

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
1. 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
2. b. What distance should the plates each of area 0.2m×0.1m 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
3. b. Prove that the equation of continuity $\vec{\nabla} \cdot \vec{J} + \frac{\partial \rho}{\partial t} = 0$ 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
4. 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
5. 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

PHYSICS

- 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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The figures in the margin indicate full marks.

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. $\theta = \omega t + \phi$ 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

1. 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. 6
2. 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
 - 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
 - i. on its axis. $E_{\text{axis}} = \frac{2P}{4\pi\epsilon_0 r^3}$
 - ii. on its perpendicular bisector

$$E_{\text{axis}} = \frac{2P}{4\pi\epsilon_0 r^3}$$

$$E_{\text{equator}} = \frac{P}{4\pi\epsilon_0 r^3}$$

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:
- Between two ends?
 - Between opposing rectangular faces?
- 6

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?

$$T = \frac{0.158 V}{A}$$

$$\begin{aligned} ds &= \\ ds_1 &= \\ \angle &= \end{aligned}$$

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The figures in the margin indicate full marks.

Attempt all the questions.

1. a) What is wave motion? Derive an expression for the intensity of plane progressive wave along a stretched string. 9
 - b) The time of reverberation of an empty hall without and with 500 audiences is 1.5s and 1.4s respectively. Find the reverberation time with 800 audiences in the hall. $T = \frac{0.1658V}{A e^{\text{total absorption}}}$ 6
 2. a) Define coherent source. Dérive the maximum and minimum intensity with the help of analytical treatment of interference of light wave. 9
 - b) The balance wheel of watch oscillates with an angular amplitude of π radian and a period of 0.5 sec. Find:
 - i. Maximum angular speed of wheel. $\omega_m = \theta_m / T$ 6
 - ii. The angular acceleration of wheel when the displacement is $\pi/2$ radian. $\alpha = \omega_m^2 \theta$ 9
 3. a) Find the potential and field due to electric quadrupole. 9
 - b) A 200 mm long tube containing 48 cm^3 of sugar produces an optical rotation of 11° when placed in a Saccharimeter. If the specific rotation of sugar solution is 66° , calculate the quantity of sugar contained in the tube in the form of a solution. 6
- ~~QUESTION~~
- $S = \frac{100}{4. a)$
- $\frac{1}{2C}$
- a) State Biot's and savart's law and use it to find the magnetic field at a point on the infinite length of wire. 6
 - b) What is the magnitude of a point charge chosen so that the electric field 50cm away has the magnitude of 2N/C ? 5
5. a) Show that $C = \frac{Em}{Bm}$ where symbols have their usual meaning. 5
- b) Show that B at the center of rectangle of length l and width d, carrying a current 'i' is given by $B = \frac{2\mu_0 i (l^2 + d^2)^{1/2}}{\pi l d}$. 5

- c) Derive continuity equation using Maxwell's equations. 5
6. a) What is wave function? Derive the Schrodinger time dependent wave equation for a free particle like electron. 9
- b) Explain the electrical conduction in metals, insulators and semiconductor according to band theory. 6
7. Write short notes on: (Any two) 2×5
- a) Propagation of light wave through fiber.
- b) Magnetic energy density.
- c) Displacement Current.

POKHARA UNIVERSITY

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Attempt all the questions.

1. ~~(a)~~ Derive the equation of simple harmonic motion in different form and calculate the velocity and acceleration of a body with the help of the solution of this equation. 9
1. ~~(b)~~ Calculate the wave length, frequency, speed of the wave and maximum particle velocity in the wave represented by $y = 20 \sin \pi (2t - 0.05x)$. The values of x and y are in centimetres. 6
2. ~~(a)~~ Discuss the interference in thin films due to reflection and obtain the condition for bright and dark fringes. 9
2. ~~(b)~~ What is reverberation and reverberation time? Derive Sabines reverberation formula. 6

