

Please check that this question paper contains \_\_\_\_\_ questions and \_\_\_\_\_ printed pages within first ten minutes.

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Uni. Roll No. ....

Program: B.Tech. (Batch 2018 onward)

Semester: 1

Name of Subject: Physics

Subject Code: BSC-101

Paper ID: 15925

Time Allowed: 03 Hours

Max. Marks: 60

**NOTE:**

- 1) Parts A and B are compulsory
- 2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
- 3) Any missing data may be assumed appropriately

**Part – A**

[Marks: 02 each]

**Q1.**

- a) What you understand by simple harmonic motion? Give examples.
- b) What is the Physical signification of wave function ?
- c) Differentiate between intrinsic and extrinsic semiconductors.
- d) Write Maxwell's equations in differential form.
- e) Describe how Laser radiation is different from ordinary light ?
- f) What is the concept of displacement current?

**Part – B**

[Marks: 04 each]

**Q2.** Solve the Schrodinger equation for one dimensional motion of a particle in a box of side L and show that its eigenvalues is inversely proportional to the square of side L.

**Q3.** Compare the properties of diamagnetic, paramagnetic and ferromagnetic materials.

**Q4.** Calculate the value of  $\vec{\nabla} \cdot (r^2 \vec{r})$  where  $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ .

**Q5.** Prove by mathematical analysis that the mechanical energy of free oscillations of a simple harmonic oscillator is conserved.

**Q6.** Discuss the propagation mechanism of light waves in optical fiber.

**Q7.** Define damped harmonic oscillations. Solve its differential equation and discuss special cases of oscillatory motion.

## Part – C

[Marks: 12 each]

Q8. (i) Describe the Constuction and working mechanism of ruby laser. Also explain why He-Ne laser is superior to a ruby laser?

(ii) Calculate the refractive indices of the core and cladding material of a fiber from the following data:  $NA=0.22$ , relative refractive index is  $0.012$ , where  $NA$  is numerical aperture.

OR

(i) . Deduce maxwell's equations using basic laws of electricity and magnetism.

(ii) Given  $\vec{A} = x^2y \hat{i} + (x - y)\hat{k}$ . Find  $\vec{\nabla} \times \vec{A}$  and  $\vec{\nabla} \cdot \vec{A}$

Q9. (i) Show that Fermi level in case of intrinsic semiconductor lies in the middle of conduction and valence band. Also explain its variation with temperature.

(ii) The wave function of a certain particle is  $\Psi=A\cos^2x$  for  $-\pi/2 < x < \pi/2$ . Find the value of  $A$ . Also find the probability that a particle be found between  $x=0$  and  $x=\pi/4$ .

(iii) What do understand by damped and undamped Oscillations

OR

(i) Explain the terms Meissner effect and London penetration depth in superconductors Also discuss some applications of Meissner effect.(HOTS)

(ii) Write some important applications and risks of nano materials.

(iii) Determine the penetration depth in mercury at  $0K$  , if the critical temperature of mercury is  $4.2K$  and the penetration depth is  $57 \text{ nm}$  at  $2.9K$ .

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