

POKHARA UNIVERSITY

Level: Bachelor
 Programme: BE
 Course: Physics

Semester: Fall

Year : 2015
 Full Marks: 100
 Pass Marks: 45
 Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) Define point of oscillation and the radius of gyration in compound pendulum. Also, prove that time-period of any physical pendulum is minimum, not maximum when the length of pendulum is equal to radius of gyration. 9
- b) Calculate frequency of vibration of air particles in plane progressive wave of amplitude 2.18×10^{-10} m and intensity 10^{-10} W/m², the velocity of sound in air is 340 m/s and density of air is 0.00129 gm./cc? 6
2. a) What is interference? Discuss Newton's rings and hence derive an expression for the radius of nth dark ring due to reflected light. And explain why central ring is dark. 9
- b) A soap film 5×10^{-5} cm thick is viewed at an angle of 35° to the normal. Find the wavelength of light in the visible spectrum which will be absent from the reflected light if the refractive index of the soap film is 1.33. 6
3. a) Discuss the design of optical fiber and explain its working principle. 9
- b) Find the potential at the centre of the square having charges 2×10^{-6} C, 3×10^{-6} C, 4×10^{-12} C and -4×10^{-12} C at four corners. 6
4. a) Show that potential, $V \propto \frac{1}{r}$ for electric monopole whereas $V \propto \frac{1}{r^2}$ for electric dipole. Where r is the distance at which potential is to be determined. 9
- b) What is the initial rate of increase of current and final saturation current in RL circuit with $L=15$ mH, $R=24$ Ohm and emf=10 volt? 6

5. a) State Biot-Savart's law. Use it to find the magnetic field due to an infinitely long straight wire. 9
- b) A light beam travelling in x direction is described by electric field $E_y = 300 \sin w \left[t - \frac{x}{c} \right]$. An electron is constrained to move in y direction with speed $2 \times 10^7 \text{ m/s}$. Find maximum electric and magnetic force on electron. 6
6. a) Write the Maxwell's equation in integral form and convert them in its differential form. 9
- b) The fast moving neutron has wave associated with it, whose De-Broglie wavelength is $2 \times 10^{-12} \text{ m}$. Find phase velocity, group velocity and kinetic energy. (Given mass of neutron $1.67 \times 10^{-27} \text{ kg}$)
7. Write short notes on: (**Any two**) 2x5
- a) Piezoelectric effect and Magnetostriction effect.
- b) Band theory of solid.
- c) Lorentz electromagnetic force.

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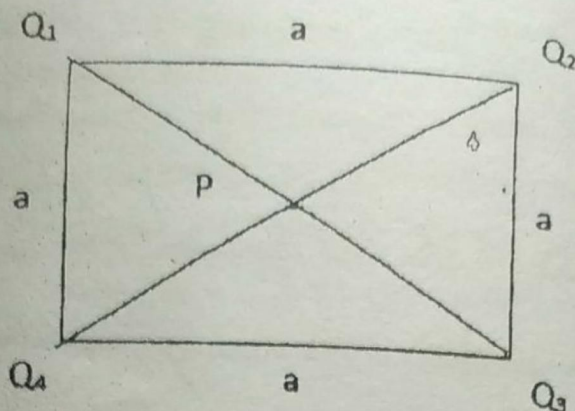
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Attempt all the questions.

- 1) SHM is rarer in nature, why? Derive the time period of bar pendulum and discuss about length of equivalent simple pendulum. 9
- 2) A progressive and stationary, simple harmonic wave having frequency 250 Hz and each having same velocity 30 m/s. 6
 - i. Determine the phase difference between two vibrating points in a progressive wave at a distance of 10 cm.
 - ii. Wave equation of progressive wave if amplitude is 0.03 m.
 - iii. Distance between nodes in stationary wave.
- 3) Define coherent sources and write conditions for sustain interference. Derive the maximum and minimum intensity with the help of analytical treatment of interference of light wave. 9
- 4) If a and b be the slit width and opaque width respectively in Fraunhofer's double slit diffraction experiment, deduce the missing orders. 6
- 5) Define terms population inversion and optical pumping. Explain construction and the working principle of He-Ne Laser. 9
- 6) Derive the expression for Schrodinger time independent wave equation. 6
- 7) Define quadrupole? Find potential and field due to electric quadrupole at a point, not lying along the quadrupole. 9
- 8) What is the potential at the center of the square of the figure. Assume $Q_1 = +1 \times 10^{-8} \text{ C}$, $Q_2 = -2 \times 10^{-8} \text{ C}$, $Q_3 = +3 \times 10^{-8} \text{ C}$, $Q_4 = +2 \times 10^{-8} \text{ C}$ and $a = 1 \text{ m}$. 6



- a) Discuss Maxwell equation in differential form. Also show that electromagnetic wave travels with velocity of light in vacuum. 9
- b) Prove that the equation of continuity, $\nabla \cdot \vec{j} + \frac{\partial \rho}{\partial t} = 0$ 6
- a) Discuss about Lorentz force with example and explain about Hall Effect. 9
- b) A square loop of wire of edge length 'l' carries a current I. Show that at the centre of the loop, the magnitude of magnetic field produced is given by, $B = \frac{2\sqrt{2}\mu_0 I}{\pi l}$ 6

Write short notes on: (Any two)

- a) Difference between Reverberation of sound and echo 2x5
- b) Biasing of Junction diode
- c) Magnetic energy density