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ROLL- 22MS077

SUBJ: PH2201

ASSIGNMENT-5

Q) using Levi civita symbol.

deduce $L_y = zp_x - xp_z$

$L_z = xp_y - yp_x$.

A) In index Notation,

$$L_i = \sum_{j,k=1}^{3} \epsilon_{ijk} r_j p_k$$

where $L_1 = L_x$, $L_2 = L_y$, $L_3 = L_z$.

$\epsilon_{123} = \epsilon_{231} = \epsilon_{312} = 1$

$\epsilon_{321} = \epsilon_{213} = \epsilon_{312} = -1$

$\epsilon_{ijk} = 0$ if $i=j$ or $j=k$ or $k=i$

now

$$L_2 = L_y = \sum_{j,k=1}^{3} \epsilon_{2jk} r_j p_k$$

$$= \epsilon_{231} r_3 p_1 + \epsilon_{213} r_1 p_3$$

Now in cartesian coordinate.

$r_1 = x$, $r_2 = y$, $r_3 = z$.

& $p_1 = p_x$, $p_2 = p_y$, $p_3 = p_z$.

$\therefore L_2 = 1 \cdot z p_x - x p_z$

D

and,

$$L_3 = L_z = \sum_{j,k=1}^{3} \epsilon_{3ij} r_j p_k$$

$$= \epsilon_{312} r_1 p_2 + \epsilon_{321} r_2 p_1$$

$$= x p_y - y p_x$$

□