POKHARA UNIVERSITY

Semester: Fall

Year : 2014
Full Marks: 100
Pass Marks: 45
Time : 3hrs.

Level: Bachelor
Programme: BE
Course: 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.

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

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 $20\times15\times5$ 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.

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.

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 8.4×10^{28} m^{-3} and resistivity is 1.72×10^{-8} Ω-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'.

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 μF. 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

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

$\psi = 0$, outside 6

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.

Write short notes on *any two:* 2×5

a) Band thery in solids

b) Atomic view of resistivity

c) Nicol Prism

POKHARA UNIVERSITY

Level: Bachelor
Programme: BE
Course: Physics

Semester: Spring

Year : 2014
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.

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

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

a) What is polarization of light? Explain the construction of calcite crystal and show how it produces double refraction. 9

b) If the earth had a net charge equivalent to 1 electron/m^2 of surface area. 6

i. What will be the earth's potential?

ii. What would the electric field due to earth be just outside its surface?

a) Define Biot-Savart law. Use it to find the magnetic field strength along the axis of circular current carrying loop. 9

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

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. a) Define solid in terms of band theory and discuss about knee voltage and breakdown voltage.

b) Newton's ring are observed in reflected light of $\lambda=5.9\times10^{-5}$cm. The diameter of 10the dark ring is 0.5cm. Find the radius of curvature of the lens and the thickness of air film.

7. Write short notes on: **(Any two)**

a) Absorption co-efficient and reverberation.

b) LASER and its application.

c) Lorentz electromagnetic force.

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.

2

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. 18x10^-10 m and intensity 10 ^-10 w/m^2, 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 X 10 $^{-5}$ cm thick is viewed at an angle of 35^0 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 $2\times10^{-6}C, 3\times10^{-6}C, 4\times10^{-12}C$ and $-4\times10^{-12}C$ 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=15mH, 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 $E_y = 300\, v/m \sin w\left[t - \frac{x}{c}\right]$. An electron is constrained to move in y direction with speed $2 \times 10^7\, m/s$. 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 $2 \times 10^{-12} m$. Find phase velocity, group velocity and kinetic energy.

(Given mass of neutron $1.67 \times 10^{-27} kg$)

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

a) Piezoelectric effect and Magnetostriction effect.

b) Band theory of solid.

c) Lorentz electromagnetic force.

POKHARA UNIVERSITY

Level: Bachelor
Programme: BE
Course: Physics

Semester: Spring

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.

a) SHM is rarer 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. 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.

a) 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

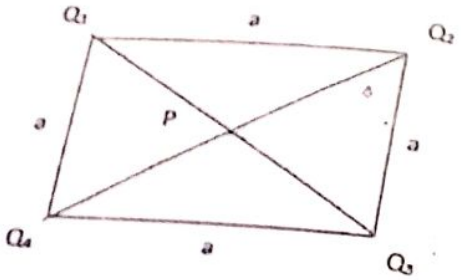
b) If a and b be the slit width and opaque width respectively in Fraunhoffer's double slit diffraction experiment, deduce the missing orders. 6

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

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 $Q_1 = +1 \times 10^{-8}$ c, $Q_2 = -2 \times 10^{-8}$ c, $Q_3 = +3 \times 10^{-8}$ c, $Q_4 = +2 \times 10^{-8}$ c and a = 1m. 6



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 , $\nabla \cdot \vec{J} + \frac{\partial \rho}{\partial t} = 0$

a) Discuss about Lorentz force with example and explain about Hall Effect 6

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

b) Biasing of Junction diode

c) Magnetic energy density

2×5

POKHARA UNIVERSITY

Level: Bachelor
Programme: BE
Course: Physics

Semester: Fall

Year : 2016
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) 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 10cm×15cm×20cm. 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 $I = I_0\left[1 - e^{-R/L\,t}\right]$. 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 $\mu_E = 1.658$, $\mu_0 = 1.486$ and $\lambda = 5890$ A°. Find the type of wave plate. 6

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

a) Types of optical fiber

b) Classify solids on the basis of band theory of solids.

c) Lorentz force with example.

