

Pre-University Examination subject wise paper collection



Applied Physics



Provided By:

Aasha Thapa

Arpan Adhikari

Asim Pandey

Harry Xettri

Kamal Rokaya

Samir kc

Prince subedi

Safal Poudel

POKHARA UNIVERSITY

Level: Bachelor

Semester: Spring

Year : 2023

Programme: BE

Full Marks: 100

Course: Applied Physics

Pass Marks: 45

Time : 3hrs.

Techno

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) What is simple harmonic motion? Derive an expression for the time period of a bar pendulum and show that the point of suspension and oscillation are interchangeable. 9

OR

What is torsional pendulum? Derive an expression for time period of torsional pendulum. Find the expression for modulus of rigidity of the wire.

- (b) Find the expression for experimental value of g (acceleration due to gravity) by using time period of compound pendulum. 6
2. a) What is reverberation time? Find the expression for Sabine's Formula. 9
What are its significance in our daily life?

- b) The size of an empty assembly of bell has dimensions $20 \times 15 \times 5 \text{ cm}^3$ 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 the curtain cloth is 0.5. Also calculate the average absorption coefficient of the bell! 6

3. a) What is LASER? Explain the construction & working principle of He-Ne Laser with necessary energy level diagram. Also write the applications of LASER. 9

- b) What do you mean by acceptance angle & numerical aperture in optical fibre. An optical fiber has fractional refractive index change of 0.2 and a cladding refractive index 1.59. Determine acceptance angle for the fiber in water, which has refractive index of 1.33. Also evaluate Numerical Aperture (N.A.). 6

4. a) What is Capacitor? Discuss charging and discharging of capacitors. 9

$$\text{N.A.} = n_1 \sin \theta_1$$

$$\frac{n_1 - n_2}{n_1 + n_2}$$

$$n_1 = 1.59$$

$$n_2 = 1.33$$

POKHARA UNIVERSITY

Level: Bachelor

Semester: Fall

Year : 2023

Programme: BE

Full Marks: 100

Course: Applied Physics

Pass Marks: 45

Time : 3 hrs.

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) What is forced oscillation? Derive differential equation for forced oscillation and show that amplitude at resonance is inversely proportional to the damping constant of medium. 9
OR
What is a physical pendulum? Establish a formula for a physical pendulum's time period and show that the shortest duration is attained when the pendulum's length and radius of gyration are equal.
- b) The equation of transverse wave on a string is $y=(2.0\text{mm}) \sin [(20\text{m}^{-1})x - (600 \text{ S}^{-1})t]$. The tension on the string is 15 N. i) What is the wave speed ii) Find the linear density of the string in grams per meter. 6
2. a) Describe process of Laser emission and explain the construction and working principle of He-Ne laser. 9
b) What is the reverberation time for a hall with length 10m, breadth 8m, and height 5m? If the coefficients of absorption of walls, ceiling and floor are 0.3, 0.4 and 0.5 respectively. 6
3. a) What is electronic polarization? Explain mathematically how relative permittivity is related with electronic polarizability using Clausius-Massotti equation. 9
b) An optical fiber has core of RI 1.5 and cladding of RI 1.45. Calculate critical angle for core cladding interface, angle of acceptance in air and numerical aperture of the fiber. 6
a) Derive Maxwell's electromagnetic wave equation with their physical significance and express them in free space as well as in dielectric medium. 9
b) Two capacitors of capacitances $25\mu\text{F}$ and $5\mu\text{F}$ are connected in parallel and charged with a 100V power supply. Calculate the total energy stored in the two capacitors. 6

5. a) Discuss the physical significance of the wave function and deduce the time dependent Schrödinger wave equation. 9
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) Differentiate between heat engine and heat pump hence describe the COP of refrigerator with four essential components. 9
b) Describe briefly about the mode of transfer of heat. 6
- OR**
- Calculate the change in internal energy of 1 gm of water when boiled at 100°C at 1 atm pressure. The volume of steam at 100°C is 1671 cc and latent heat of vaporization is 540 cal/gm.
7. Write short notes on: (Any two) 2×5
- a) Energy and momentum operator
b) Displacement Current
c) Thermodynamic Process (Adiabatic and isothermal)

**POKHARA UNIVERSITY
FACULTY OF SCIENCE AND
TECHNOLOGY
SCHOOL OF ENGINEERING**

Exam	Final Internal Examination 2081		
Level	B.E	F.M	100
Programme	computer	PM	45
Year/Part	2024/II	Time	3 Hrs.

