Physics I

[2nd Internal Exam, for 1st semester, 2009 session]

Time 1 hr 30 minutes

Group A 20 marks [10 questions $\times$ 2 marks]

Group B 20 marks [2 out of 3 questions $\times$ 10 marks]

Group A [short/objective questions]

1. Define Gradient and Divergence. Define a solenoidal field and a irrotational field.
2. Give mathematical statements of line, surface and volume integral. Give a physical example of line and surface integral.
3. if $\overrightarrow{E} = -\overrightarrow{\nabla}\Phi$, what is the value of $\overrightarrow{\nabla} \mathrm{x} \overrightarrow{E}$. Is $\overrightarrow{E}$ an irrotational field?
4. State the mathematical form of Gauss divergence theorem and Stoke's theorem.
5. What is Coulomb's law of electrostatic force?? State Gauss law in electrostatics.
6. If $\psi = A\sin(kx - \omega t + \alpha)$, derive the wave equation $\frac{\partial^2 \psi}{\partial t^2} = v^2 \frac{\partial^2 \psi}{\partial x^2}$.
7. What is diffraction?
8. Write the difference between diffraction and interference.
9. State Huygen's principle.
10. Newton's rings are formed using a lens of radius of curvatiure of 100 cm. Calculate the diameter of the 20th bright ring, with $\lambda = 5900A^0$

Group B [Long type questions, write steps in detail, answer any two, don't answer all three]

1. Define a stationary wave. If ψ_1 and ψ_2 are two wave functions with sinusoidal behavior, find the wave function ψ that represents the stationary wave. From the amplitude of this wave function ψ define the "nodes" and "anti-nodes" and find the points on the stationary wave where they appear, in terms of the wavelength λ. Write few important differences between a stationary wave and a progressive wave.
2. Draw a neat diagram for a coupled mass-spring system, set the normal mode equations. [start from equation of motion in x, y and convert into Q_1, Q_2].
3. With the help of a suitable ray diagram, describe the production of Newton's rings and find the diameters of both bright and dark rings.