Level: Bachelor
Program: B.E. Computer
Course: Applied Physics

Semester : II_Spring

Year: 2022
F.M.: 100
P.M. : 45
Time: 3 hrs.

Attempt all the questions.
Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate full marks

1. a) Point out the difference between simple and compound pendulum. Suppose, a meter stick suspended from one end swings as a compound pendulum; (i) what is the period of oscillation, (ii) Show that point of suspension and point of oscillation are interchangeable. Also write the condition for minimum & maximum time period. [2+7]

   b) A thin straight uniform rod of length 1m and mass 160gm hangs from a pivot at one end. (a) what is it's time period for small amplitude oscillation ? (b) what is the length of a simple pendulum that will have the same time period? [6]

   ### OR,

   a) What do you mean by damped mechanical oscillation? Derive an expression for time period of damped mechanical oscillation and hence discuss the time-displacement graph. [2+7]
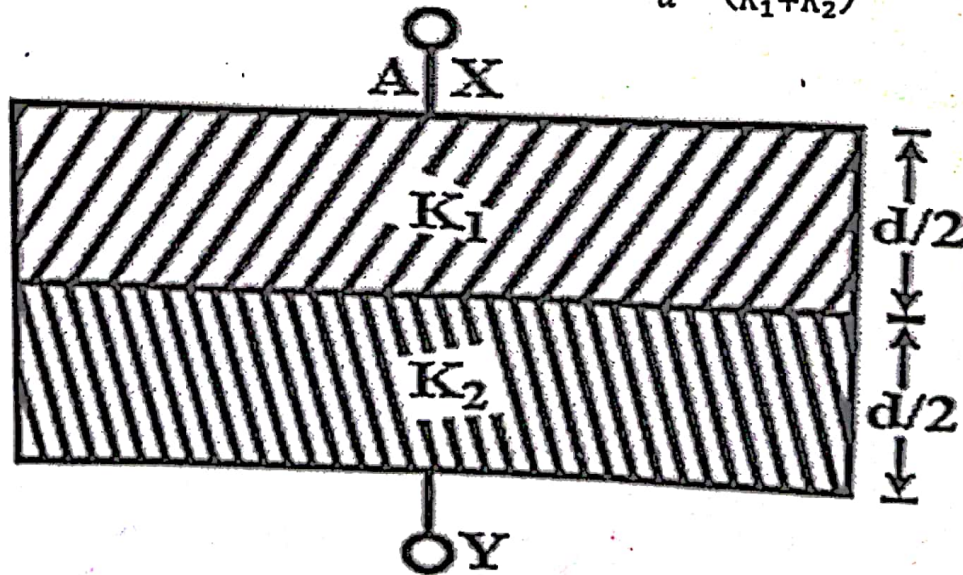
   b) A mass 0.01 kg suspended from a string oscillates freely with a time period of 1 sec. When it is immersed in oil and allowed to oscillate, the time period increases by 0.2 sec. calculate the damping constant due to oil medium. [6]

2. a) What do you mean by progressive wave? Derive the relation between wave velocity & particle velocity. Also discuss about energy, power and intensity of plane progressive wave with necessary derivation. [1+2+4]

   b) The equation of a transverse wave travelling in a string is given by $y = (2.0 \text{ mm}) \sin[(20 \text{ m}^{-1})x - (600 \text{ sec}^{-1})t]$. Find (i) Amplitude, Frequency, wavelength and velocity of wave. (ii) The maximum transverse speed 'u' of the particle in the string. [6]

3.a) Define Ultrasound. Discuss the method for production of Ultrasonic wave by Electrostriction & Magnetostriction method. Write any three uses of Ultrasound.

[1+6+2]

b) The size of an empty assembly of bell has dimensions 20×15×5 m^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]

4.a) Define polar & non-polar molecules with examples. Discuss the effect of electric field in polar & non-polar dielectrics. What do you mean by polarization of dielectrics? Also derive Clausius-Mosotti relation.