Subject Applied Physics

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

The figure in the margin indicates full marks.

Attempt all the questions

- 1 (a) Define harmonic motion. Derive an expression for the time period of compound pendulum and discuss the maximum and minimum time period of compound pendulum.
OR
Derive the differential equation of forced oscillation and show that the amplitude of oscillation is inversely proportional to the damping constant of the medium. [2+7]
- (b) Calculate the frequency of vibration of air particle in a plane progressive wave of amplitude $2.18 \times 10^{-10} \text{ m}$ and intensity 10^{-1} W/m^2 , the velocity of sound in air is 330 m/s and density of air is 0.001293 g/cm^3 . [6]
- 2 (a) Discuss the types of optical fiber and explain the working principle of optical fiber. [2+7]
(b) The time of reverberation of an empty hall without audience and with 500 audience are 1.5 sec and 1.4 sec respectively then find the reverberation time with 800 audience in that hall. [6]
- 3 (a) Define capacitance and hence derive the expression for capacitance of spherical capacitors with its significance. [2+7]
(b) Two capacitors of capacitance 20 micro farad and 30 micro farad are connected in series when they are charged up to the potential of 500 volt, find the energy stored in each capacitor. [6]
- 4 (a) Discuss the damped LCR oscillation with its special cases. [9]
(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]
- 5 (a) What is wave function? Describe its significance and derive the Schrodinger time independent wave equation for a free particle like an electron. [8+1]
(b) Calculate the energy in electron volt of an electron wave of wave length $3 \times 10^{-3} \text{ m}$ and plank's constant $6.62 \times 10^{-34} \text{ Js}$. [6]
- 6 (a) What is the main difference between heat engine and heat pump? Discuss about coefficient of performance (COP) of heat pump. [4+5]
(b) Calculate the rate of heat transfer through a 2cm thick wall made of a material with a thermal conductivity of $0.5 \text{ W m}^{-1} \text{ }^\circ\text{C}^{-1}$. The temperature difference between the two sides of the wall is 50°C . [6]
- 7 Write short notes (any two)
(a) Working principle of He-Ne laser.
(b) Significance of dielectrics
(c) Concept of Black body
(d) Combination of capacitors [2x5]

**POKHARA UNIVERSITY,
NCIT COLLEGE, BALKUMARI, LALITPUR**

Assessment-Examination

Level: Bachelor

Year: 2024

Programme: BE

Full Marks: 100

Course: Applied Physics

Pass Marks: 45

Time: 3 hrs

Candidate 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 the plane progressive wave. Find an equation of plane progressive wave is travelling toward the positive x-axis. Develop the theory of maximum value of particle acceleration, and establish the relation between wave velocity and particle velocity. 9

OR

What is physical pendulum? Find the time period of it, and show that time period of compound pendulum is equal when it's point of suspension and point of oscillation are interchanged to each other's. .

- (b) A progressive and stationary simple harmonic wave having frequency 250 Hz and each having same velocity 30 m/sec. Determine: (i) the phase difference between two vibrating point 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 any two successive nodes in the stationary wave. 6

2. (a) Define the capacitance of capacitor. Develop and expression of capacitance, energy stored and energy density of parallel plates capacitor. 9
- (b) What is Clausius-Mossotti relation? Develop the relation between atomic polarizability and dielectric constant of non-polar molecule. 6

3. (a) Write Maxwell's equations in integral and differential forms. Using Maxwell's equations, and prove that $C = 1/(\mu_0 \epsilon_0)^{1/2}$, where symbols carry their usual meaning. 9
- (b) Calculate the resonating frequency and quality factor of a LCR circuit having 0.02 μF capacitance, 8 mH inductance and 0.25 Ohm resistance. 6