POKHARA UNIVERSITY

Level: Bachelor
Programme:BE
Course: Physics

Semester:Spring

Year : 2016
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) 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

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 2N. Find the speed, amplitude, time period and wave length of the wave motion. 6

2. a) What is the diffraction of light? Discuss fraunhoffer's diffraction pattern in a single slit. 9

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 A^0 is used for the experiment then what is the diameter of 4^{th} bright ring? 6

3. a) Discuss Gauss law in electrostatics and use the law to determine electric field intensity due to changed sphere and charged plane sheet of a conductor. 9

b) Find electric field intensity at the centre of a square of side 5 cm consisting of 2 μ F charges in each vertex.

4. a) State Biot-Savart's law. Use it to find the magnetic field due to an infinitely long straight wire.

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 μF capacitor form oscillating circuit. What is the peak value of current if the initial charge is 40 μC? 6

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)** 2×5

a) Lase characteristics and advantages

b) Reverberation of sound

c) Hall effect

POKHARA UNIVERSITY

Level: Bachelor
Programme: BE
Course: Physics

Semester: Fall

Year : 2017
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) 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

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 6

i. Period and frequency?

ii. The wavelength is 1.40m; what is the wave speed?

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

b) Deduce the missing orders in Fraunhoffer's double slit diffraction experiment in which slit width a=0.08mm and opaque width b=0.16mm. 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

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

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? 6
      ii. The mean free path for free electrons in copper? (Given $n=8.4\times10^{28}m^{-3}$, $\rho=1.7\times10^{-8}\Omega m$, $v_{avg}=1.6\times10^{6}$ 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

POKHARA UNIVERSITY

Level: Bachelor
Programme: BE
Course: Physics

Semester: Spring

Year : 2017
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) Discuss different types of oscillations and hence determine the time period of compound pendulum and compare it with time period of simple pendulum. 9

   b) Two progressive waves of equal amplitude and frequency travelling in opposite direction superimpose to each other so as to form a standing wave of equation $y = Acosksinwt$. Where A=1mm, $k=1.57cm^{-1}$ and $w=78.5sec^{-1}$. Find: 6
      i. Velocity of progressive wave
      ii. Node closet to the origin, X>0
      iii. Antinode closet to the origin, X>0
      iv. Amplitude of resultant wave when, X=2.33cm.

2. a) What are the difference between interference and diffraction? Explain the phenomenon of interference in thin film by refracted rays. 9

   b) A diffraction grating 20.0mm wide has 6000 rulings 6
      i. Calculate grating element
      ii. At what angles will intensity maxima occur on a viewing screen if the radiation incident on the grating has wave length of 589nm?

3. a) Write the circuit equation for a charging RC circuit. Solve it to find charge and current. Explain the meaning of time constant. Provide qualitative sketch for charge and current varying with time. 9

   b) Show that electric potential at a point due to short dipole is inversely proportional to the square of distance from center of dipole. 6

4. a) Describe about Hall-effect with its application. Derive an expression for Hall coefficient, Hall Voltage and establish the relation with 9

mobility of charge carriers and conductivity of the material of wire.

b) Using Biot-Savart's law, find the magnetic field strength at the center of a rectangle loop of wire of length L.

5. a) What do you mean by electromagnetic oscillation? Derive the frequency of electromagnetic oscillation in LCR circuit.

b) A certain radio station broadcasts at a frequency of 1020 kHz. At a point some distance from the transmitter, the maximum magnetic field of the electromagnetic wave emits is found to be 1.6×10^{-6} T.

i. What is the speed of propagation of wave?

ii. What is the wavelength?

iii. What is the maximum electric field?

6. a) What is wave function? Derive the expression for Schrodinger time independent wave equation, using time dependent wave equation.

b) What do you mean by semiconductor? Explain the terms intrinsic and extrinsic semiconductor. Classify extrinsic semiconductors on the basis of doping.

7. Write short notes on: **(Any two)**

a) Production of ultrasound by magnetostriction method

b) Working principle of optical fiber

c) Lorentz force with an example

POKHARA UNIVERSITY

Semester: Fall

Year : 2018

Full Marks: 100

Pass Marks: 45

Time : 3hrs.

