SECTION 'B'

SHORT ANSWER QUESTIONS (32 Marks)

NOTE: Attempt any *FIVE* part questions from this Section. All questions carry equal marks. Draw diagrams where necessary.

Q.2(i) Define torque of a couple. Prove $\tau = Fd$ with the help of a diagram.

(ii) Show that any of the following equations are dimensionally correct:

☆ $s = v_i t + \frac{1}{2} a t^2$ ☆ $T = 2\pi\sqrt{\frac{l}{g}}$

☆ $T = 2\pi\sqrt{\frac{m}{k}}$

(iii) Two converging lenses of focal length 40cm and 50cm are placed in contact. What is the focal length of this lense combination?

(iv) A cyclist is going up a slope of 30° with a speed of 3.5 m/s. If he stops pedalling, how much distance will he move before coming to rest? (Assume, friction is negligible).

(v) Define intensity of sound and loudness. State Weber Fechner law and formula for intensity level.

(vi) What is the ratio of maximum range and maximum height of a projectile for an angle at which range is maximum.

(vii) At what height from center of the earth, the value of 'g' becomes 36% of its value on the surface of earth?

(viii) Two forces $\vec{F} = 3\hat{i} + 2\hat{j} + 5\hat{k}$ and $\vec{F}_2 = \hat{i} + 6\hat{j} - 2\hat{k}$ act on a body which is displaced along a vector $\vec{r} = 4\hat{i} - \hat{j} + 3\hat{k}$. Calculate the work done on the body.

(ix) Show that gravitational field is conservative.

(x) Two cars approaching each other from opposite directions with same speed. The horn of one is blowing with the frequency of 3000 Hz and is heared by the people in the other car with the frequency of 3400 Hz. Find the speed of both cars, if speed of sound in air is 340 ms^{-1}.

(xi) A particle of mass 'm' is located at the vector position '$\vec{r}$' and has a linear momentum vector $\vec{P}$. The vectors '$\vec{r}$' and P are non-zero. If the particle moves in xy-plane, prove that $L_x = L_y = 0, L_z \neq 0$.

(xii) Why the central ring of Newton's ring is dark? State the reason.

SECTION 'C'

DETAILED ANSWER QUESTIONS (20 Marks)

NOTE: Answer any *TWO* questions from this Section. All questions carry equal marks. Draw diagrams, where necessary

Q.3(a) Two non-rotating spheres of masses m_1 and m_2, initially moving with velocities u_1 and u_2 respectively in one dimensions collide elastically. Derive expression for their final velocities v_2 or v_2. (diagram is not required).

(b) Describe the addition of two vectors by rectangular components method. Draw labelled diagrma.

Q.4(a) Describe Young's double slit experiment. Derive the formula for fringe spacing.

(b) By using a ray diagram, derive an expression for the centripetal acceleration in terms of linear velocity, angular velocity and time period.

Q.5(a) What is an Astronomical Telescope? With the help of a ray diagram derive an expression for its magnifying power when it is focused at infinity.

(b) How standing waves are produced in a stretched string? Derive an expression for frequencies when such a string vibrates in one loop, two loops and n loops.