[9]

b) A parallel plate capacitor is filled with two dielectrics as in figure: Show that the capacitance is given by $C = \dfrac{2\epsilon_0 A}{d} \cdot \left(\dfrac{K_1 K_2}{K_1 + K_2}\right)$
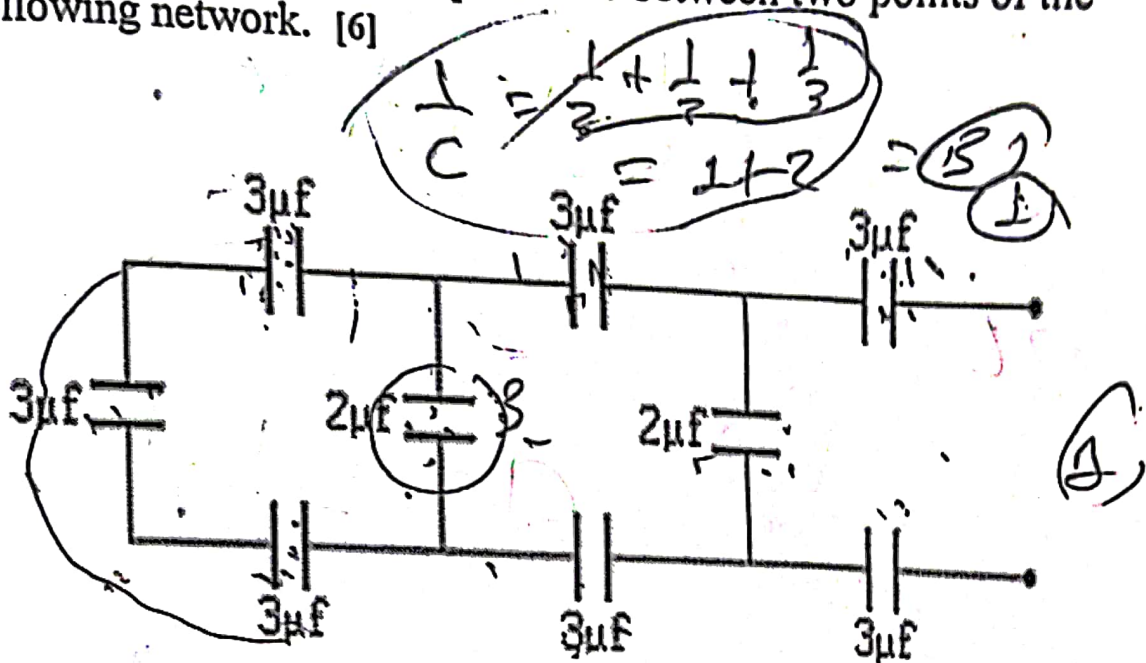
[6]

5.a) Write down the Maxwell's equations. Starting from integral form; Derive the differential forms of Maxwell's equations and also mention their physical significance.

[2+7]

b) A circuit has inductance of 10 mH & capacitance of $1\mu F$. How much resistance must be inserted in the circuit to reduce the (undamped) resonant frequency by 0.01% ?

[6]

OR,

a) State Gauss' law of electrostatics. Use this law to calculate electric field due to (i) Infinite line of charge, (ii) infinite sheet of charge.

[2+7]

b) Calculate the equivalent capacitance between two points of the following network. [6]

3µf

3µf

3µf

3µf

2µf

2µf

3µf

3µf

3µf

6.a) Define quantum wave function and mention it's significance. Derive the expression for Schrodinger Time Independent wave equation, using time dependent wave equation. [2+7]

b) An electron moving as a wave has the wave function $\psi(x) = A$ $\text{Cos}\frac{2\pi x}{L}$; $-\frac{L}{4} \le x \le \frac{L}{4}$; Using normalization condition find the value of constant A and normalized wave function. [6]

7. Write short notes on : (Any two) [5+5]
   a. Charging & discharging of capacitor.
   b. Damped electromagnetic LCR-oscillation.
   c. Electromagnetic Wave equations in free space.

BEST OF LUCK !!!

