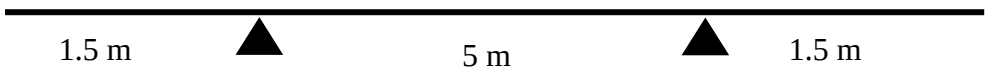
Birzeit University
Faculty of Engineering
Department of Civil and Environmental Engineering
ENCE 335, Reinforced Concrete Design I
First semester 2020-2021
Midterm Exam

(If any needed information is not given, assume reasonable value and state your assumption clearly)

Question 1: (50 Points)

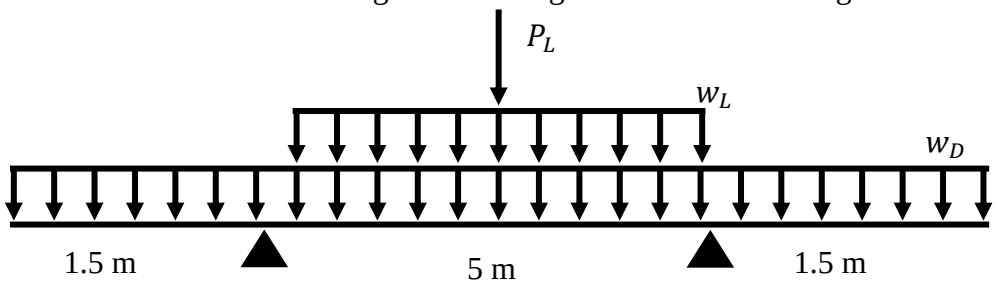
The beam shown supports a uniform dead load of 40 kN/m including its self-weight and a uniform live load of 15 kN/m and a concentrated live load of 50 kN.

(use f_c' = 21 MPa , f_y = 420 MPa)



1) Develop all load cases required to draw the moment envelop for the beam

2) Draw Shear force and bending moment diagrams for the following load case.



3) If the absolute maximum bending moment was 270 kN.m and the beam has a rectangular cross section, determine the beam geometry to the nearest 5 cm.
(d=1.5B and ρ= 0.75 $\rho_{0.005}$)

4) If B = 350 mm and H = 550 mm. Determine the exact reinforcement required for the maximum positive (270 kN.m) and negative moment (-190 kN.m).
(use 1 layer of steel for both moments). **Perform all necessary checks**

5) Draw all necessary cross-sections and side views

6) If B = 350 mm and H = 550 mm. Calculate the moment that causes the beam to start cracking. **(ignore reinforcement)**

7) If B = 350 mm and H = 550 mm, under service load conditions, the maximum positive service moment is 190 kN.m. Calculate the maximum stress in concrete and steel. **Use 3Φ32 bottom reinforcement.**

Question 2: (50 points)

The T-Beam shown in the figure, has a stem width of 350 mm (b_w = 350 mm) and total depth of 650 mm (H= 650 mm) and the flange thickness is 100 mm. The Beam is reinforced with 8Φ36 at the bottom and 2Φ36 at the top.

(Assume 2 layers of steel at the bottom and 1 layer at the top)

Determine:

a) The positive moment capacity of the beam
b) If the Beam is simply supported with a span of 8m and carries a total uniform service dead load of 50 kN/m. Calculate the maximum allowable uniform service live load the beam can support.

(Take $f_c^{'}$ = 28 MPa, f_y = 420 MPa)