*T. S. T. - 1
Avinash Acharya
26 July 2024*

4. (a) Define normalized wave function and derive the time dependent Schrodinger wave equation of a particle. 9
- (b) An electron is moving with a wave function $\psi(x) = 2 \sin 2\pi x$. Find the probability of finding the electron in the region $x = 0.25$ m to 0.5 m. 6
5. (a) What are the limitations of first law of thermodynamics? Discuss the construction and working of refrigerator and find its coefficient of performance 9
- (b) A brick wall 12 cm thick and 5 m^2 surface area exposed to 50°C at one face and 20°C to another face. If the thermal conductivity of the material is 1.5 W/m K . Find the rate of heat transfer. 6
6. (a) Define the thermal conductivity of material. Write the statement and assumption of Fourier law of thermal conductivity. State and explain the Stefan's law of black body radiation. 9
- (b) An ideal engine has an efficiency of 25% . If the source temperature is increased by 200°C , its efficiency gets doubled. Determine its source and sink temperatures. 6

OR

The time of reverberation of an empty hall and with 600 audiences is 1.8 sec. and 1.6 sec respectively. Find the reverberation time with 1000 audiences in the hall.

7. Write short notes on: (Any Two)

$2 \times 5 = 10$

- a. Isothermal process
- b. He-Ne Laser
- c. Energy and momentum operators

Appoon Athukorulli
26 Page
July 2024

POKHARA ENGINEERING COLLEGE
Assessment examination

Level: Bachelor

Semester – Fall

Year : 2024

Programme: Computer

Full Marks: 100

Course: Applied physics

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) Starting from time period of compound pendulum, 3+3+3
 i) Derive Condition for maximum and minimum time period.
 ii) Show point of suspension and centre of oscillation are interchangeable.
 iii) Explain how acceleration due to gravity can be determined.
OR
 What is resonance? Derive equation of motion of forced harmonic oscillator and its solution and state condition related to resonance. 2+5+2
- b) A solid sphere of radius 50 cm executes torsional oscillation of time 25 sec at the end of suspension wire where the upper end is fixed in rigid support. Find out the mass of the sphere .(torsional constant $C=5 \times 10^{-3} \text{ N} - \text{m/rad}$) 6
2. a) Define absorption coefficient of sound. Derive a relation between reverberation time and absorption coefficient for acoustically good hall. 2+7
 b) The speed of transverse wave on a string is 170 m/s when the string tension is 120 N. To what value must the tension be changed to raise the wave speed to 180 m/s? 6
3. a) Define Laser and explain the optical pumping. 1+4
 b) Explain types of optical fibre. What are the applications of optical fibre in various fields? 2+3
 c) An optical fibre has core of RI 1.5 and cladding of RI 1.45. Calculate critical angle for core cladding interface, angle of acceptance in air and numerical aperture of the fibre. 5

4. a) State Maxwell equations in integral form. Convert them into differential form. Explain each of these equations. 1+5+3

OR

What are the electromagnetic waves? Establish relation between electric field , magnetic field and speed of electromagnetic wave. 2+7

- b) A coil has an inductance of 53 mH and a resistance of 0.35Ω . If a 12V emf is applied across the coil, how much energy is stored in the magnetic field after the current has built up to its equilibrium value? After how many time constants will half this equilibrium be stored in the magnetic field? 6

5. a) Describe the concept of inadequacy of classical mechanics and deduce the time dependent and independent Schrodinger equation. 3+3+3

- b) The De-Broglie wavelength of electron is $2 \times 10^{-12} \text{ m}$.Find Kinetic energy and phase velocity. 6

6. a) State and explain first law thermodynamics. What is its physical significance? what are the limitations of first law of thermodynamics? 2+1+2

- b) State and explain Stefan- Boltzmann law of radiation and explain its importance. 5

- c) Calculate the change in internal energy of 1 gm of water when boiled at 100°C at 1 atm pressure. The volume of steam at 100°C is 1671 cc and latent heat of vaporization is 540 cal/gm. 5

7. Write short notes (Any two)

- a) Discharging of capacitor. 5x2
- b) Coefficient of performance of refrigerator
- c) Applications of ultrasound.
- d) Gauss law in dielectrics.