Level: Bachelor

Programme: BE

Course: 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.

a) Point out the differences between Simple linear harmonic motion and angular harmonic motion. Show that the radius of gyration is equal to distance from the centre of suspension to center of gravity of a compound pendulum, when the time period is minimum. 2+7

b) A simple harmonic transverse wave is propagating along a string towards the left direction as shown if figure. Figure shows a plot of displacement as a function of position at time t= 0. The string tension is 3.6 N and its linear density is 25 g/m. Calculate: 6

i. The amplitude

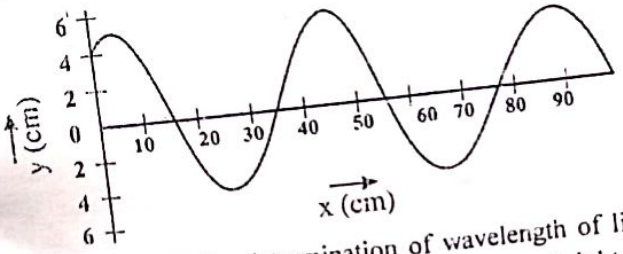
ii. The wavelength

iii. Wave speed

iv. The period

v. The maximum particle speed in the string.

vi. Write an equation describing the traveling wave.



2. a) Derive expression for determination of wavelength of light by using Newton's ring method when reflected light forms bright ring. Express the relation between optical and geometrical path. 2

OR

What is specific rotation of light? Explain how it is determined in laboratory.

b) A sugar solution in a tube of length 10 cm produces optical rotation of 15^0. The solution is then diluted to one fifth of it's previous concentration. Find the optical rotation produced by 25 cm long tube containing the diluted solution. 6

3. a) Define electric dipole. Find the electric field at a point along equatorial line such that the point is not lying along the direction perpendicular to the center of dipole. 1+8

b) The magnitude of the average electric filed normally present in the earth's atmosphere just above the surface of the earth is about 150 N/C, directed downward (radially inward, towards the center of earth). What is the total net surface charge carried by the Earth? Assume the Earth to be a conductor. 6

4. a) State Biot and Savart's law. Derive an expression for magnetic field intensity at a point along the axis of a current carrying circular loop. 1+8

b) A solenoid has an inductance of 100 H and a resistance of 150 ohms. If it is connected to a 100 volt battery, how long will it take for the current to reach one half of its final equilibrium values? 6

a) Derive the Maxwell's electromagnetic wave equations with their physical significance. 7+2

b) A circuit has L=10mh and C=10μF. How much resistance should be added to circuit so that the frequency of oscillation will be 1% less than that of free LC oscillation. 6

a) An electron is trapped in an one dimensional infinite potential well having width "b" such that; 9

$V=\infty$ for $x \leq 0$ and $x \geq b$

$V=0$ for $0 < x < b$

Using boundary condition, prove that the energy in potential well is quantized.

b) The time of reverberation of an empty hall without and with 600 audiences is 1.8s and 1.6s respectively. Find the reverberation time with 1000 audiences in the hall.(Do not use unitary method to solve) 6

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

) Spontaneous and stimulated emission of radiation

Types of semi-conductor Dopping

Hall effect

POKHARA UNIVERSITY

Semester: Spring

Year : 2018

Full Marks: 100

Pass Marks: 45

Time : 3hrs.

Level: Bachelor

Programme: BE

Course: 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.

a) Differentiate between damped oscillation and forced oscillation. Show that center of oscillation of compound pendulum lies beyond the center of gravity. 2+7

b) A stretched string has a linear mass density of 5 gm/cm and a tension of 10N. A wave on the string has amplitude of 0.12 mm and a frequency of 100 Hz is travelling in negative x-direction. 4+2

i. Write the wave equation with appropriate units.

ii. At what average rate does the wave transport energy?

a) Define Newton's Ring and explain why center of Newton's Ring is dark. Also, determine the expression to find the unknown wavelength of monochromatic light using Newton's Ring apparatus. 2+

b) A class room has dimensions 20x15x5 m^3. The reverberation time is 3.5 sec. calculate the total absorption of its surfaces and the average absorption coefficient. 3·

a) Define electric quardrupole. Hence determine the expression for electric potential due to quardrupole, at a point such that the point not lying along the axis of quardrupole. 1

b) Light of wavelength 5000 A^0 is incident normally on a plane transmission grating. Find the difference in the angle of deviation in the first and third order spectra. The number of lines per cm on grating is 6000.

4. a) State Biot's and Savart's law. Find the expression of magnetic field strength due to a straight conductor which carries some current on it. (use Biot's and Savart's law)

b) A parallel plate capacitor has a capacitance of 100×10^{-12} F, a plate of

area of 100 cm^2 mica (k=7) is used as a dielectric, at 50 volts potential difference. Calculate the electric field intensity and magnitude of induced change.