OR

3. ~~a)~~ Calculate the frequency and maximum particle velocity due to wave represented by $y(x, t) = 0.03 \sin(60\pi t - 0.03\pi x)$. The values of x and y are in centimeters. 9
3. ~~a)~~ What is electric flux? State Gauss Law in electrostatics and explain two applications of Gauss Law. 9
3. ~~b)~~ What is the highest order speed which may be seen with monochromatic light of wave length 6000 \AA by means of a diffracting grating with 5000 lines/cm. 6
4. ~~a)~~ Explain Biot and Savart's law. Use it to find the magnetic field at any point inside the solenoid. 9
4. ~~b)~~ A circular loop of wire 5 cm of radius carries a current of 100 amps. What is the energy density at the centre of the loop? 6
5. ~~a)~~ What are Maxwells equation? Convert the integral form of Maxwells equation in its different form. 9

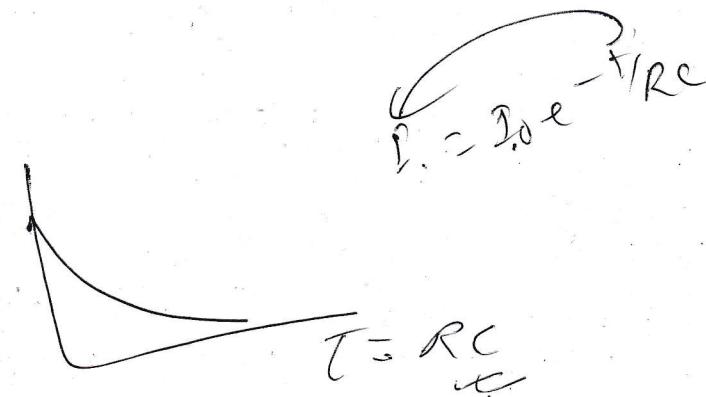
- b) Using Maxwell's equation, prove that $C = \frac{Em}{Bm}$ where symbols carry their usual meaning. 6
6. a) Explain physical significance of wave function ψ . Discuss and find the Eigen function of the particle travelling in one dimensional box of infinite height. 9

OR

Explain Doppler's effect taking all three conditions and mention it's limitation also:

- i. Observer moving but source at rest
- ii. Source moving but observer at rest
- iii. Both source and observer are moving.

- b) A parallel plate capacitor has a capacitance of $100 \times 10^{-12} \text{ F}$, a plate area of 100 cm^2 mica is used as a dielectric. At 50 Volts p.d, calculate electric field intensity and magnitude of induced charge. 6
7. Write short notes on: (Any Two) 2x1
- a) ~~Optical fibre and its advantages~~
 - b) N-type and p-type semiconductor
 - c) Describe about the spontaneous and stimulated emission of radiation.
 - d) Displacement current.



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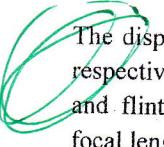
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Attempt all the questions.

- | | | |
|-------|---|---|
| 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) | Calculate the speed of transverse wave in a rope of length 20cm having 60gm of wire under a tension of 500N. | 6 |
| 2. a) | Define coherent sources. Also, calculate the wavelength of light used with the help of Newton's ring experiment, when gap is filled with liquid of refractive index μ . | 9 |
| b) | The size of an empty assembly of bell has dimension $20 \times 15 \times 5$ cm ³ and the reverberation time is 3.5 sec. What area of the wall should be covered by curtain cloth to reduce the reverberation time by 2.5 sec if the absorption coefficient of curtain cloth is 0.5. Also calculate the average absorption coefficient of the bell. | 6 |

Or


The dispersive power of crown and flint glasses are 0.016 and 0.032 respectively. Calculate the focal lengths of the lenses made of crown and flint glasses which forms an achromatic doublet of equivalent focal length 20 cm when placed in contact.

- | | | |
|-------|---|---|
| 3. a) | What is meant by electrostatic potential? Obtain expressions to evaluate electrostatic potential due to electric dipole and quadrupole | 9 |
| b) | Obtain the charging time constant of a capacitor in a RC circuit such that current through the resistor is decreased by 50% of its peak value in 5 seconds. | 6 |

Or


Show that sound wave is a pressure wave.

- | | | |
|-------|--|---|
| 4. a) | State Biot-Savart's Law and apply to calculate the flux density of | 9 |
|-------|--|---|

magnetic field due to an infinite long straight conductor. Can the result for the infinite long straight conductor be used for a conductor of finite length?

Or

Derive the expression for force per unit length between two infinite current carrying conductors. Define one ampere current.

- 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 T and cross sectional area 'A' when placed in a uniform magnetic field of strength 'B'.