.....

LUMBINI ENGINEERING COLLEGE (LEC)

Final Internal Exam

Level: Bachelor's Degree

Year: 2023

Program: Computer 2nd. sem.

Full Mark: 100

Course: Applied Physics

Pass Mark: 45

Time: - 3 hrs

Attempt all questions

- 1.a) What is damped harmonic oscillator? Write down the equation for damped oscillation. Using the equation explain what are underdamped, overamped and critically damped oscillations.

OR

What is a compound pendulum? Show that there are four collinear points in a bar pendulum where time period of oscillation is same. Also find the situation when the time period will be minimum. (10)

- b) A solid sphere of radius 0.3m executes torsional oscillation of time period $2\pi\sqrt{12}$ sec at the end of suspension wire where upper end is fixed in a rigid support. Of the torque constant of the wire be 6×10^{-3} Nm/rd, calculate the mass of sphere. (5)

- 2.a) What is wave. Derive a relation for speed of transverse wave in a stretched string and show that the average rate of transfer of energy is $\frac{1}{2} \mu v w^2 A$ where symbols carry their usual meaning. (10)

- b) The equation of the transverse wave on a string is $y = (2.0 \text{ mm}) \sin [(20 \text{ m}^{-1})x - (600 \text{ s}^{-1})t]$. The tension of the string is 15N (i) what is wave speed (ii) Find the linear density of the string in grams per meter. (5)

- 3.a) What is capacitor write circuit equation for a charging RC circuit solve it to find charge and current. Explain the meaning of time constant by sketching the graph for charge and current varying with time. (10)

- b) Derive Clausius-Massotti equation. (5)

$$\frac{\epsilon_r - 1}{\epsilon_r + 2} = \frac{N_a}{3\epsilon_0}$$

- 4.a) Write down Maxwell's equation in integral form. Convert them into differential form. Explain the physical significance of each equation. (10)

- b) Derive continuity equation (5)

$$\nabla \cdot \vec{J} + \frac{dp}{dt} = 0$$

- 5.a) What is wave function? Describe its significance. An electron is trapped in one dimensional infinite potential well of width a such that $V = \infty$ for $x \leq 0$ and $x \geq a$. (10)

$$V = 0 \text{ for } 0 < x < a$$

using boundary condition, prove that total PE of system is $E = \frac{n^2 h^2 \pi^2}{2 m l^2}$. Where symbols have their usual meaning.

- b) An electron moving as a wave has wave function $\Psi(x) = 2 \sin 2\pi x$. Find the probability of finding the electron in the region $x = 0.25 \text{ m}$ to 0.5 m . (5)

- 6.a) State the first law of thermodynamics and also write the limitation of the law Define refrigerator and its coeff. of performance (COP). Explain how first law is applied to analyze the performance of refrigerator. (10)

OR

What is radiation mode of heat transfer. State and explain Stefan's Botzmann law for two particle bodies at different temperature. What is black body. Write the properties of black body.

- b) An ideal engine has an efficiency of 25%. If the source temperature is increased by 200°C its efficiency gets double. Determine its source and sink temperature. (5)

7. Write short notes on (any two) (5*2=10)

a. Laser

b. Reverberation

c. Optical fibre

Lumbini Engineering, Management & Science College
Final Internal Assessment Exam

Level: Bachelors

Program: Computer 2nd sem.

Course: App. Physics

Year: 2024

Full Mark: 100

Pass Mark: 45

Attempt all the questions

- 1.a) What is compound pendulum? Derive an expression for time period of a compound Pendulum and hence show that centre of suspension and centre of oscillation are interchangeable. (9)

OR

What is forced oscillation? Derive differential equation for forced oscillation and show that amplitude at resonance is inversely proportional to the damping constant of medium.

