Question **1**

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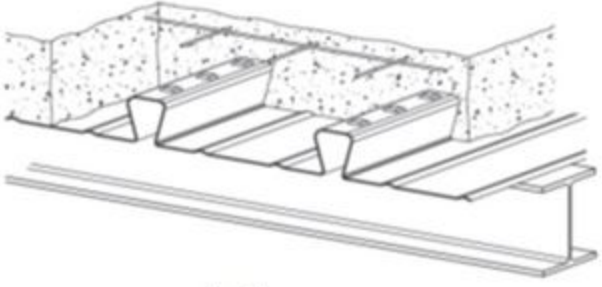
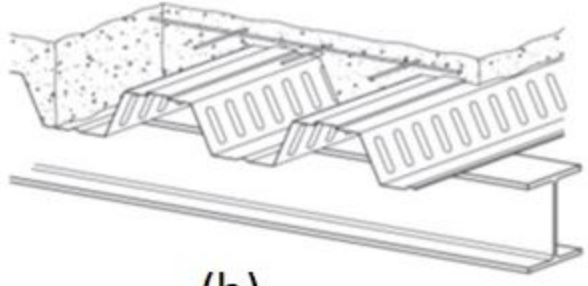
1. Explain the essential issues in designing steel-concrete composite slab at both construction and composite stages.
2. If the composite slab is unproped during the construction stage, which type of the composite slab in the figure is more efficient? Please clarify the reasons.



(a)



(b)

Question **2**

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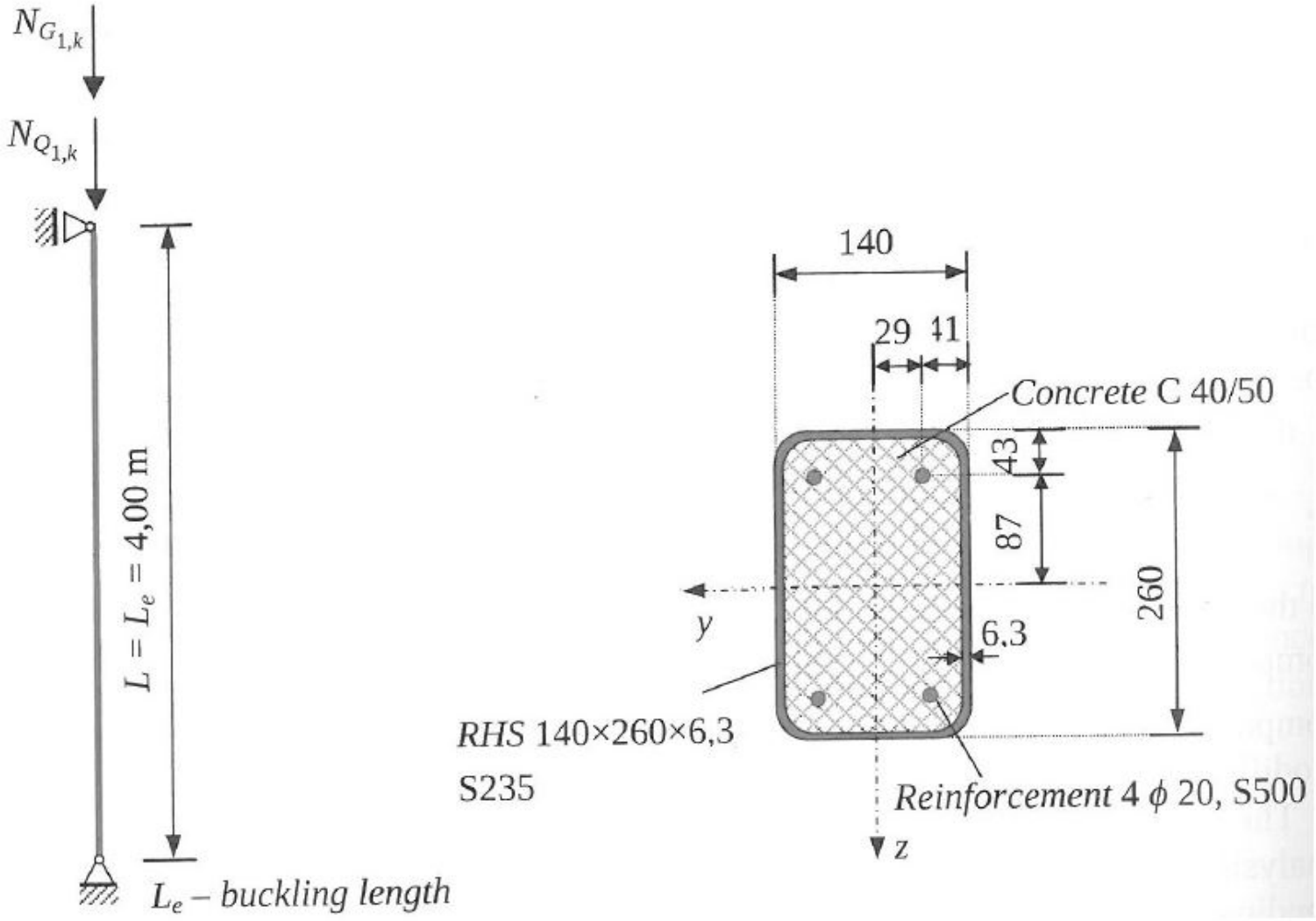
The concrete-filled composite column consists of the rectangular hollow section filled with concrete. According to EN1994-1-1, check if the composite column has enough resistance in major axis when the permanent load of $N_{G,k}$ = 410 kN and the variable load of $N_{Q,k}$=230 kN are axially applied. The dimensions and the materials of the column are given in the figure.