5. a) Obtain all four Maxwell's Wave Equation in free space in terms of \vec{E} and \vec{B} Write significance of each equation. 9
- b) An LC circuit is converted into an LCR circuit inserting a resistance of 10Ω . Calculate the percentage change in frequency in this conversion. Given: inductance = 10 mH and capacitance = $10 \mu\text{F}$. 6
6. a) Describe about the principle of working of a optical fibre and its application. 9

Or

Write down the principles of laser action and explain the construction and working principle of He-Ne laser.

- b) Normalize the one dimensional wave function

$$\psi = A \sin\left(\frac{nx}{a}\right), \quad 0 < x < a$$

$$\psi = 0, \quad \text{outside}$$

Or

An electron moving is a wave has wave function $\psi(x) = 2 \sin 2\pi x$. Find the probability of the electron forming in the region $x = 0.25$ to 0.5m .

7. Write short notes on *any two*: 2x5
- a) Band theory in solids
- b) Atomic view of resistivity
- c) Nicol Prism

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Attempt all the questions.

1. a) Define the terms frequency and time period in SHM. Derive the time period of compound pendulum in terms of equivalent length of simple pendulum. 9
1. b) A stretched string has a linear density 525g/m and is under tension 45N. We send a sinusoidal wave with a frequency 120Hz and amplitude 8.5mm along the string from one end. At what average rate does the wave transport energy? 6
2. a) What is polarization of light? Explain the construction of calcite crystal and show how it produces double refraction. 9
2. b) If the earth had a net charge equivalent to 1 electron/m² of surface area.
 - i. What will be the earth's potential?
 - ii. What would the electric field due to earth be just outside its surface?
3. a) Define Biot-Savart law. Use it to find the magnetic field strength along the axis of circular current carrying loop. 9
3. b) At some distance from transmitter of radio station, the magnetic field of electromagnetic wave emitted by radio station is found to be 1.6×10^{-4} T. If frequency of broadcast is 1020 KHz then find speed, wavelength and maximum electric field of electromagnetic wave. 6
4. a) Discuss the charging and discharging phenomenon of a capacitor through resistor. 9
4. b) What is the initial rate of increase of current and final saturation current in RD circuit with L=15mH, R=24 Ohm and emf=10 volt? 6
5. a) Write the Maxwell's equation in differential form and their 9

significance. Using Maxwell's equations prove that $\frac{E_m}{B_m} = C$, Where
symbol carry usual meaning.

- b) A particle is moving in one dimensional box of infinite probability of finding the particle within the range 1°A at the centre of box when it is in lowest energy state. 6
6. a) Define solid in terms of band theory and discuss about knee voltage and breakdown voltage. 9
- b) Newton's ring are observed in reflected light of $\lambda=5.9 \times 10^{-5}\text{cm}$. The diameter of 10th the dark ring is 0.5cm. Find the radius of curvature of the lens and the thickness of air film. 6
7. Write short notes on: (Any two) 2×5
- a) ~~Absorption co-efficient and reverberation.~~
- b) LASER and its application.
- c) Lorentz electromagnetic force.

$$L = 15\text{mJ}$$

$$R = 24\text{ m}$$

$$\text{emf} = 10\text{ Volt}$$

POKHARA UNIVERSITY

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Semester: Fall

Year : 2015
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Candidates are required to give their answers in their own words as far as practicable.

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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 $2 \times 10^{-6} C$, $3 \times 10^{-6} C$, $4 \times 10^{-12} C$ and $-4 \times 10^{-12} C$ 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 $L=15\text{mH}$, $R=24\text{ Ohm}$ and $\text{emf}=10\text{ volt}$? 6

VOL¹

1

23.

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 $E_y = 300 \text{ V/m} \sin \omega [t - \frac{x}{c}]$. 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 $1.67 \times 10^{-27} \text{ kg}$) $V_p = \frac{\lambda}{T}$ 2x5
7. Write short notes on: (Any two)
- Piezoelectric effect and Magnetostriction effect.
 - Band theory of solid.
 - Lorentz electromagnetic force.

