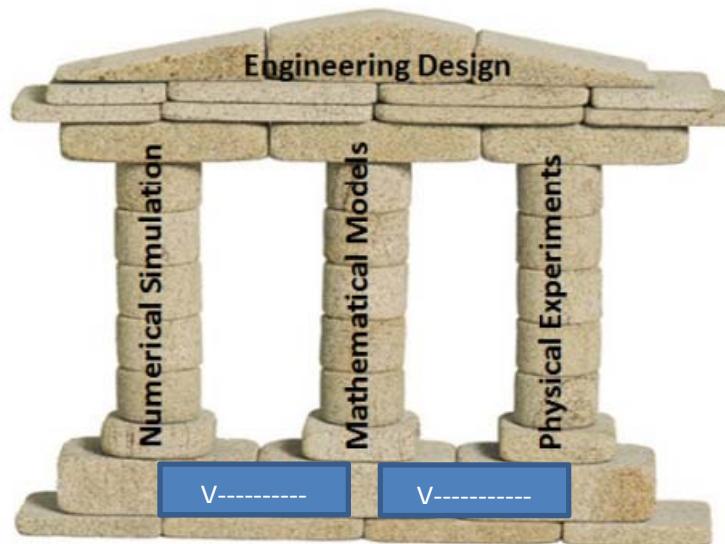


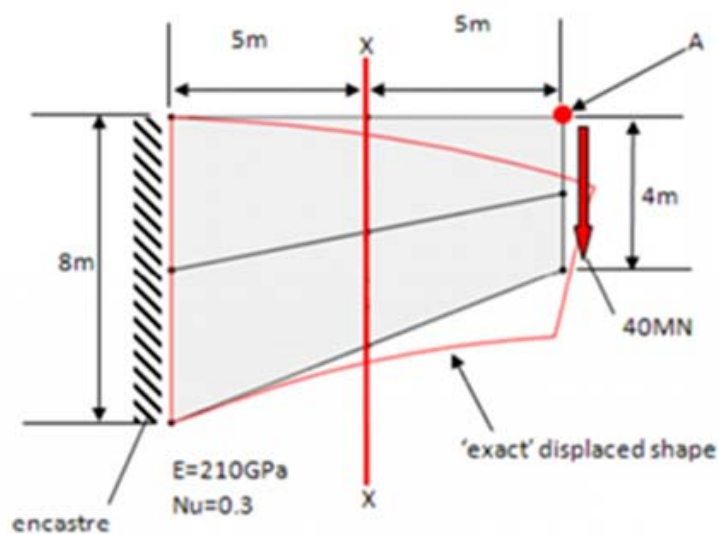
Question 1

Given that the following diagram illustrates the three pillars supporting sound engineering design and that you understand the two processes of verification and validation, fill in these processes on the diagram.



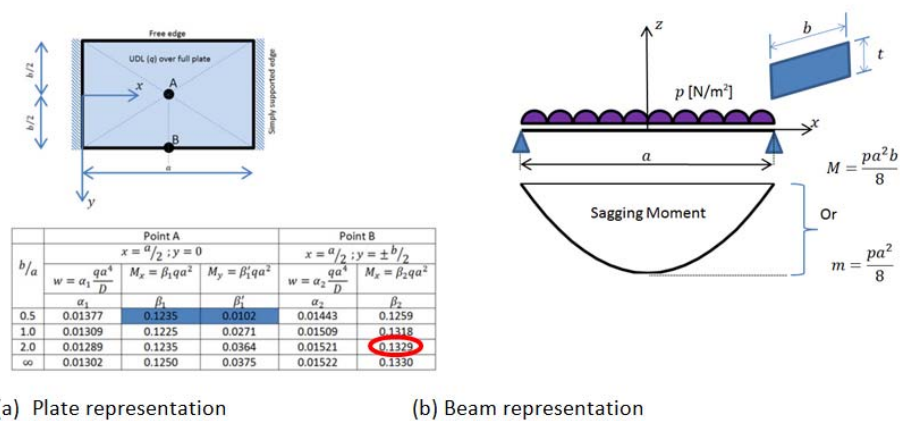
Question 2

If you cut the structure on the section XX then what are the forces and moments required on the cut section to hold the structure in equilibrium with the applied load?



Question 3

Consider the two representations of a plate member:



The bending moment M for the beam has the usual units Nm. However, when considering plates it is more usual to use moments per unit width, m , which then has units Nm/m.

Figure 4: Two representations of a plate problem

Consider a wide plate with an aspect ratio of 2 where $a=1\text{m}$, $b=2\text{m}$, $t=0.01\text{m}$ and the material has a yield stress of $S_y=275\text{MPa}$ and using the following moment capacities determine the pressure to cause first yield and the pressure to cause collapse of the beam.

$$m_f = \frac{S_y t^2}{6} \quad \text{Moment to cause first yield of section} \quad (1)$$

$$m_c = \frac{S_y t^2}{4} \quad \text{Moment to cause collapse of section} \quad (2)$$

The Steel Construction Institute offers practising engineers advice on the design of structural steel members in its Steel Designers' Manual. An extract from the SDM relevant to the plate being considered is shown below:

Ultimate load capacity (kN/m²) for floor plates simply supported on two edges stressed to 275 N/mm²

Thickness on plain mm	Span (mm)							
	600	800	1000	1200	1400	1600	1800	2000
4.5	20.48	11.62	7.45	5.17	3.80	2.95	2.28	1.87
6.0	36.77	20.68	13.28	9.20	6.73	5.20	4.07	3.30
8.0	65.40	36.87	23.48	16.38	11.97	9.23	7.23	5.93
10.0	102.03	57.42	36.67	25.55	18.70	14.45	11.30	9.25
12.5	159.70	89.85	57.40	39.98	29.27	22.62	17.68	14.50

Stiffeners should be used for spans in excess of 1100 mm to avoid excessive deflections.

Comparing the SDM value with the values already obtained from the beam, what do you make of the SDM result?

Question 4

Do you think that conventional yield line theory, applicable to reinforced concrete slabs, is equally applicable to other ductile materials like, for example, steel plates?