POKHARA UNIVERSITY

Level: Bachelor   Semester: Fall   Year   : 2016
Programme: BE   Full Marks: 100
Course: 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.

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**

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**

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**

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 **6**
$I = I_0\left[1 - e^{-R/L^t}\right]$. Find the growth current at one time constant with neat graph.

10

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 $\times$ 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)

a) Types of optical fiber   2×5

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

c) Lorentz force with example.

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Attempt all the questions.

1. a) What is S.H.M? Discuss the theory of mass-spring system and derive the expression for time period and frequency. Also state the conditions of resonance. 9

   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 4th 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. 6

4. a) State Biot-Savart's law. Use it to find the magnetic field due to an infinitely long straight wire. 9

OR

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

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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 $\dfrac{E_m}{B_m} = C$, Where 6

symbol carry usual meaning.

5. 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