- b) A piano wire with mass 5gm and length 90cm is stretched with tension of 25N. A wave with frequency 100 HZ and amplitude 1.6mm travels along the wire. (6)

a) Calculate the average power carried by the wave.

b) What happens to the power if the wave amplitude is halved.

- 2.a) What is reverberation time? Derive an expression for sabine's formula. Explain the significance of reverberation time in our daily life. (9)

- b) In an optical fibre, the core material has refractive index 1.6 and refractive index of clad material is 1.3. Calculate the value of critical angle and the angle of acceptance. (6)

- 3.a) What is capacitor? Discuss the charging and discharging of capacitor through resistor. (9)

- b) Obtain the charging time constant of a capacitor in a R.C circuit such that the current through the resistor is decreased by 50% of its peak value in 5 seconds. (6)

- 4.a) What is Maxwell equations? Write Maxwell's equation in differential and integral form. Convert integral form of Maxwell's equation in differential form. (9)

- b) What resistance should be connected in series with an inductance 220mH and capacitance 12 μ F for the maximum

charge on the capacitor to decay to 99% of its initial value in 50 cycles. (6)

- 5.a) What is wave function? Show that the difference in energy between any two consecutive energy levels of a free particle inside a potential well is inversely proportional to the square of well length. (9)
- b) Show that velocity of electromagnetic wave in free space is given by $C = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$ (6)
- 6.a) Differentiate between isobaric and isochoric process. Derive an expression for COP of heat engine and refrigerator. (9)
- b) Derive an expression for the one dimensional steady state heat conduction through a plane wall. (6)

OR

Calculate the change in internal energy of 1gm of water when boiled at 100°C at 1 atm pressure. The volume of steam at 100°C is 1671 cc and latent heat of vaporization is 549 cal/gm.

7. Write short notes on any two (2*5=10)
- a) Clausius- Moissotti Equation
- b) Time independent SWE
- c) He-Ne Laser.

Nepal Engineering College

Level: Bachelor

Programme: BE (Computer/CRE)

Course: Applied Physics

Year : 2023

Full Marks: 100

Time :3hrs.

Solve all questions. Assume missing data, if necessary.

1. a) What is a compound pendulum ? Derive the frequency of oscillation of compound pendulum in terms of equivalent length of simple pendulum. Also, calculate the conditions for the maximum and minimum value of time period of its oscillation. [10] ✓
- b) Calculate the average amplitude of sinusoidal sound wave in the air at a frequency of 1 KHz and average intensity of 10^{-6} W/cm², the velocity of sound in air is 334 m/s and the density of air is 1.293 kg/m³. [5]
2. a) Define reverberation time and absorption coefficient. Also , derive the Sabine's relation in MKS system and convert it into FPS system. [9]
- b) A 0.5kg block is attached to a spring ($k=12.5\text{N/m}$). The damped frequency is 0.2% lower than the natural frequency. [6]
 - i)What is the damping constant?
 - ii)How does the amplitude vary in time?
 - iii)What is the critical damping constant?
3. a) What is a capacitance of a capacitor? Develop a relation for charge stored at any time 't' in the capacitor. Show that the current decreases to 37 percent of its maximum value at capacitive time constant. [10]
- b) Show the relation $D = \epsilon_0 E + P$ where the symbols carry their usual meanings. [5]
4. a) Write down Maxwell's equation in integral form. Convert them into differential form. Explain the physical significance of each equation. [10] ✓
- b) A circuit has an inductance of 10 mH and 1 μF capacitance. How much resistance should be added to the circuit so that the frequency of oscillation will be 1 percent less than that of free LC oscillation? [5]
5. a) What is a wave function? Explain the physical significance of wave function. Discuss and find the energy of an electron travelling in the one-dimensional box of infinite height. [9]
- b) Find the de-Broglie wavelength associated with:
 - i) A 46gm golf ball with a velocity of 36m/s.
 - ii)An electron with a velocity of 10^7 m/s. [6]
6. a) Explain what are reversible and irreversible process in thermodynamics. Why in a gas system there are two types of specific heat capacities? Show that specific heat capacity of a gas at constant pressure is always greater than that at constant volume.[10]
- b) calculate the rate of loss of heat from a room through a glass window of the area of 2 m² and thickness of 1 mm ,when the temperature of the room is 20 °C and that of the air outside is 5 °C. The thermal conductivity of glass is 1.2 W/mK. [5]
7. Write short notes on (any two) [2X5 = 10]
 - i) He- Ne laser operation
 - ii) de-Broglie relation
 - iii) Speed of wave in vibrating string