5. a) Enlist the Maxwell's electromagnetic wave equation, with derivation in differential form. 9

b) A wire of resistance 6 Ω is stretched by 20% what is the resistance of wire? Assume that resistivity remains same. 6

a) Derive the expression for schrodinger time dependent wave equation. 9

b) If 10mH inductor and two capacitors of 5 μF and 2 μF are given, find the two resonant frequencies that can be obtained by connecting these elements in different ways. 6

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

a) Semi-conductor interms of Band theory.

b) Optical fiber

c) Lorentz force.

POKHARA UNIVERSITY

Level: Bachelor
Programme: BE
Course: Physics

Semester: Fall

Year : 2019
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) Why compound pendulum is preferred than simple pendulum. For compound pendulum, prove that the minimum time period is obtained if the point of suspension and point of oscillations are equidistant from centre of gravity. 1+8

b) What is amplitude, the wave length and the velocity of the wave represented by y=5 $\sin(6\pi t + 4x)$ Where distance and time are measured in S.I Units? 6

2. a) What are the differences between Interference and diffraction of light? Explain the fraunhoffer diffraction through single slit and hence calculate the width of central maximum. 1+8

b) A classroom has dimension of 20x15x5 m^3. The reverberation time is 3.5sec. Calculate the total absorption of its surface and the average absorption coefficient. 6

3. a) Define electric dipole. Develop a relation of electric field intensity of a dipole not lying along equatorial line. 1+8

b) A soap film of $5x10^{-7}$ m thick is viewed at an angle of 35^0 to the normal. Find the wavelengths of light in the visible spectrum which will bw absent from the reflected light, given that the refractive index of the film is 1.33. 6

4. a) Derive an expression for the growth and decay of current in L-R circuit. Also, show that the value of transient current never exceed the steady current. 8+1

b) Find the magnitude of induced emf in a 200 turns coil with a cross-sectional area of $0.16m^2$, if the magnetic field through the coil changes from $0.10wm^{-2}$ to $0.50\ wm^{-2}$ at the uniform rate over a period 0.02 sec. 6

5. a) Write Maxwell's equations in integral and differential form. Using Maxwell's equation in free space show that speed of electromagnetic wave is equals to the speed of light. 2-

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 10 seconds. 6

6. a) What is wave function? Describe its significance. Derive Schrodinger time independent wave equation for a free particle like electron. 2+

b) Prove that the equation of continuity $\vec{\Delta}.\vec{J} + \frac{\partial \rho}{\partial t} = 0$ 6

Write short notes on: **(Any two)** 2×

a) Describe Spontaneous emission and Stimulated emission of a radiation

b) Resistance and Resistivity

c) Semi-conductor dopping

POKHARA UNIVERSITY

Level: Bachelor
Programme: BE
Course: Physics

Semester: Spring

Year : 2019
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) Why is really S.H.M rare? Deduce the expression for the time period of a compound pendulum and radius of gyration of compound pendulum. 9

b) A boy claps his hands once every second and hears the echo from a distant building. He hears the echo of each clap mid-way between it and the next clap. If the velocity of sound is 340m/s, what is the distance of the building from the body? 6

2. a) What is diffraction? Differentiate between Fresnel and Fraunhofer diffraction pattern. Discuss the intensity distribution in the diffraction pattern due to single slit. 9

b) Newton's rings that are formed by sodium light between the flat glass plate and convex lens are viewed normally from above. What will be the order of the dark ring, which will have double the diameter of 40th dark ring? 6

3. a) Discuss the types of optical fiber and explain the working principle of optical fiber. 9

b) A hall has a volume 2265m^3. Its total absorption is equivalent to 92.9m^2 of open window. What will be the effects of reverberation time if and audience fills the hall and thereby increase the absorption by another 92.9m^2? 6

4. a) Show that the magnitude of electric potential along axial line due to linear quadrupole is double than the potential along equatorial line. 9

b) Obtain the charging time constant of a capacitor in a RC circuit such that current through the resistor is decreased by half of its peak value in 5 seconds. 6

5. a) State and explain Biot-Savart's law. Use it to find the expression for magnetic field on the axis of current carrying coil. 9

b) Find the strength of magnetic field at the center of rectangular coil of length l and width d, which carries current I. 6

6. a) 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.
   b) Discuss the Sabine's formula to obtain the expression for growth and decay of sound energy in room.
7. Write short notes on: **(Any two)**
   a) Classify solids on the basis of band theory of solids
   b) Tunneling effect
   c) Lorentz force