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Semester: Spring

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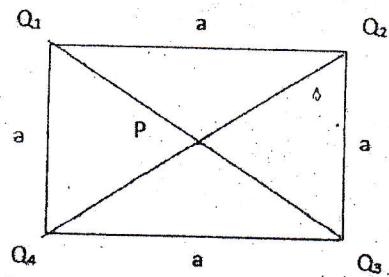
Attempt all the questions.

1. a) SHM is later in nature, why? Derive the time period of bar pendulum and discuss about length of equivalent simple pendulum. 9
- b) A progressive and stationary, simple harmonic wave having frequency 250 Hz and each having same velocity 30 m/s.
 - 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. *X2*
2. a) Define coherent sources and write conditions for sustain interference. 9
 - i. Derive the maximum and minimum intensity with the help of analytical treatment of interference of light wave.
- b) If a and b be the slit width and opaque width respectively in Fraunhofer's double slit diffraction experiment, deduce the missing orders. 6
3. a) Define terms population inversion and optical pumping. Explain construction and the working principle of He-Ne Laser. 9
 - b) Derive the expression for Schrodinger time independent wave equation. 6
4. a) Define quadrupole? Find potential and field due to electric quadrupole at a point, not lying along the quadrupole. 9
 - b) 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

मुम स्टेनरी सलायर्स एण्ड फोटोकपी सर्विस

बालकुमारी, ललितपुर ९८४१५९३९२

NCIT College



- a) Discuss Maxwell equation in differential form. Also show that electromagnetic wave travels with velocity of light in vaccum. 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)

2×5

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

POKHARA UNIVERSITY

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Semester: Fall

Year : 2016
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Attempt all the questions.

1. a) For a compound pendulum prove that the minimum time period is obtained if the point of suspension and point of oscillation are equidistance from C.G. Also explain how can we get the value of acceleration due to gravity 'g'. 9
- b) Calculate the wave length, frequency, speed of the wave and the maximum particle velocity in the wave represented by, $y = 10\sin(8\pi t - 0.08\pi x)$. The value of x and y are in CGS system. 6
2. a) Discuss the conditions for sustain interference of light wave. Explain the interference on thin films due to transmitted rays. 9
- b) A room has dimensions $10\text{cm} \times 15\text{cm} \times 20\text{cm}$. The reverberation time for an empty room is 0.4 sec. Find the average absorption coefficient of the room. If the room is provided with curtain cloths of absorption coefficient 0.5, what area is covered by the cloths? 6
3. a) Define electric dipole. Prove that electric field due to short dipole at axial point is twice that at equatorial line. 9
- b) If the charge on a capacitor is increased by 2 coulomb, the energy stored in it increased by 21%. Find the original charge on the capacitor. 6
4. a) Give the method of Biot and Savart law to calculate the magnetic field due to current carrying conductor. Obtain an expression for magnetic field intensity due to solenoid carrying current. 9
- b) The growth of the current in L-R circuit is given by $I = I_0 [1 - e^{-R/L t}]$. Find the growth current at one time constant with neat graph. 6

5. a) Write Maxwell equation for non conducting medium. Using these equations to determine the electromagnetic wave equation in terms of magnetic field non conducting and an isotropic medium. Hence prove that the velocity of electromagnetic wave is equal to velocity of light in free space. 9
- b) Prove that, at any point in electromagnetic field, energy density stored in electric field is equal to energy density stored in magnetic field. 6
6. a) Discuss the dual nature of light. Show that the real waves are complex wave by showing the wave has group velocity rather than a single phase velocity. 9
- b) The thickness of calcite plate to produce plane polarized light is 8.56×10^{-5} cm, the principal refractive indices are $\mu_E = 1.658$, $\mu_o = 1.486$ and $\lambda = 5890 \text{ A}^\circ$. Find the type of wave plate. *For practice* 6
7. Write short notes on: (Any two) 2x5
- a) Types of optical fiber
- b) Classify solids on the basis of band theory of solids.
- c) Lorentz force with example.

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Attempt all the questions.