LUMBINI ENGINEERING COLLEGE (LEC)
Final Internal Exam

Level: Bachelors 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 overage rate of transfer of energy is $\frac{1}{2}\mu v w^2 A^2$ where symbols carry their usual meaning. (10)

b) The equation of the transverse wave on a string is $y=(2.0mm)\sin[(20m^{-1})x-(600S^{-1}t]$. 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- Massoti equation. (5)
$$\frac{\epsilon_r - 1}{\epsilon_r + 2} = \frac{N_\alpha}{3\epsilon_0}$$

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)

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

5.a) What is wave function? Describe be it's significance. An electron is trapped in one dimensional infinite potential well of width a such that V=∞ for x≤0 and x≥a. (10)

V= 0 for 0<x<a

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

b) AN electron moving is a wave has wave function Ψ(x)= 2 sin2πx. Find the probability of find the electron in the region x=0.25m to 0.5m. (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 ane explain stefan's Botzmann law for two particle bodies at different temperature. What is bloack body. Write the properties of black body.

b) An ideal engine has a efficiency of 25%. If the source temperature is increased by 200°C it 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

National Academy of Science and Technology
(Affiliated To Pokhara University)
Dhangadhi Kailali
Pre-University Examination

Level: Bachelor
Program: B.E. Computer
Course: Applied Physics

Semester : II_Spring

Year: 2023
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) What do you mean by Torsion Pendulum? How torsion pendulum is used to determine the modulus of elasticity of material of wire? Explain with necessary derivations. [1+4]

   b) What do you mean by radius of gyration? Deduce an expression for the time period and radius of gyration for compound pendulum. [1+4]

   c) 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. [5]

   OR,

   a) What do you mean by damped mechanical oscillation? Derive an expression for the frequency of damped mechanical oscillation and hence discuss the time-displacement graph. [2+7]

   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 it's initial value in 5 cycles. [6]

2. a) What is meant by wave motion? What are it's characteristics? Explain how it transports energy and derive a relation for the average rate at which the wave transports the energy along the string. [1+2+6]

   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]

3. a) What do you mean by building acoustics? How reverberation is different from echo? Derive Sabine's formula for the reverberation time. [1+2+6]

b) Calculate the reverberation time of conference hall of 1500 m³ 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 (m²)	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

4.a) Write down the principles of laser action and explain the construction and working principle of He-Ne laser. Also write the applications of laser. [9]

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. [6]

5.a) How electromagnetic wave is different than mechanical wave? Prove that the ratio of electric field to the magnetic field is equal to speed of light. [2+7]

b) An inductor of inductance 40mH is placed in series with a resistor of resistance 3 Ω and a charged capacitor of capacitance 4.8 µF. Show that this current will oscillate and find the frequency of oscillation. What is the interval of time required for the charge amplitude to drop half of its starting value? [6]

6.a) Define quantum wave function and mention it's significance. Calculate the normalized wave function describing the motion of an electron inside in an one dimensional infinite potential well. [2+7]

b) The electronic polarizibility of an Argon atom(Ar) is 1.7×10^{-40} Fm². What is the static dielectric constant of solid Ar if it's density is 1.8 g/cc? (Given; N_A= 6.023×10^{23} mol⁻¹, and atomic mass of Ar=39.95 g/mol) [6]

UNITED TECHNICAL COLLEGE
Bharatpur-11, chitwan

Level: Bachelor   full marks: 50
Programme: B.E.   Pass marks: 23
Subject: Applied physics   Time: 1.5 Hrs.

1. a) Why compound pendulum is preferred than simple pendulum? Prove that the minimum time period is obtained if the point of suspension and point of oscillation are equidistance from the center of gravity.   2+7

    b) A sinusoidal wave travels along a string. The time for particular point to move from maximum displacement to zero is 0.17s what are the 3+3

        i) Period and frequency?
        ii) The wavelength is 1.40 m; what is the wave speed?

2. a) What is the forced oscillation? How does the amplitude of forced oscillation vary with the frequency of external periodic forced? 2+7

    b) A room has dimension 10cm ×15cm×20cm. the reverberation time for an empty room is 0.4sec. Find the average absorption coefficient of the room. If the room is provided with curtain clothes of absorption coefficient 0.5, what area is covered by the clothes?   6

3. a) What are the fundamental components of heat pump and refrigerator? Explain brief function of each component.   9

    b) A vessel of cylinder shape having 50 cm in diameter and 75 cm high. It contains of 4 kg of gas. The pressure measured with manometer indicates 62 mm of Hg above the atmosphere with barometer reads 760 mm of Hg. Find.   6

        i) the absolute in the gas in the vessel in bar
        ii) Specific volume and density of the gas

    a) Write short note on: (any one)5×1=5
    b) Different mode of heat transfer
    c) Reverberation of sound.

