

POKHARA UNIVERSITY

Level: Bachelor
Programme: BE
Course: Physics

Semester – Fall

Year : 2012
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. Derive the equation of motion of simple harmonic motion (not in differential form) and discuss the energy conservation in simple harmonic motion. 9
b. Calculate the frequency of vibration of air particle in a plane progressive wave of amplitude 2.18×10^{-10} m and intensity 10^{-10} W/m², the velocity of sound in air is 330 m/s and density of air is 0.001293 g/cm³. 6
2. a. What is thin film? Discuss the interference due to reflection on thin film. 9
b. What distance should the plates each of area $0.2\text{m} \times 0.1\text{m}$ of an air capacitor be placed in order to have same capacitance as a spherical conductor of radius 0.5m? 6
3. a. What is reverberation? Derive Sabine's reverberation formula and explain its significance. 9
b. Prove that the equation of continuity $\vec{\Delta} \cdot \vec{f} + \frac{\partial \rho}{\partial t} = 0$ 6
4. a. What do you mean by capacitance? Derive an expression for current in RC-circuit for both charging and discharging of capacitor. 9
b. Calculate the energy in electron volt of an electron wave of $\lambda = 3 \times 10^{-2}$ m. Given $h = 6.62 \times 10^{-34}$ JS. 6
5. a. Derive the Maxwell's third and fourth equations and write its significance. 9
b. In the Bohr model of H-atom, the electron circulates around the nucleus in a path of radius 5.1×10^{-11} m at a frequency of 6.8×10^{15} 6

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rev/sec. What is the value of magnetic field at the center of orbit?

6. a. State Biot's and savart's law and use it to find the magnetic field at a point on the axis of circular coil. 9
- b. Describe about the spontaneous and stimulated emission. 6
7. Write short notes on **any two**: 5×2
 - a. Extrinsic semiconductor
 - b. Displacement current
 - c. Hall effect

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Programme: B.E
Course: Physics

Semester: Spring

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Attempt all the questions.

1. a) What is S.H.M? Derive an expression for the period and radius of gyration of a compound pendulum and show that centre of oscillation and centre of suspension are interchangeable. 9
b) A wave of frequency 493 Hz has a speed of 353m/sec. $\phi = \omega t + kx$ 6
 - i. How far apart are the two points differing in phase by 55° ?
 - ii. Find the difference in phase between two displacements at the same point but at time differing by 1.12 sec.
2. a) What is the physical significance of wave function ψ ? Derive the Schrödinger's time independent wave equation for a free particle like electron. 9
Or
b) What are Newton's rings? Explain necessary theory for the calculation of diameter of n^{th} rings. Show that the fringe width decreases as increase the order of Newton's ring.
b) Charge is distributed uniformly throughout an infinitely long cylinder of radius R show that E at a distance 'r' from the cylinder axis ($r < R$) is given by $E = \frac{\rho r}{2\epsilon_0}$, where E is electric field Intensity & ρ is the density of charge (C/m^3) 6
3. a) Drive an expression for the growth of current in an LR circuit. 9
b) Calculate the potential and field due to a dipole of dipole moment 4.5×10^{-10} coul/meter at a distance of 1m from it 6
 - i. on it's axis. $E_{\text{axis}} = \frac{2P}{4\pi\epsilon_0 r^3}$
 - ii. on its perpendicular bisector $E_{\text{equator}} = \frac{P}{4\pi\epsilon_0 r^3}$

4. a) Differentiate between spontaneous and stimulated emission. Describe the working principle of He-Ne Laser. 9

Or

Define optical activity. Find the expression for Fraunhofer diffraction at single slit.

- b) A copper strip of 2cm wide and 1.0mm thick is placed in a magnetic field 1.5T. If a current of 200A is setup in the strip, Calculate (i) Hall voltage and (ii) Hall mobility, if the number of electrons per unit volume is $8.4 \times 10^{28} \text{ m}^{-3}$ and resistivity is $1.72 \times 10^{-8} \Omega\text{-m}$. 6

Or

Calculate the magnetic force experienced by a current carrying conductor of length 'l' and cross sectional area 'A' when placed in a uniform magnetic field of strength 'B'.

5. a) What is current density and mobility? Explain the atomic view of resistivity and obtain the relation $\rho = m/ne^2\tau$ 9

Or

State Biot-Savart's Law. Calculate the magnetic field due to long straight conductor.

- b) A circuit has $L = 5\text{mH}$ and $C = 2 \mu\text{F}$. How much resistance must be inserted in the circuit to reduce the resonant frequency by 5%? 6
6. a) What are the significance of Maxwells equations. Using Maxwells equations prove that electromagnetic wave propagates with the speed of the light in free space. 9
- b) The resistivity of carbon at 20°C is $3.5 \times 10^{-5} \text{ ohm-meter}$. A rectangular carbon block has dimension $1\text{cm} \times 1\text{cm} \times 50\text{cm}$. What is the resistance measured: 6
- Between two ends?
 - Between opposing rectangular faces?

7. Write short notes on: (Any two) 2×5

- Superconductor.
- Nicol Prism
- Wave velocity and particle velocity.
- Define ultrasound. What are the properties and uses of ultrasound?