## SOLUTIONS C106 THERMODYNAMIC, FLUID AND PROCESS ENGINEERING Year 2004

2. A vertical wall acts as a dam between fresh water (density 1000 kg/m<sup>3</sup>) and sea water (density 1030 kg/m<sup>3</sup>) on the other side. The depths are 2 m and 3.5 m respectively. Calculate the resultant force and resultant turning moment about the base for a init width.

## FRESH WATER

$$\begin{split} R &= \rho g A \, \overline{y} \text{ and } \overline{y} = h/2 = 2/2 = 1 \\ R &= 1000 \text{ x } 9.81 \text{ x } 2 \text{ x } 1 = 19620 \text{ N} \\ M &= R \text{ A} \quad A = (2 - \overline{h}) \text{ In this case } \overline{h} = 2h/3 \\ M &= 19620 (2/3) = 13080 \text{ N m} \end{split}$$

SALT WATER  $R = \rho g A \overline{y}$  and  $\overline{y} = h/2 = 3.5/2 = 1.75$   $R = 1030 \times 9.81 \times 3.5 \times 1.75 = 61889 \text{ N}$   $M = R B \quad B = (3.5 - \overline{h})$  In this case  $\overline{h} = 2h/3$  $M = 61889 \times 1.1667 = 72204 \text{ N m}$ 



Resultant Force = 61889 - 19620 = 42269 N (acting right to left)

Resultant Moment = 72204 – 13080 = 59124 Nm (acting anti clockwise)

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