COSMOS COLLEGE
OF MANAGEMENT AND TECHNOLOGY

Term Test I

Date 2080 03 0?	
Level	I3I
Programme	BCE
Semester	II

| Full Marks | 50 |
| Time | 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) Define compound pendulum. Derive the relation for time period of compound pendulum. Show that point of suspension and point of oscillation are interchangeable. [10]

   OR

   What do you mean by forced oscillation? Write the appropriate equation for forced oscillation. Discuss resonance with band width and sharpness of resonance.

   b) A body of mass 0.3 kg executes SHM with a period 2.5 sec and amplitude of 4 cm. Calculate the velocity, acceleration and kinetic energy. [5]

2. a) What do you mean by capacitor? Discuss charging and discharging of capacitor in RC circuit. [10]

   b) Prove that $D = \varepsilon_0 E + P$, where symbols have their usual meaning. [5]

   c) Derive the Clausius-Mossotti equation. If μ be the refractive index of non-magnetic substance then prove that, $\dfrac{\mu^2 - 1}{\mu^2 + 2} = \dfrac{n\alpha}{3\varepsilon_0}$ [10]

3. Write short notes on: (*any two*) [5*2 = 10]

   a) Free oscillation
   b) Parallel plate capacitors
   c) Torsional pendulum

$A =$

$T =$

$y = A \sin(\omega t + \phi)$.

$\left(\dfrac{dy}{dt}\right)$

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 of 10^{-6} W/cm^2, the velocity of sound in air is 334 m/s and the density of air is 1.293 kg/m^3. [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=12.5N/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 m^2 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

NEPAL COLLEGE OF INFORMATION TECHNOLOGY
ASSESSMENT SPRING-2023

Programme: BE CE/SE

Full Marks : 100
Pass Mark : 45
Time : 3 hrs

Course: Applied Physics

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 is SHM important in physics? You are given a compound pendulum. How can you show that it oscillates simple harmonically? Hence find its time period. Also show that point of suspension and point of oscillation are interchangeable. (10)

OR

Discuss the theory of torsion pendulum. Show that the motion of the torsion pendulum is simple harmonic. How can you find the value of modulus of rigidity? What are the differences between a torsion pendulum and a compound pendulum?

b) A meter stick is suspended at one end. Determine its frequency and time period. (5)

2.
a) What is optical fiber? Discuss the components, types and working of optical fiber? Derive an expression of the numerical aperture and the acceptance angle. Also discuss the applications of optical fiber. (10)

b) Calculate frequency of vibration of air particles in plane progressive wave of amplitude 2.18×10^{-10} m and intensity 10^{-10} W/m^2, velocity of sound in air is 340 m/s and density of air is 0.00129 gm/cc. (5)

3. a) What are first law and second law of thermodynamics? Discuss the working principle of heat engine and heat pump. (10)

Or

What are the similarities and the differences of refrigerator and heat pump. Describe the components of refrigerator and heat pump with diagram.

b) For the gas in a container having a pressure 100 N/m^2 and volume 2 m^3, calculate the work done by the gas when it reaches to a volume of 3 m^3 under (i) constant pressure (ii) constant temperature. (5)

4. a) Derive Maxwell's equations. Write the physical significance of each equation. (10)

b) Show that E/B = c, where the symbols have their usual meanings. (5)

5. a) The concept of the wave function is essential for the proper understanding of the microscopic particles. What is the significance of wave function ψ? Derive the time independent Schrodinger wave equation for a free particle. (10)

b) Find the least energy of an electron in a potential well of length $1A^0$. (5)

6. a) Discuss electronic polarization. Hence derive an expression of Clausius Mossotti equation in terms of electronic polarizability. (10)

b) Find the time constant in an RC circuit such that the current becomes one third in 5 seconds. (5)

7. Write short notes on any two: (2 x 5 =10)
   a) LASER and its application
   b) Wave and differential equation
   c) Ultrasound and applications

$$\omega = \sqrt{\frac{I}{mgl}}$$