Birzeit University
Faculty of Engineering
Department of Civil and Environmental Engineering
ENCE 335, Reinforced Concrete Design I
1st semester 2020-2021
Final Exam

NAME: **ID#:**

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

Question 1: (50 Points)

A Cantilever beam with 3m span is subjected to uniform dead load of 25 kN/m, a uniform live load of 15 kN/m, and a concentrated live load of 20 kN. If the beam cross-section is 550mm x 350mm (HxB)

- Draw shear and moment diagrams for the beam.
- Calculate the exact reinforcement required for the beam, **perform all necessary checks**.
- If 1ϕ10 closed loop stirrups to be used. Calculate the exact number of stirrups needed for the beam.
- Calculate the exact length of the required reinforcing bars.
- Draw proper detailing for beam.
- If the beam is not carrying any non-structural members and part of an interior floor. Does the beam satisfy the ACI code deflection control conditions?

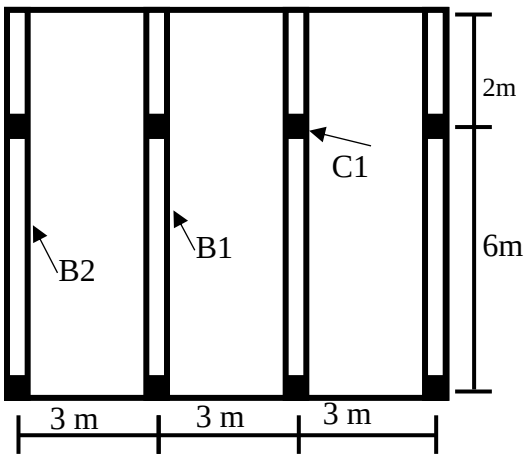
(Take f_c' = 28 MPa, f_y = 420 MPa)

Question 2: (40 Points)

The given floor is carrying 7 kN/m^2 and 4.8 kN/m^2 total service dead (including SW) and live loads. And the solid slab thickness H=150 mm. Answer the following Questions:

$[f_c' = 28\ MPa, F_y = 420\ MPa]$

1) Draw the **load path** on the figure, then draw **representative structural systems** to be used for the **beam B1 & B2** and **one-way slab** analysis and design (show loads)?
2) Draw shear and moment diagrams for the one-way slab design strip. And design the slab for shear and flexure. (Use ACI coefficients)
3) Draw detailing for the one-way slab reinforcement.
4) Assuming the building has 5 typical floors with the same layout and loads. What is the **total ultimate load on Column C1** and **design a square non-slender column**.? [use $\rho = 0.02$]



Question 3: **(20 Points)**

You are a site engineer now supervising a big project. While preparing the steel for the second floor, you see the following beam detailing. And instantly, you notice several detailing mistakes. Knowing that the designer did not make mistakes in the design itself (calculating #bars, spacing …. etc.), it is most likely the person who did the final drawings was confused.

Answer the following questions:

1) What mistakes do you see the given beam detailing? Justify your answer?
2) Suggest a practical detailing to solve this problem as fast as possible?

$[f_c' = 28\ MPa, F_y = 420\ MPa]$