**TASK 1**

**Situation**

In this task, you are required to design a simply supported reinforced concrete beam, which will be used as internal flexural member in a commercial building. So, your design should include both the flexural and shear designs using the relevant Australian Standard and the below information. As well, you need to make sure that your design satisfies all other requirements.

**Design information:**

* The span length of beam is 7.5m.
* The beam carries its own self weight plus uniform live load of 15kN/m and superimposed dead load of 18kN/m.
* The concrete compressive strength f’c = 40MPa.
* The modulus of elasticity of concrete Ec = 30,100MPa.
* Concrete density = 25kN/m3.
* Steel yield strength fsy = 500MPa.
* The modulus of elasticity of steel Es = 200,000MPa.
* The concrete clear cover = 40mm, based on the exposure condition as the beam is an external beam.
* For cost estimation, consider the below estimations:

1. Unreinforced concrete cost is $250/m3
2. Framework and labour costs are $400/m3.
3. Steel cost is 1200/ton.
4. Labour of steel is 1000/ton.
5. *Flexural design:*

Using the given information above, design the required steel reinforcement for flexural, showing the below design requirements.

1.1. Identify and interpret design requirements and given information.

1.2. Calculate:

* + 1. The dimensions of the beam’s section (D and b).
    2. Required loads (total dead deal loads, total live load and the total design factored load).
    3. Stresses
    4. Bending moment.
    5. Required longitudinal steel reinforcement.
    6. Appropriate reinforcement selection.
    7. Carry out risk assessment for above design using risk assessment strategies (Risk matrix that includes likelihood and impact).

*2. Shear design:*

Use the same beam that you have designed for flexural in 1.1 and design the shear reinforcement for this beam, showing the below design requirements.

* 1. Shear force diagram.
  2. Bending moment diagram.
  3. Appropriate reinforcement SELECTION.
  4. Spacing of stirrups according to standards
  5. Location of first stirrup
  6. Location of last stirrup
  7. All relevant checks to make design safe
  8. A neat sketch of the beam and its cross-section using appropriate scale, showing the following:
     1. A neat plan of the beam and its cross-section, showing all their dimensions and the concrete cover.
     2. Arrangement of steel reinforcement (both the flexural and shear reinforcements) with labelling.

**Other requirements of task**

1. Describe relevant legislations and standards you need to apply for developing above design.
2. Role-play activity. Meet with your supervisor and discuss the design including design requirements, best possible option within criteria and finalise the design.
3. Role-play activity. Meet with your co-worker (assessor) and review above design with co-workers (assessor) to ensure your design is correct and meets the requirements.
4. Prepare cost estimate for the above design
5. Develop a process to maintain the design and cost record.
6. Develop criteria to validate above design and validate using the design criteria. The criteria include:
7. Compliance with Australian relevant standard.
8. Risk assessment of
   * + 1. The existing conditions.
       2. The application of the design.
9. Health, safety and environmental requirements.

**TASK 2**

**Situation**

In this task, a simply supported reinforced concrete beam is reinforced with 4N24 (N class reinforcement) as shown in the section below. This beam is a part of building that designed to be used as warehouse. The beam carries a slab of 4m width. Ignore the stiffness contribution from slab and use the below design information to:

1. Calculate the mid-span deflections (short term and long-term deflections).
   1. Calculate the self-weight, the total dead load, the total live load and then the total factored load.
   2. Calculate the modular ratio and the ratios of steel reinforcement.
   3. Calculate the Bending moment.
   4. Calculate the second moment of area for uncracked section Ig and for cracked section Icr and the effective second moment of area Ief and maximum effective second moment of area Ief,max.
   5. Calculate the cracking moment of concrete.
   6. Calculate the maximum shrinkage tensile stress.
2. Check whether span-to-depth ratio of the above beam would satisfy the deemed to comply requirement.

**Design information:**

* The span length of beam is 6m.
* The beam carries a slab-4m width and 100mm thickness. The unfactored loads on slab are 5kN/m2-dead load and 3kN/m2-live load.
* The concrete compressive strength f’c = 35MPa.

300mm

500mm

4000mm

100mm

**Note: the drawing is not to scale.**

* The modulus of elasticity of concrete Ec = 32,800MPa.
* Concrete density is 25kN/m3.
* Steel yield strength fsy = 500Mpa.
* The modulus of elasticity of steel Es = is 200,000Mpa.
* The concrete clear cover = 40mm.
* The final design shrinkage strain ϵ\*cs = 510\*10-6

4N24