POKHARA UNIVERSITY

Level: Bachelor
Programme: BE
Course: Physics

Semester: Fall

Year : 2020
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) Show that motion of a compound pendulum is angular simple harmonic and derive its time period. Also show that the time period of compound pendulum is minimum when length of pendulum is equal to the radius of gyration. 9
   b) A piano wire with mass 5gm and length 90 cm is stretched with tension of 25 N. A wave with frequency 100 Hz and amplitude 1.6 mm travels along the wire a) calculate the average power carried by the wave b) what happens to the power if the wave amplitude is halved. 6
2. a) What is interference of light wave? Describe the intensity distribution in the interference due to Young's double slits and show that the fringe width is same both for bright and dark fringes 9
   b) Derive the expression for the refractive index of the liquid which replaces the air film between Plano-convex lens and base plate in Newton's Ring experiment. 6
3. a) Define electric field and potential due to monopole, show that the magnitude of electric field along axial line due to linear dipole is double than that of the electric field due to dipole along equatorial line. 9
   b) Obtain the time constant of a capacitor in RC circuit such that the current through the resistor increases to one third of its peak value in 5 seconds. 6
4. a) State Biot-Savart's law. Use it to find the magnetic field due to an infinitely long straight wire. 9
   b) A circular loop of wire 5 cm in radius carries a current of 100 A. What is the energy density at the centre of the loop? 6

5. a) Write Maxwell's equations in integral and differential form. Using Maxwell's equation in free space show that speed of electromagnetic wave is equals to the speed of light.

b) Discuss the LC oscillation. Hence prove that the frequency of oscillation is $f=\frac{1}{2\pi\sqrt{LC}}$.

5. a) Define wave function with significance. Prove that energy levels are quantized, when a particle is trapped in an infinite potential well of a width "a" such that.

$V = \infty \; for \; x \leq 0 \; and \; x \geq a$

$V = 0 \; for \; 0 < x < a.$

b) The time of reverberation of an empty hall without and with 500 audiences is 1.5 sec and 1.4 sec respectively. Find the reverberation time with 800 audiences.

Write short notes on: **(Any two)**

a) Atomic View of resistivity

b) Types of optical fiber

c) Semi-conductor dipping.

POKHARA UNIVERSITY

Semester – Spring

Year: 2020

Full Marks: 70

Pass Marks: 31.5

Time: 2 hrs.

Level: Bachelor

Program: BE

Course: Physics

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

The figures in the margin indicate full marks.

Attempt all the questions.

Section - A: (5×10=50)

Q. N. 1 Point out the differences between simple and compound pendulum. Suppose, a meter stick suspended from one end swings as a compound pendulum; (a) what is the period of oscillation, (b) what would be the length of the simple pendulum that would have the same period and show that the point of oscillation lies beyond center of gravity.

OR

What is wave function? Derive the expression for Schrodinger time dependent and time independent wave equations.

Q. N. 2 What are coherent sources? Can the interference patterns be formed due to two independent sources? Define thin film and explain the phenomenon of interference in thin film due to reflected rays.

Q. N. 3 An inductor of inductance 40 mH 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?

Q. N. 4 Define electric quadrupole? Derive the expression for electric potential across the axial line and show that electric potential due to quadrupole along axis is double than that of electric potential along equatorial line in magnitude at equal distance "r" from the center of quadrupole?

Q. N. 5 Write down Maxwell's equations. Derive the differential forms of Maxwell's equations starting from integral form and also mention their physical significance.

Section - B: (1×20=20)

Q. N. 6 Present the importance of Hall-effect in different types of materials. Theoretically derive the expressions for Hall coefficient, Hall voltage and also establish the relation between Hall mobility of charge carriers and conductivity of the material. If a current of (20+ y) A (y is the number of letters in your first name) is passed through a long foil of silver, which is 0.1 mm thick and 4 m long. Calculate the Hall voltage produces across the width by a flux of 1.4 Wb/m2. If the conduction of silver is 6.8 x 107 mho/m. Estimate the number density, Hall coefficient and Hall mobility.