The End

NATIONAL ACADEMY OF SCIENCE & TECHNOLOGY
 (Affiliated To Pokhara University)
 Dhangadhi-04, Uttar Behadi, Kailali
PRE-UNIVERSITY EXAMINATION : 2024
 Semester : II_Spring

Level : Bachelor
 Program : BE Computer
 Course : Applied Physics

F.M-100
 P.M- 45
 Time: 3 hrs.

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) Why simple harmonic motion is really rare in actual practice? Derive an expression for time period of compound pendulum and hence show that point of suspension and point of oscillation are interchangeable. Also write the conditions for maximum & minimum time period. [9]
- b) A solid sphere of radius 0.3m executes torsional oscillation of time period $2\pi\sqrt{12}$ sec at the end of suspension wire where upper end is fixed in a rigid support. If the torsional constant of the wire be 6×10^{-3} Nm/rad, calculate the mass of the sphere. [6]

$$\tau = \frac{m}{k}$$

OR,

- a) What do you mean by damped mechanical oscillation? Derive an expression for the time period of damped mechanical oscillator and hence discuss the time-displacement graph for it. Also write the factors affecting damping constant. [9]
 - b) What value of 'b' should be in the system having mass $m = 0.1$ kg and force constant 10 N/m for the maximum amplitude to decay to 90% of its initial value in 5 cycles. [6]
2. a) State Kelvin-Planck's statement for second law of thermodynamics. Explain heat pump refrigeration cycle with brief function of each component. Also calculate the COP of refrigerator. [9]
 - b) An ideal engine has an efficiency of 25%. If the source temperature is increased by 200°C , its efficiency gets doubled. Determine its source and sink temperature. [6]

OR,

- a) State first law of thermodynamics. Apply this law to isothermal, adiabatic and isochoric process. [5]
 - b) What do you mean by black body? State and explain Stefan-Boltzmann's law of black body radiation. Also write any three properties of black body. [5]
 - c) Assuming that the thermal insulation provided by a woolen glove is equivalent to a layer of air 3mm thick, determine the heat loss per minute from a man's hand, surface area 200 cm^2 on a winter's day when the atmospheric air temperature is -3°C . The skin temperature is to be taken as 34°C and thermal conductivity of air as $24 \times 10^{-3} \text{ W/mK}$. [5]
3. a) What do you mean by progressive wave? Derive the relation between wave velocity & particle velocity. Starting from progressive wave equation, $y = a \sin \frac{2\pi}{\lambda} (vt - x)$, how could you obtain its differential form as $\frac{d^2y}{dx^2} = \frac{1}{v^2} \cdot \frac{d^2y}{dt^2}$. [9]
 - b) In a sonometer experiment, the resonance length is found to be 0.5 m with mass 5 kg and vibrates at 100Hz. Find the linear density of the wire. [6]

- a) Define ultrasonic wave. Discuss the method for production of ultrasound by Electrostriction method. Also write any three uses of ultrasound in non-destructive testing. [9]
 b) Calculate the reverberation time of conference hall of 1500 m^3 having seating capacity of 120 persons when: (i) the hall is empty and, (ii) with full capacity of audience for the following data: [6]

Surfaces	Areas (m^2)	Absorption Coefficient
✓ Plastered Walls	112	0.03
✓ Wooden Floor	130	0.06
✓ Plastered Ceiling	170	0.04
✓ Wooden Doors	20	0.06
✓ Chairs	120	0.5
Audience	120	0.44