Question **3**

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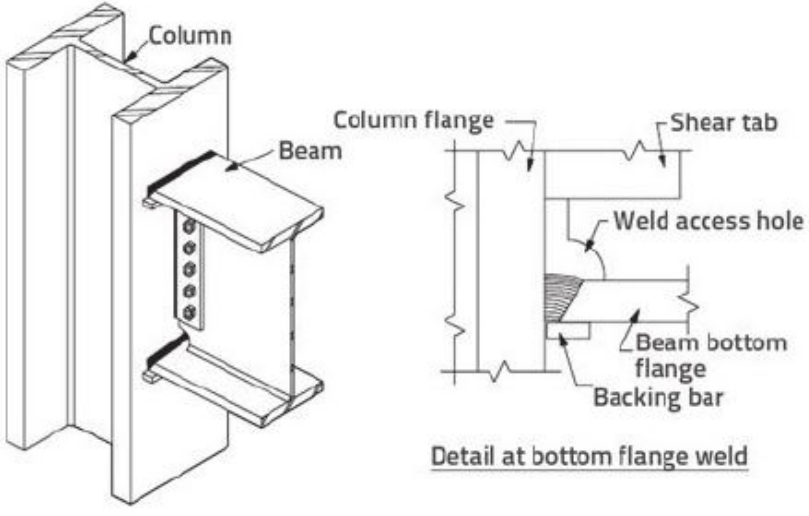
(a) Based on the component methods in EN 1993-1-8, identify the components for the beam-to-column joint shown in the figure.

(b) If the joint is inside a braced frame, how would you like to classify this joint according to the strength criteria in EN 1993-1-8? Clarify the reasons.



