

Total No. of printed pages = 4

PH 181101

20/IV/18

Roll No. of candidate

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Azara, Hatkhowapara,
Guwahati -781017

2018

B.Tech. 1st Semester End-Term Examination

PHYSICS – 101

(New Regulation) (w.e.f. 2017-2018)

(New Syllabus) (w.e.f. 2018-2019)

(GROUP-B)

Full Marks – 70

Time – Three hours

The figures in the margin indicate full marks
for the questions.

Answer Question No.1 and any *four* from the rest.

(10 × 1 = 10)

1. (i) The Curl of a Physical quantity highlights its _____ properties.
- (ii) Ampere's Circuital Law is valid for _____ current only.
- (iii) The condition for Achromatism for two lenses in contact is given by the equation _____
- (iv) Multipath time dispersion can be minimized in a _____ optical fibre.
- (v) Optical pumping in a LASER is done to achieve _____.

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- (vi) Holography is the phenomenon of creating a _____ dimensional image of an object.
- (vii) Density of states of the valence band, N_v is proportional to _____
- (viii) In silicon, Band splitting takes place for the states _____ and _____
- (ix) The temperature, below which a material in normal state goes into superconducting state, is known as the _____ temperature.
- (x) The magnetic susceptibility χ for diamagnetic materials is _____
2. (a) State the four Maxwell's equations in differential form and write their physical significances.
- (b) Draw the (B-H) curve for a ferromagnetic material. What do you mean by retentivity and coercivity of the material?
- (c) If A be a vector field represented by $\vec{A}(x, y, z) = 3x\hat{i} - y^3z^2\hat{j}$. Find $\nabla \cdot \vec{A}$ and $\nabla \times \vec{A}$ at a point $(1, -2, -1)$. (6 + 5 + 4 = 15)
3. (a) What is spherical aberration? Describe how spherical aberration can be minimized by using two Plano convex lenses separated by a distance.
- (b) Draw a neatly labelled diagram to show the experimental set up for formation of Newton's Rings.

- (c) In a Newton's Rings setup, the diameter of the 4th ring was found to be 0.4 cm and that of 24th ring was 0.8 cm and radius of curvature of the plano-convex lens is 100 cm. Calculate the wavelength of the light used. (7 + 4 + 4 = 15)
4. (a) What are Einstein's coefficients? Derive the expression for the ratio of the coefficients.
- (b) Write few applications of LASER.
- (c) Discuss in brief the working of semiconductor laser. (7 + 4 + 4 = 15)
5. (a) Discuss in detail the characteristics of step index and graded index optical fibre with suitable diagrams.
- (b) What do you mean by angle of acceptance and numerical aperture of an optical fibre?
- (c) The refraction indices of the core and the cladding of an optical fibre are 1.50 and 1.47 respectively. Calculate the acceptance angle and numerical aperture. (7 + 4 + 4 = 15)
6. (a) Derive the time dependent Schrodinger's equation.
- (b) Define Group velocity and Phase velocity in a travelling wave.
- (c) The uncertainty in time of an excited atom is about 10^{-8} s. What are the uncertainties in energy and frequency of the radiation? (7 + 4 + 4 = 15)

7. (a) Write short notes on :
- (i) LED and
 - (ii) Solar cell.
- (b) What do you mean by Meissner effect in superconductivity?
- (c) Calculate the critical current for a superconducting wire of Lead (Pb) having diameter of 1 mm at temperature 4.2°K . Given T_c for Pb = 7.18°K and $H_c(0) = 6.5 \times 10^4 \text{ A/m}$.
(8 + 3 + 4 = 15)
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