Registration No. :

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B. Tech

BSCP 2101 (Old)

Second Semester (Back) Examination – 2013

PHYSICS – I

BRANCH : ALL

QUESTION CODE : B492

Full Marks – 70

Time : 3 Hours

Answer Question No. 1 which is compulsory and any five from the rest.
The figures in the right-hand margin indicate marks.

1. Answer the following questions :   2×10
    (a) Define resonance. How the sharpness of amplitude resonance depend upon damping ?
    (b) In a Newton's ring system, the centre is bright. Is the ring system observed in reflected or transmitted light ? Justify your answer.
    (c) If **E** is an electrostatic field then show that $\nabla \times \mathbf{E} = 0$.
    (d) What is the difference between zone plate and convex lens ?
    (e) State Huygen's principle.
    (f) What are the physical significance of Maxwell's electromagnetic equation in differential form ?
    (g) Write the integral form of the Ampere's circuital law.
    (h) Find the gradient of a scalar $\varphi = xy^2 + \dfrac{y^2}{x} + z^2 + \dfrac{\pi}{2}$ at the point $(-1, 1, -1)$.
    (i) A ball of mass 1 gram has speed of 100 m/sec. Calculate the de-Broglie wavelength associated with it ?
    (j) In Compton effect, under what condition the Compton shift is minimum ?

2. (a) Starting with the differential equation for a damped harmonic oscillator discuss
        (i) Under damped oscillation,
        (ii) Over damped oscillation.
        Represent these oscillation on the displacement-time graph.   6
    (b) What is the physical significance of damping co-efficient ? What is its unit ?   2

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(c) Two simple harmonic oscillators of mass 10 grams and 800 grams oscillate separately under the action of same restoring force. Calculate the ratio of their frequencies. 2

3. (a) Draw the schematic diagram for production of Newton's rings with reflected light. Show that diameter of bright ring is proportional to square root of natural odd number for Newton's ring formed with reflected light. 5

(b) Why very narrow slits are taken in Young's double slit interference experiment ? 2

(c) The diameter of nth dark ring in Newton's ring arrangement is changed from 0.25 cm to 0.16 cm as liquid is introduced between lens and plate. Calculate the refractive index of the liquid. 3

4. (a) What is a zone plate ? Explain the formation of images by a zone plate. Compare its working with that of a converging lens. 5

(b) In a plane transmission grating, the width of each slit is equal to half of the width of the opaque portion. Which order of spectra will be absent ? 2

(c) The principal focus of a positive zero plate is 60 cm for a light of wavelength 6×10^{-5} cm. Compute the radii of first two transparent zones. 3

5. (a) Describe with principle, the construction and working of Nicol Prism. 6

(b) 50 gram of optically active substance is dissolved in 100 ml of water. A plane polarized light when passing through 30 cm of solution suffers a rotation of 39^0 in its plane o polarization. Find specific rotation of the solution. 4

6. (a) Using Stoke's law prove that line integral of position vector over a closed contour is equal to zero. 3

(b) Electromagnetic waves are transverse waves, that means electric vector, magnetic vector and propagation vector are perpendicular to each other. Prove this statement mathematically. 4

(c) Distinguish between displacement current and conduction current ? 3

7. (a) Define scalar and vector potentials and express electric and magnetic fields in terms of these potentials. 4

(b) State and prove Poynting theorem. Explain the physical significance of each term. 6

8. (a) Radiation of wavelength 2400 $\overset{0}{A}$ is incident on a metal surface whose photoelectric work function is 3.2 eV. Calculate the maximum KE of the emitted photoelectrons and the stopping potential. 4

(b) Solve the Schrodinger's time independent equation to find the energy Eigen values of a free particle. 6