NAME: OKWUOKWU BRYAN COURSE: MAT 102

MATRIC No. 19/ENG05/049 DEPARTMENT: Mechatronics

① $m = pi - 6j - 3k$ $N = 4i + 3j - k$ $O = i - 3j + 2k$

② $m \cdot N = 0$

$\therefore (pi - 6j - 3k) \cdot (4i + 3j - k) = 0$

$4p - 18 + 3 = 0$ $4p = 18 - 3 = 15$

$\therefore \frac{4p}{4} = \frac{15}{4}$ $= 3\frac{3}{4}$

③ $m \cdot (N \times O) = 0$

$$N \times O = \begin{vmatrix} i & j & k \\ 4 & 3 & -1 \\ 1 & -3 & 2 \end{vmatrix} = i(6-3) - j(8+1) + k(-12-3)$$

$= 3i - 9j - 15k$

$m \cdot (N \times O) = (pi - 6j - 3k) \cdot (3i - 9j - 15k)$

$= 3p + 54 + 45 = 0$

$3p = -54 - 45 = -99$

$\frac{3p}{3} = \frac{-99^{33}}{3}$ $\therefore p = -33$

② $3i + 2j + 5k = a$

$2i - j + 6k = b$

$5i + 2j - 3k = c$

$a+b+c = 3i+2i+5i+2j-j+2j+5k+6k-3k$

$= 10i+3j+8k$

$\sqrt{a+b+c} = \sqrt{10}$

$|a+b+c| = \sqrt{(10)^2+(3)^2+(8)^2} = \sqrt{100+9+64} = \sqrt{173}$

Unit vector $= \hat{u} = \frac{a+b+c}{|a+b+c|} = \frac{10i}{\sqrt{173}} + \frac{3j}{\sqrt{173}} + \frac{8k}{\sqrt{173}}$

Direction cosines, $\cos\alpha = \frac{10}{\sqrt{173}}$ $\cos\beta = \frac{3}{\sqrt{173}}$ $\cos\gamma = \frac{8}{\sqrt{173}}$

(3) $F = 3ui + u^2j + (u+2)k$

$V = 2ui - 3uj + (u-1)k$

$(F \times V) = \begin{vmatrix} i & j & k \\ 3u & u^2 & (u+2) \\ 2u & -3u & (u-1) \end{vmatrix}$

$= i((u^3-2u^2)+3u^2+6) - j((3u^2-6u)-2u^3) + k(-9u^2-2u^3)$

$= (u^3+u^2+6)i - (-2u^3+(3u^2-6u))j + (-9u^2-2u^3)k$

$\int_0^1 (F \times V)\,du = \int (u^3+u^2+6)i + \int (2u^3-3u^2+6u)j + \int (-9u^2-2u^3)k$

$$= \left[\frac{u^4}{4} + \frac{u^3}{3} + 6u\right]_0^1 + \left[\frac{u^4}{2} - u^3 + 3u^2\right]_0^1 +$$

$$\left[-3u^3 + \frac{u^4}{2}\right]_0^1$$

$$= \left(\frac{1}{4} + \frac{1}{3} + 6\right) + \left(\frac{1}{2} - 1 + 3\right) + \left(-3 - \frac{1}{2}\right)$$

$$= \frac{79}{12} + \frac{5}{2} - \frac{7}{2} = \frac{79}{12} - \frac{2}{2} = \frac{79}{12} - \frac{12}{12}$$

$$\int_0^1 (EXu)\, du = \frac{67}{12} = \underline{5.8333}$$