END SEMESTER EXAMINATION   NOV.-DEC.-2011

AP-103 APPLIED PHYSICS-I

Time: 3 Hours
                                                  Maximum Marks : 70

Note :	Answer any **FIVE** questions.
	Assume suitable missing data, if any.

1[a] State the fundamental postulates of special theory of relativity. Derive Lorentz transformation equations for position & time.   7

[b] Show that the relativistic kinetic energy (K.E.) of a particle is given by

$$K.E. = (m - m_0) c^2$$

Where m and m_0 are relativistic and rest mass of the particle & c, the speed of light.   7

2[a] Obtain expression for relativistic addition of velocities using Lorentz transformation equations.   6

[b] The frequency of a damped simple harmonic oscillator is given by

$$\omega'^2 = \frac{s}{m} - \frac{r^2}{4m^2} = \omega_0^2 - \frac{r^2}{4m^2}$$

     2x4=8

(i) $\omega_0^2 - \omega'^2 = 10^{-6} \omega_0^2$, calculate the values of quality factor and the logarithmic decrement.

(ii) If $\omega_0 = 10^6$ and $m = 10^{-10} kg$. Calculate the stiffness of the system and the resistive constant.

(iii) If the maximum displacement at t=0 is 10^{-2} m, calculate the energy of the system and relaxation time for energy.

(iv) Calculate the energy loss in the first cycle.

3[a] Define quality factor of damped harmonic oscillator. Deduce its expression in terms of relaxation time.   7

[b](i) Explain the sharpness of resonance and explain the condition when resonance is sharp.   3½

(ii) Derive am expression for transverse wave in a string having linear density ρ and tension T.   3½

4[a] Derive an expression for the amplitude of forced vibrations of a mechanical system in steady state. 7

[b] Obtain an expression for reflection and transmission co-efficients of amplitude of longitudinal waves propagating from one medium to another medium. 7

5[a] Describe and explain the formation of Newton's rings with a suitable diagram for the reflected light system. Prove that in reflected light, diameters of the dark rings are proportional to the square root of natural numbers. 7

[b] Explain Rayleigh's criterion of resolution. Derive the expression for resolving power of a plane transmission grating. 7

6[a] What is meant by (i) plane polarized (ii) circularly polarized & (iii) elliptically polarized light? Briefly describe how these can be produced and detected using Nicol prism and quarter wave plate. 5

[b] A half wave plate is constructed for wavelength of 6000 Å. For what wavelength does it work as a quarter wave plate? 5

[c] Explain the following terms:
  (i) Population Inversion
  (ii) Point out the units of co-efficients of stimulated & spontaneous emission 4

7[a] What is the difference between step index and graded index optical fibres? Discuss the mechanism of light propagated in both types of fibres. Point out the advantages of graded index optical fibre over step index optical fibre. 5

[b] Draw the schematic diagram of He-Ne laser and describe its method of working. 5

[c] Explain the following terms:
  (i) Numerical Aperture (N.A.)
  (ii) Acceptance cone 4

8 Write short notes on the following: 3½ x4=14
[a] Spherical & Chromatic aberrations.
[b] Comparison between Huygens & Ramsden's eyepiece
[c] Zone plate
[d] Brewster's law