

Code : 221101

B.Tech 1st Semester Examination, 2016

Physics

Time : 3 hours

Full Marks : 70

Instructions :

- (i) There are Nine Questions in this Paper.
- (ii) Attempt five questions in all.
- (iii) Question No. 1 is Compulsory.
- (iv) The marks are indicated in the right-hand margin.
- (v) Symbols used (in any) have their usual meaning

1. Answer any seven questions: 2×7=14

- (a) Write down Maxwell's equations in differential forms in a free space.
- (b) Define Poynting vector.
- (c) Write down expression for resultant intensity due to Fraunhofer diffraction grating.
- (d) Define population inversion.
- (e) What do you mean by double refraction?
- (f) What do you mean by elliptically polarised light?
- (g) What is photo electric effect?

www.akubihar.com

- (h) Write down Schrodinger's time independent wave equation in one dimension.
- (i) What is length contraction?
- (j) Write down applications of nanotechnology.

2. (a) List the properties of nanomaterials? How nanomaterials are different from their bulk counterparts? Describe any one method used for the synthesis of nanomaterials. 8
- (b) Explain Davisson and Germer experiment. Clearly write down findings of this experiment. 6
3. What are the Einstein's coefficients? Derive their relations. Describe working principle of Helium-Neon laser. 3+3+8=14

4. Write down postulates or special theory of relativity. Derive Lorentz transformation equations for space and time coordinates. Show that when $v \ll c$, then Lorentz transformations converts into Galilean transformations. 2+10+2=14

5. Using Maxwell's equations, show that electromagnetic waves are transverse in nature. If magnitude of \vec{H} in a plane wave is 1 amp/met, find the magnitude of \vec{E} for a plane wave in free space. Express your result with proper units. 10+4=14

[Given; $\mu_0 = 4\pi \times 10^{-7} \frac{H}{m}$; $\epsilon_0 = 8.85 \times 10^{-12} C^2 / Nm^2$]

Code : 221101

2

www.akubihar.com

6. Write short notes on the followings: $3+6+5=14$

- (a) Wave function and its physical significance.
- (b) Derive Schrodinger's time Independent equation.
- (c) The Tunnel effect OR Tunnelling.

7. (a) What is temporal coherence ? $2+12=14$

- (b) Discuss Fraunhofer's diffraction at single-slit. Find the positions of maxima and minima.

8. Explain the following : $2 \times 7 = 14$

- (a) How would you obtain plane polarised light by reflection?
- (b) What are the ordinary and extra-ordinary rays?
- (c) How would you distinguish between unpolarised and plane polarised light?
- (d) Plane of polarisation and plane of vibration.
- (e) How would you distinguish between circularly polarised and unpolarised light?
- (f) How would you distinguish between circularly polarised and elliptically polarised light?
- (g) How will you convert left elliptically polarised light into right elliptically polarised light?

9. (a) Calculate the percentage contraction of a rod moving with a velocity $0.8c$ in a direction indicated at 60° to its own length.

6

(b) Find the stored energy in a system of three equal charges, $Q = 2 \text{ nC}$, arranged in a line with 0.5 m separation between them. 4

(c) Which of the following cannot have physical significance in the interval shown ? Why not ? 4