Question **4**

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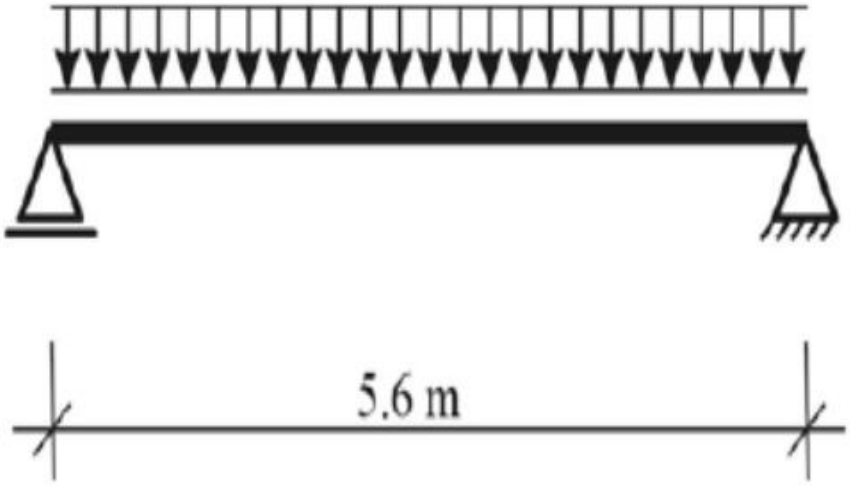
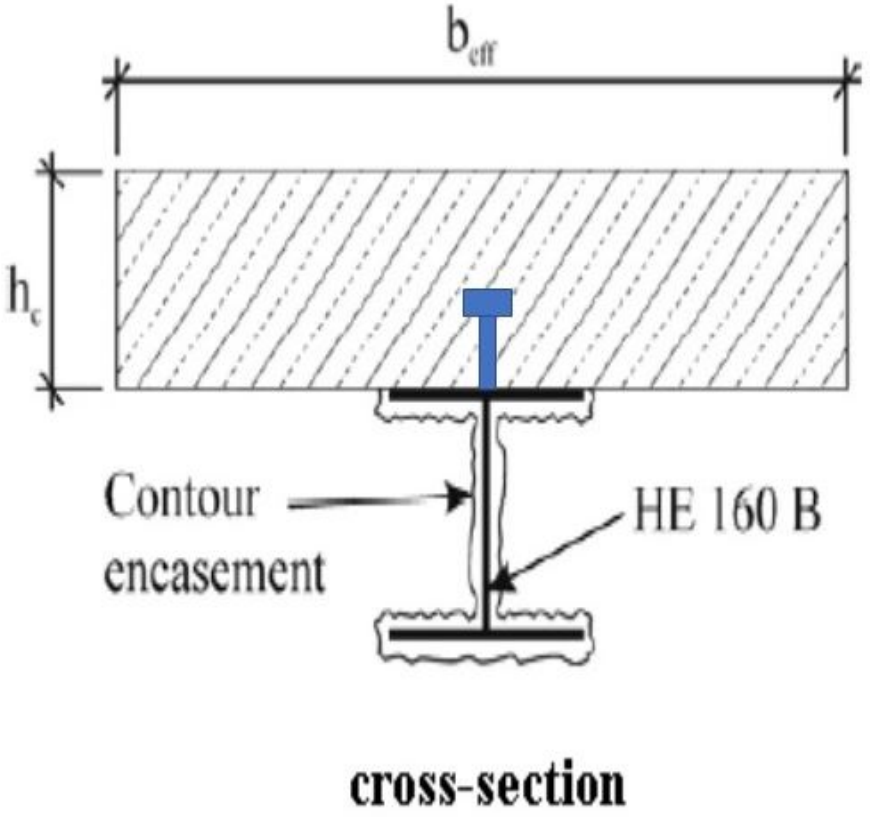
A simply supported composite beam is 5.6 m long and loaded uniformly as shown in the figure. The composite beam is composed of a steel beam (HEB 160, S355) and the concrete slab with a height of 160 mm (C25/30, f_{ck}=25N/mm^2, E_{cm}= 30500N/mm^2). The steel beam is contour protected with plasters (thermal conductivity: λ_p = *0.12 W/(mK)*, specific heat: c_p = *1100 J/(kgK)*, Density: ρ_p = *550 kg/m^3*, thickness *t = 15 mm*). It is assumed that the shear connectors between the steel beam and the concrete slab are strong enough to provide full shear connections at elevated temperatures.

a) Determine the temperature distribution across the steel profile if the beam is exposed to the standard fire for 60 min.

b) Determine the load that the composite beam can carry if the beam is rated as R60.





cross-section