8. (a) Describe various methods for the synthesis of nanoparticles. 6

(b) Discuss the wide applications of nanotechnology. AKUBIHAR.COM 8

9. Write notes on : 7+7=14

(a) Single-slit diffraction

(b) Poynting theorem

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Code : 221101

2012

PHYSICS

Time : 3 hours *Full Marks* 70

Instructions :

(i) The marks are indicated in the right-hand margin.

(ii) There are ***NINE*** *questions in this paper.*

(iii) Attempt ***FIVE*** *questions in all.*

(iv) Question No. ***1*** *is compulsory.*

1. Answer any *seven* questions : 2×7=14

(a) Write the expression for relativistic mass.

(b) Write the postulates of Einstein's special theory of relativity.

(c) Find the differential form of Gauss's theorem.

(d) Write the wavelength of a scattered photon for Compton scattering.

(e) Express normalized wave function mathematically. AKUBIHAR.COM

(f) Write an electric and a magnetic field equations for an electromagnetic wave in free space.

(g) Define population inversion in laser.

(h) What is grating element?

(i) Find the Brewster angle for the glass ($\mu = 1 \cdot 732$).

(j) Write about de Broglie wavelength.

2. (a) Derive the Maxwell four equations in integral and differential forms. 6

(b) Find the boundary conditions for electric field vector for an interface separated by two dielectric media. 8

3. (a) For what velocity the mass of a particle becomes $\frac{5}{4}$ times the rest mass of it? 6

(b) Derive relativistic length contraction and time dilation using Lorentz transformation. 8

4. (a) Using Compton scattering, derive the wavelength of scattered photon. 6

(b) Derive time independent form of Schrödinger's wave equation. For a free particle of mass m, explain whether the energy will be quantized. 8

  (Continued)

5. (a) What is the highest order spectrum, which may be seen with monochromatic light of wavelength $\lambda = 6000$ Å by means of diffraction grating with 5000 lines/cm? 6

(b) What do you mean by spontaneous and stimulated emissions of radiation? Explain the working of He-Ne laser. 8

6. (a) Describe the process of production of plane-polarized light by reflection. State Brewster's law and give its significance. 6

(b) How would you produce and detect the plane-polarized light and circularly-polarized light? 8

7. (a) Show that the displacement current density between the capacitor plates is given by

$$j_d = \varepsilon_0 \frac{dE}{dt}$$ 6

(b) State and explain Heisenberg's uncertainty principle. Using this principle, show that electron cannot reside in the nucleus. 8

  (Turn Over)