POKHARA UNIVERSITY

Level: Bachelor
Programme: BE
Course: Physics

Semester: Fall

Year : 2021
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.

a) Point out the differences between simple pendulum and physical pendulum. Explain how we can overcome with the limitations associated with simple pendulum. 2+7

b) A wave is propagating on a long stretched string along its length taken as the positive x-axis. The wave equation is given by $y = y_0 e^{-(\frac{t}{T}-\frac{x}{\lambda})^2}$. Where $y_0 = 4mm, T = 1s$ and λ=4cm. 2+4

i. Find the velocity of the wave.
ii. Find the function f (t) giving the displacement of the particle at x=0.
iii. Find the function g(x) giving the shape of the string at t=0.
iv. Plot the shape g(x) of the string at t=0.
v. Plot the shape of the string at t=5sec.

a) What is interference of light wave? Write down the conditions for sustain interference and derive the condition for obtaining destructive interference and constructive interference. 1+1+7

b) For an empty assembly hall of size 20x15x10 m^3, the reverberation time is 3.5sec. Calculate the average absorption coefficient of the hall. What area of the wall should be covered by the curtain so as to reduce the reverberation time to 2.5sec? Given the absorption coefficient of curtain cloth is 0.5. 3+3

a) What is electric dipole? Find the electric potential and field at a point lying along the equatorial line due to an electric dipole. 1+4+4

b) A parallel beam of light of wavelength 5890A^0 is incident on a thin glass plate of refractive index 1.5 such that the angle of 6

refraction into the plate is 60^0. Calculate the smallest thickness of the glass plate which will appear dark by reflection.

4. a) State Biot's and Savart's law. Find the magnetic field strength along the axis of coil using the Biot's and Savart's law.
   b) Two charges of 10 coulombs and 40 coulombs are placed 12 cm apart. Find the position of the point where intensity is zero.
5. a) Describe damped and undammed oscillation of the circuit between inductor and fully charged capacitor.
   b) A light beam travelling in the x- direction is described by the electric field E_y=300v/m sinw(t-x/c). An electron is constrained to move along the y-direction with a speed of $2.0x10^7$ m/s. find the maximum electric force and maximum magnetic force on the electron.
6. a) What is the physical meaning of wave function φ? Considering a particle of mass 'm' moving inside a box along x axis and it is confined to move freely in the region 0<x<L, find the Eigen value and Eigen function with normalized wave function.
   b) A copper strip of 2cm wide and 1mm thick is placed in a magnetic field 1.5T. If a current of 200A is set up in the strip, calculate.
      i. Hall voltage
      ii. Hall mobility, if the number of electrons per unit volume is $8.4x10^{28}/m^3$ and resistivity is $1.72x10^{-8}$ohm-meter

Write short notes on: **(Any two)**

a) Process of laser beam
b) Solids in terms of band theory
c) Resistance and resistivity

POKHARA UNIVERSITY

Level: Bachelor
Programme: BE
Course: Thermal Science

Semester: Fall

Year : 2014
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.

a) What is thermodynamic property? Also describe its various types along with relevant examples. 7
b) 0.2 $m^3$of an ideal gas at a pressure of 2Mpa and 600 k is expanded isothermally to 5 times the initial volume. It is then cooled to 300 K at constant Volume and then compressed back polytropically to its initial state. Show the process on a P-V diagram and determine the work done. 8
a) Draw with neat labeling of the P-V diagram of water and describe it. 7
b) A vessel having a volume of 0.5m3 contains 3 kg of liquid water and water vapor mixture in equilibrium at a pressure of 0.6 Mpa. Calculate: 8
   i. The mass of liquid and vapor.
   ii. The volume of liquid and vapor.
a) Derive the equation for turbine and nozzle with the help of steady energy equation by stating their assumptions. 7
) The properties of a system, during a reversible constant pressure non-flow process at P=1.6 bar, changes from V_1=0.3m^3/kg, t_1=20^0C to V_2=0.55m^3/kg, t_2=260^0C. The specific heat of the fluid is given by 8

$$C_p=1.5+75/(t+45)\ kJ/kg^0C$$ where t is in ^{0}C.

