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COMPUTER ENGINEERING
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SERIAL NO: 35

MAT 102 ASSIGNMENT

(1) $A = 2i - j \quad B = 3i + j - 11k \quad C = 4i + 4j - 5k$

(i) $-3A + 7B - 8C$

$= -3(2i - j) + 7(3i + j - 11k) - 8(4i + 4j - 5k)$

$= -6i + 3j + 21i + 7j - 77k - 32i - 32j + 40k$

$= -6i + 21i - 32i + 3j + 7j - 32j - 77k + 40k$

$= -17i - 22j - 37k$

$\therefore -3A + 7B - 8C = -17i - 22j - 37k$

(ii) $k = 2A + 4B - C$

$= 2(2i - j) + 4(3i + j - 11k) - (4i + 4j - 5k)$

$= 4i - 2j + 12i + 4j - 44k - 4i - 4j + 5k$

$= 4i + 12i - 4i - 2j + 4j - 4j - 44k + 5k$

$= 12i - 2j - 39k$

$\therefore 2A + 4B - C = 12i - 2j - 39k$

$|k| = \sqrt{(12)^2 + (-2)^2 + (-39)^2}$

$|k| = \sqrt{1669}$

$|k| = 40.85$

$\therefore$ The direction Cosine of k are:

$\cos\alpha = \frac{12}{40.85} = 0.2938$

$\cos\beta = \frac{-2}{40.85} = 0.0490$

$\cos\gamma = \frac{-39}{40.85} = -0.9547$

(iii) $A \times (B \times C)$

$$B \times C = \begin{vmatrix} i & j & k \\ 3 & 1 & -11 \\ 4 & 4 & -5 \end{vmatrix}$$

$$= i\begin{vmatrix} 1 & -11 \\ 4 & -5 \end{vmatrix} - j\begin{vmatrix} 3 & -11 \\ 4 & -5 \end{vmatrix} + k\begin{vmatrix} 3 & 1 \\ 4 & 4 \end{vmatrix}$$

$$= i(-5-(-44)) - j(-15-(-44)) + k(12-4)$$

$$= i(39) - j(29) + k(8)$$

$$B \times C = 39i - 29j + 8k$$

$$\therefore A \times (B \times C) = \begin{vmatrix} i & j & k \\ 2 & -1 & 0 \\ 39 & -29 & 8 \end{vmatrix}$$

$$= i\begin{vmatrix} -1 & 0 \\ -29 & 8 \end{vmatrix} - j\begin{vmatrix} 2 & 0 \\ 39 & 8 \end{vmatrix} + k\begin{vmatrix} 2 & -1 \\ 39 & -29 \end{vmatrix}$$

$$= i(-8+0) - j(16-0) + k(-58-(-39))$$

$$= i(-8) - j(16) + k(-19)$$

$$= -8i - 16j - 19k$$

(iv) $(3A \times B) \cdot (A \times 2B)$

$$3(2i - j) \times 3i + j - 11k$$

$$6i - 3j \times 3i + j - 11k$$

$$(3A \times B) = \begin{vmatrix} i & j & k \\ 6 & -3 & 0 \\ 3 & 1 & -11 \end{vmatrix}$$

$$= i\begin{vmatrix} -3 & 0 \\ 1 & -11 \end{vmatrix} - j\begin{vmatrix} 6 & 0 \\ 3 & -11 \end{vmatrix} + k\begin{vmatrix} 6 & -3 \\ 3 & 1 \end{vmatrix}$$

$$= i(+33-0) - j(-66-0) + k(6+9)$$

$$= i(33) - j(-66) + k(15)$$

$$(3A \times B) = 33i \pm 66j + 15k$$

$$(A \times 2B) = 2i - j \times 2(3i + j - 11k)$$

$$= 2i - j \times 6i + 2j - 22k$$

$$(A \times 2B) = \begin{vmatrix} i & j & k \\ 2 & -1 & 0 \\ 6 & 2 & -22 \end{vmatrix}$$

$$= i\begin{vmatrix} -1 & 0 \\ 2 & -22 \end{vmatrix} - j\begin{vmatrix} 2 & 0 \\ 6 & -22 \end{vmatrix} + k\begin{vmatrix} 2 & -1 \\ 6 & 2 \end{vmatrix}$$

$$= i(22-0) - j(-44-0) + k(4+6)$$

$$(A \times 2B) = 22i + 44j + 10k$$

$$\therefore (3A \times B)\cdot(A \times 2B) = (33i + 66j + 15k)\cdot(22i + 44j + 10k)$$

$$= 726 + 2904 + 150$$

$$= 3780$$

(v) $A - 2B - C$

$2i - j - 2(3i + j - 11k) - (4i + 4j - 5k)$

$2i - j - 6i - 2j + 22k - 4i - 4j + 5k$

$2i - 6i - 4i - j - 2j - 4j + 22k + 5k$

$-8i - 7j + 27k$

(2) Perpendicular vectors are vectors in which their scalar product is equal to zero e.g Two vectors A and B are said to be perpendicular if their scalar product equal to zero

$A \cdot B = 0$

Coplanar vectors are vectors in which their scalar triple product is equal to zero e.g Three vectors A, B and C are said to be coplanar if the triple scalar product equal to zero

$A \cdot (B \times C) = 0$