1. a) What is S.H.M? Discuss the theory of mass-spring system and derive the expression for time period and frequency. Also state the conditions of resonance. 9
1. b) A transverse sinusoidal wave is generated at one end of a long horizontal string by a bar, which moves up and down through a distance of 0.5 m. The motion is continuous and repeated regularly twice each second. If the string has linear mass density of 0.005 kg/m and is kept under a tension of 2 N. Find the speed, amplitude, time period and wave length of the wave motion. 6
2. a) What is the diffraction of light? Discuss Fraunhofer's diffraction pattern in a single slit. 9
2. b) The equiconvex lens of focal length 4 cm and refractive index 1.5 is placed in flat glass plate. The combination is used in Newton's ring experiment, if the light of wavelength 5890 Å is used for the experiment then what is the diameter of 4th bright ring? 6
3. a) Discuss Gauss law in electrostatics and use the law to determine electric field intensity due to charged sphere and charged plane sheet of a conductor. 9
3. b) Find electric field intensity at the centre of a square of side 5 cm consisting of $2 \mu\text{C}$ charges in each vertex. 6
4. a) State Biot-Savart's law. Use it to find the magnetic field due to an infinitely long straight wire. 9

OR

Why did Maxwell modify Ampere's law? Explain with mathematical details. Hence explain the significance of displacement current.

- b) A 40 mH inductor and $1000 \mu\text{F}$ capacitor form oscillating circuit. 6
- What is the peak value of current if the initial charge is $40 \mu\text{C}$?
5. a) Derive all the four Maxwell's wave equations and write physical significance of each equation. 9
- b) Write the Maxwell's equation in differential form and their significance. Using Maxwell's equations prove that $\frac{E_m}{B_m} = C$, Where symbol carry usual meaning. 6
6. a) What is the significance of wave function ψ ? Derive the time independent Schrodinger wave equation for a free particle. 9
- b) Discuss the types of semiconductor by considering band theory of solid. 6
7. Write short notes on: (Any two) 2x5
- a) Lase characteristics and advantages
- b) Reverberation of sound
- c) Hall effect

सुगम स्टेनरी समायर्स एण्ड फोटोकॉम्पनी सर्विस
बालकुमारी, ललितपुर १८७९५९५९२
NCIT College

POKHARA UNIVERSITY

Level: Bachelor
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Attempt all the questions.

1. a) Why compound pendulum is preferred than simple pendulum? Obtain time period of a bar pendulum and hence show that centre of oscillation and centre of suspension can be interchanged. 9
1. b) A sinusoidal wave travels along a string. The time for a particular point to move from maximum displacement to zero is 0.17 s. What are the
 - i. Period and frequency?
 - ii. The wavelength is 1.40m; what is the wave speed? 6
2. a) What is interference and why are coherent sources necessary for interference? Explain necessary theory for Newton's rings method to determine the wavelength of monochromatic light. How can we get the centre of the rings bright? 9
2. b) Deduce the missing orders in Fraunhofer's double slit diffraction experiment in which slit width $a=0.08\text{mm}$ and opaque width $b=0.16\text{mm}$. 6
3. a) Define quadrupole moment and derive the expression for potential at a point when point does not lie along a axis of quadrupole. 9
3. b) A parallel plate capacitor has circular plates of 8 cm radius and 1 mm separation. What charge will appear on the plates if a p.d. of 100 volt is applied? 6
4. a) Compare Ampere's law with Biot – Savert law. Use Biot – Savert law to calculate the magnitude of magnetic field strength due to current carrying solenoid at any point. 9
4. b) Show that ratio of electric field strength and magnetic field strength is equal to speed of light, hence calculate maximum value of magnetic 6

- field and average intensity of light, if the maximum electric field at a distance of 10m from an isotropic light source is 2 V/m,
5. a) Using Schrodinger's wave equation obtain energy and wave-function of a particle confined in infinite potential well. 9
- b) What are the
i. Mean time between collisions?
ii. The mean free path for free electrons in copper?
(Given $n=8.4 \times 10^{28} \text{ m}^{-3}$, $\rho=1.7 \times 10^{-8} \Omega \text{m}$, $v_{\text{avg}}=1.6 \times 10^6 \text{ m/s}$.)
6. a) Discuss the LC oscillation. Hence prove that the frequency of oscillation is $f=\frac{1}{2\pi\sqrt{LC}}$. Is this real or ideal explain? 9
- b) Discuss the factor reverberation for quality control of sound in public buildings. How it is different from echo. 6
7. Write short notes on: (Any two) 2×5
- a) Optical fibre and its uses
b) Explain knee voltage and junction breakdown
c) Time constant in LR circuit