Determine:

i. Heat added /kg
ii. Change in internal energy/kg
iii. Change in enthalpy/kg

POKHARA UNIVERSITY

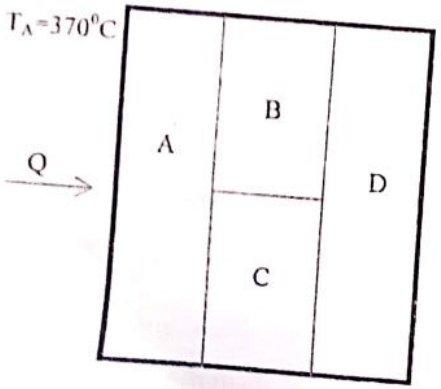
Level: Bachelor | Semester: Spring | Year : 2014
Programme: BE | Full Marks: 100
Course: Thermal Science | Pass Marks: 45
Time : 3hrs.

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.

7. a) Define thermodynamic system. Explain any three extensive thermodynamic properties. 8
   b) A fluid at pressure of 3 bar, and with specific volume 0.18m³/kg, contained in a cyclinder behind a piston that expands reversibly to a pressure of 0.6 bar according to a law: $p = C/v^2$, where c is a constant. Show the expansion process on p–V diagram and calculate the net work done by the fluid on the piston.
8. a) Derive an expression for work done and heat transfer during isothermal process. 7
   b) A vessel having a volume of 0.8 m³ contains 4.0 kg of liquid water and water vapour mixture in equilibrium at a pressure of 7 bar. Calculate:
      i. Mass and volume of liquid.
      ii. Mass and volume of vapour. 8
9. a) Describe first law of thermodynamics for cyclic and non-cyclic processes. 7
   b) 0.3kg of nitrogen gas at 100 kPa and 40°C is contained in a cylinder. The piston is moved compressing nitrogen until the pressure becomes 2MPa and temperature becomes 160°C. The work done during the process is 60kJ. Calculate the heat transferred from the nitrogen to the surroundings. Take c_v for nitrogen = 0.75 kJ/kg K. 8
10. a) Derive an expression for the efficiency of an ideal Rankine cycle with p-V and T-s diagrams. 7
    b) An ideal Brayton cycle has pressure ratio of 10. The temperature of air at compressor and turbine inlets are 300K and 1200K respectively. 8

4. a) Show that violation of Clausius statement leads to the violation of Kelvin-Plank statement of 2nd Law of Thermodynamics. 8
   b) Show that an isolated system obeys the principle of increase of entropy.
5. a) Describe the working principle of Rankine Cycle with corresponding T-S diagram. 7
   b) The compression ratio in an air-standard Otto cycle is 8. At the beginning of the compression stroke the pressure is 0.2 MPa and the temperature is 18°C. The heat transfer to the air per cycle is 1900 kJ/kg of air. Determine: 8
      The temperature and pressures at the end of each process of the cycle.
      i. Thermal efficiency of the cycle.

   [For air take γ = 1.4, R = 287 J/kg.K, CV = 718 J/kg.K and CP = 1005 J/kg.K]
6. a) Derive an expression for the overall heat transfer co-efficient for system composed of a plane slab separating two different fluid media. 7
   b) Find the heat transfer through the composite wall shown in figure. 8



e short notes on ***any two:*** 2×5
Refrigeration
Zeroth law of Thermodynamics
Natural and Forced convection

Determine its thermal efficiency and mass flow rate of air required to produce net power output of 80MW.

OR

The compression ratio of an air standard Otto cycle is 8. At the beginning of the compression process, the pressure and temperature of air are 100kPa and 20°C respectively. The heat added per kg of air during the cycle is 2200kJ/kg. Determine:

i. The pressure and temperature at the end of each process of the cycle.
ii. The thermal efficiency.
iii. The mean effective pressure.

5. a) Describe the concept of entropy as a property of a system and internal energy.

b) A reactor's wall 320mm thick, is made up of an inner layer of fire brick ($k = 0.84 W/m^0C$) covered with a layer of insulation ($k = 0.16 W/m^0C$). The reactor operates at a temperature of 1325°C at the atmospheric temperature of 25°C.

i. Calculate the thickness of brick and insulation
ii. Heat loss per unit area presuming that the insulating material has a maximum temperature of 1200°C.

a) Derive the expressions for overall heat transfer coefficient. 7

b) A centrifugal pump delivers water at the rate of 50 kg/s. The inlet and outlet pressures are 2 bar and 6.2 bar respectively. The suction is 2.2m below the centre of the pump and delivery is 8.5m above the centre of the pump. The suction and delivery pipe diameters are 200mm and 100mm respectively. Determine the capacity of the electric motor considering the efficiency of motor as 80% to run the pump. 8

Write short notes on: **(Any two)** 2×

a) Factors affecting thermal conductivity.
b) Prandtl Number and its relation with heat transfer.
c) Characteristics of entropy.