5. a) Write down the principle of laser production. Explain the construction & working principle of Ruby Laser with necessary energy level diagram. Also write the applications of LASER. [8]
 b) Calculate the refractive indices of the core and cladding materials of a fiber from following data:
 Numerical aperture(NA) = 0.22 and Fractional refractive index change (Δ) = 0.012. [7]
6. a) List the four Maxwell's equations. Starting from integral form; derive the differential forms of Maxwell's equations. Also mention their physical significance. [9]
 b) An electron moving as a wave has the wave function $\psi(x) = A \sin \frac{2\pi x}{L}; -L \leq x \leq L$; Using normalization condition find the value of constant A and normalized wave function. [6]
7. Write short notes on: (Any two) [2 x 5 = 10]
 a) Ruby Laser
 b) Time Independent SWE
 c) Clausius-Mossotti equation

THE END!!!

NATIONAL ACADEMY OF SCIENCE & TECHNOLOGY
 (Affiliated To Pokhara University)
 Dhangadhi-04, Uttar Behadi, Kailali
PRE-UNIVERSITY EXAMINATION : 2024
 Semester : II_Spring

Level : Bachelor
 Program : BE Computer
 Course : Applied Physics

F.M-100
 P.M- 45
 Time: 3 hrs.

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) Why simple harmonic motion is really rare in actual practice? Derive an expression for time period of compound pendulum and hence show that point of suspension and point of oscillation are interchangeable. Also write the conditions for maximum & minimum time period. [9]
- b) A solid sphere of radius 0.3m executes torsional oscillation of time period $2\pi\sqrt{12}$ sec at the end of suspension wire where upper end is fixed in a rigid support. If the torsional constant of the wire be 6×10^{-3} Nm/rad, calculate the mass of the sphere. [6]

$$\tau = \frac{m}{k}$$

OR,

- a) What do you mean by damped mechanical oscillation? Derive an expression for the time period of damped mechanical oscillator and hence discuss the time-displacement graph for it. Also write the factors affecting damping constant. [9]
 - b) What value of 'b' should be in the system having mass $m = 0.1$ kg and force constant 10 N/m for the maximum amplitude to decay to 90% of its initial value in 5 cycles. [6]
2. a) State Kelvin-Planck's statement for second law of thermodynamics. Explain heat pump refrigeration cycle with brief function of each component. Also calculate the COP of refrigerator. [9]
 - b) An ideal engine has an efficiency of 25%. If the source temperature is increased by 200°C , its efficiency gets doubled. Determine its source and sink temperature. [6]

OR,

- a) State first law of thermodynamics. Apply this law to isothermal, adiabatic and isochoric process. [5]
 - b) What do you mean by black body? State and explain Stefan-Boltzmann's law of black body radiation. Also write any three properties of black body. [5]
 - c) Assuming that the thermal insulation provided by a woolen glove is equivalent to a layer of air 3mm thick, determine the heat loss per minute from a man's hand, surface area 200 cm^2 on a winter's day when the atmospheric air temperature is -3°C . The skin temperature is to be taken as 34°C and thermal conductivity of air as 24×10^{-3} W/mK. [5]
3. a) What do you mean by progressive wave? Derive the relation between wave velocity & particle velocity. Starting from progressive wave equation, $y = a \sin \frac{2\pi}{\lambda} (vt - x)$, how could you obtain its differential form as $\frac{d^2y}{dx^2} = \frac{1}{v^2} \cdot \frac{d^2y}{dt^2}$. [9]
 - b) In a sonometer experiment, the resonance length is found to be 0.5 m with mass 5 kg and vibrates at 100Hz. Find the linear density of the wire. [6]

- a) Define ultrasonic wave. Discuss the method for production of ultrasound by Electrostriction method. Also write any three uses of ultrasound in non-destructive testing. [9]
 b) Calculate the reverberation time of conference hall of 1500 m^3 having seating capacity of 120 persons when: (i) the hall is empty and, (ii) with full capacity of audience for the following data: [6]

