg. No. :

Name :



Fourth Semester M.Sc. Degree Examination, March 2021

PHYSICS

SPECIAL PAPER II

PH 243 M : MATERIALS SCIENCE II

(2018 Admission Onwards)

Time : 3 Hours

Max. Marks : 75

PART - A

Answer **any five** questions. Each question carries **3** marks.

- I. (a) Explain the term electrostriction effect".
- (b) What are dielectrics?
- (c) Distinguish between radiative and non-radiative processes.
- (d) Explain the concept of a phonon.
- (e) What is Fermi gas?
- (f) Explain CVD technique.
- (g) What are fullerenes?
- (h) Explain split gate technology.

(5 × 3 = 15 Marks)

P.T.O.



PART – B

Answer **all** questions. Each question carries **15** marks.

- II. (A) Discuss in detail the various photonic properties exhibited by materials.

OR

- (B) Explain Seebeck effect and Peltier effect. Obtain the Thomson relation for a thermoelectric material. What is meant by figure of merit?

- III. (A) Describe in detail the fabrication of IC chips.

OR

- (B) Discuss the working of IR detector and quantum dot lasers with suitable diagrams.

- IV. (A) Discuss any three techniques used for the synthesis of nanomaterials.

OR

- (B) Describe the working principle of X-ray diffraction, FT-IR spectroscopy and Raman spectroscopy.

(3 × 15 = 45 Marks)

PART – C

Answer **any three** questions. Each question carries **5** marks.

- V. (a) The Fermi energy of a metal is 10 eV. Determine
- (i) the average energy of free electrons in the metal at 0K and
 - (ii) the corresponding classical temperature.



- (b) Explain the concept of MEMS in nanotechnology.
- (c) Evaluate the energy values of the first and second excited states of electrons in finite quantum well of size 10 nm in units of $(\frac{\hbar^2}{m^*})$ and sketch out the wavefunctions corresponding to $n = 1$ and $n = 2$ states.
- (d) What are Tauc plots? What is its significance?
- (e) Give a short account on tunnelling and tunnel junctions.
- (f) Explain any one lithographic technique with suitable diagrams.

(3 × 5 = 15 Marks)