POKHARA UNIVERSITY

Level: Bachelor
Programme: BE
Course: Thermal Science

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 thermodynamic properties and explain its types with suitable practical examples of each. 7

b) A gas expands from an initial state where $P_1=550KPa$ and $V_1=0.1m^3$ to the final state where $P_2=100KPa$. The relationship between pressure and volume during the process is $PV^2=Constant$. Determine the work in KJ. 8

2. a) Derive an expression for work done and heat transfer during isothermal process. 7

b) A vessel having a volume of 0.8 m^3 contains 4.0 kg of liquid water and water vapour mixture in equilibrium at a pressure of 7 bar. Calculate: 8

i. Mass and volume of liquid.
ii. Mass and volume of vapour.

3. a) Describe first law of thermodynamics for cyclic and non-cyclic processes. 7

b) 0.3kg of nitrogen gas at 100 kPa and 40°C is contained in a cylinder. The piston is moved compressing nitrogen until the pressure becomes 2 MPa and temperature becomes 160°C. The work done during the process is 60kJ. Calculate the heat transferred from the nitrogen to the surroundings. Take c_v for nitrogen = 0.75 kJ/kg K. 8

4. a) Derive an expression for the efficiency of an ideal Rankine cycle with p-V and T-s diagrams.

b) The compression ratio of an air standard Otto cycle is 8. At the beginning of the compression process, the pressure and temperature of

air are 100kPa and 20°C respectively. The heat added per kg of air during the cycle is 2200kJ/kg. Determine:

i. The pressure and temperature at the end of each process of the cycle.
ii. The thermal efficiency.
iii. The mean effective pressure.

a) Write a brief note on entropy. Explain about entropy change of an ideal gas for an isochoric process. 7

b) A reactor's wall 320mm thick, is made up of an inner layer of fire brick (k = 0.84W/m°C) covered with a layer of insulation (k = 0.16W/m°C). The reactor operates at a temperature of 1325°C at the atmospheric temperature of 25°C. (i) Calculate the thickness of brick and insulation, and (ii) heat loss per unit area presuming that the insulating material has a maximum temperature of 1200°C. 8

Derive the expressions for overall heat transfer coefficient.

A centrifugal pump delivers water at the rate of 50 kg/s. The inlet and outlet pressures are 2 bar and 6.2 bar respectively. The suction is 2.2m below the centre of the pump and delivery is 8.5m above the centre of the pump. The suction and delivery pipe diameters are 200mm and 100mm respectively. Determine the capacity of the electric motor considering the efficiency of motor as 80% to run the pump.

te short notes on: **(Any two)** 2×5

a) Quality and moisture content
) Refrigeration Cycle
) Reversibility, Irreversibility and Lost Work
) Saturated, Superheated and Compressed liquid region

Level: Bachelo
Programme: BE
Course: Thermal Science

Candidates are required to give their answers in
as practicable.
The figures in the margin indicate full marks.
Students are allowed to take steam tables for the values needed in calculation of thermodynamic properties.

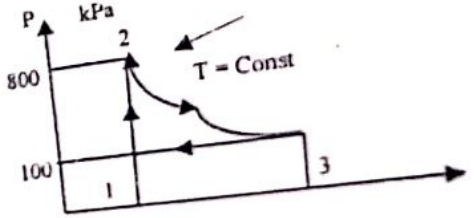
Attempt all the questions.

1. a) What is thermodynamic property? Explain its types. How can you say that given variable is a thermodynamic property? 7

b) A vessel contains one kg of steam which contains 1/3 liquid and 2/3 vapour by volume. The temperature of the steam is 151.87 °C. Find the quality, specific volume and specific enthalpy of the mixture. 8

2 a) Define heat and work. Also discuss their sign convention. 7

b) For the cycle shown in figure, determine the work output and the heat transfer. 8



OR

Steam enters a turbine operating at steady state with a mass flow rate of 4600kg/h. the turbine develops a power output of 1000kW. At the inlet, the pressure is 60 bar, the temperature is 400°C, and velocity is 10m/s. At the exit, the pressure is 0.1 bar, the quality is 0.9, and the velocity is 50m/s. Calculate the rate of heat transfer between the turbine and surroundings in kW.

3. a) Starting from steady flow energy equation, reduce it for Throttling and