Total No. of printed pages = 4

PH 181101

Roll No. of candidate

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

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

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

$(10 \times 1 = 10)$

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 an 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 care 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 $H_c(0) = 6.5 \times 10^4$ A/m.

$$(8 + 3 + 4 = 15)$$