Surfaces	Areas (m^2)	Absorption Coefficient
✓ Plastered Walls	112	0.03
✓ Wooden Floor	130	0.06
✓ Plastered Ceiling	170	0.04
✓ Wooden Doors	20	0.06
✓ Chairs	120	0.5
Audience	120	0.44

5. a) Write down the principle of laser production. Explain the construction & working principle of Ruby Laser with necessary energy level diagram. Also write the applications of LASER. [8]
 b) Calculate the refractive indices of the core and cladding materials of a fiber from following data:
 Numerical aperture(NA) = 0.22 and Fractional refractive index change (Δ) = 0.012. [7]
6. a) List the four Maxwell's equations. Starting from integral form; derive the differential forms of Maxwell's equations. Also mention their physical significance. [9]
 b) An electron moving as a wave has the wave function $\psi(x) = A \sin \frac{2\pi x}{L}; -L \leq x \leq L$; Using normalization condition find the value of constant A and normalized wave function. [6]
7. Write short notes on: (Any two) [2 x 5 = 10]
 a) Ruby Laser
 b) Time Independent SWE
 c) Clausius-Mossotti equation

THE END!!!

Term Test I

Date:	2021/03/02	Full Marks	50
Level	BE	Time	
Programme	BCE		

Semester

II

1.5 hrs

Subject: - Applied Physics

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

Answer All questions.

The figures in the margin indicate Full Marks.

Assume suitable data if necessary.

- a) What are the limitations of simple pendulum? Derive the relation for time period of compound pendulum. Also show that it is minimum when $l = K$ (symbols have usual meaning). [10]
- b) A thin, straight, uniform rod of length $l = 1\text{m}$ and mass $m = 160\text{ g}$ hangs from a pivot at one end. What is period for small oscillations? [5]
- a) Derive the relation for velocity of transverse pulse in long stretched string. [10]
- b) A transverse sinusoidal wave is generated at one end of a long horizontal string by the bar. Which moves up and down through the 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 tension of 2N . Find the speed, amplitude, time period and wave length of the motion. [5]
- a) What are Inadequacies of classical mechanics? Explain. What do state function in quantum mechanics signifies? Also derive the time independent 1-D Schrodinger's wave equation. [10]

OR

- Why we cannot represent a matter wave with single wave? Explain wave packets and group velocity for such packets.
- b) What are capacitors? Find capacitance of parallel plate capacitor. [5]

Write short notes on (Any two):

[2.5*2=5]

- a) Resonance
 b) Fundamental harmonics
 c) Gauss law in electrostatics

Date:	2081/04/13	Full Marks	50
Level	BE	Time	
Programme	BCE		
Semester	II	1.5 hrs	

Subject: - Applied Physics

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) Distinguish between simple and physical pendulum. Deduce the time period of a compound pendulum and show that it is minimum when the length of pendulum is equal to radius of gyration. [9]
- b) A progressive and stationary, simple harmonic wave having frequency 250 Hz and each having same velocity 20 m/s. [6]
 - i. Determine the phase difference between two vibrating points in a progressive wave at a distance of 10cm.
 - ii. Wave equation of progressive wave at a distance of 10cm.
 - iii. Distance between nodes in stationary wave.
2. a) State Gauss law in free space. How the law is modified if the dielectric material are present? Then prove, the relation $D = E_0 E + P$. [9]
- b) What resistance 'R' should be connected in series with an inductance 220mH and capacitance $12\mu F$ for the maximum charge on capacitor to decay 99% of its initial value in 50 cycles. [6]
3. a) Write Maxwell equations in integral form and convert them into differential form. Also write their physical significance. [9]
- b) The wavefunction of a particle confined in a box of length 'l' is

$$\psi(x) = \sqrt{\frac{2}{l}} \sin \frac{\pi x}{l}$$
Calculate the probability of finding the particle in the region $0 < x < \frac{l}{2}$ [6]
4. Write short note on any one [5]
 - a) He-Ne LASER
 - b) Black body