POKHARA UNIVERSITY

Semester: Fall   Year   : 2018

Level: Bachelor   Full Marks: 100
Programme: BE   Pass Marks: 45
Course: Physics   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 linear harmonic motion and   2+7
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.

b) A simple harmonic transverse wave is propagating along a string   6
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:

  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.
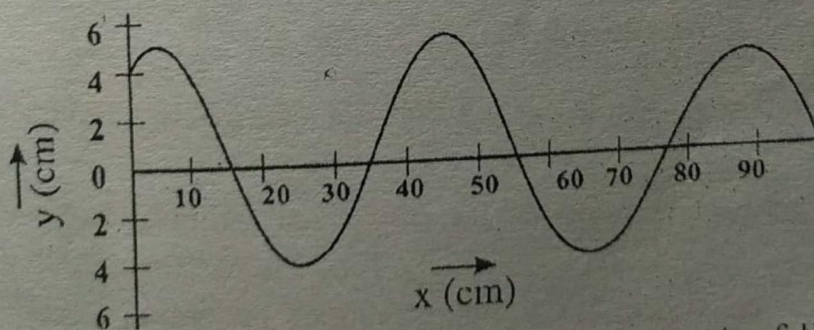
2. a) Derive expression for determination of wavelength of light by using   2+7
Newton's ring method when reflected light forms bright ring. Express
the relation between optical and geometrical path.

OR

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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

5. 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

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

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

a) Spontaneous and stimulated emission of radiation
b) Types of semi-conductor Dopping
c) Hall effect

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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+7

b) A class room has dimensions 20x15x5 m³. The reverberation time is 3.5 sec. calculate the total absorption of its surfaces and the average absorption coefficient.   3+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+8

b) Light of wavelength 5000 A⁰ 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.   6

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)   2+7

b) A parallel plate capacitor has a capacitance of 100x10⁻¹² F, a plate of   6

area of 100 cm² 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

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

7. Write short notes on: (Any two)

a) Semi-conductor interms of Band theory. 2×5

b) Optical fiber

c) Lorentz force.