

Birzeit University
Faculty of Engineering
Department of Civil and Environmental Engineering

ENCE 335, Reinforced Concrete Design I

Homework assignment #4

Due on Monday Dec. 14th, 2020 @ 11:59 AM.

A Simply supported beam with a span of 10 m (center to center) is carrying a total uniform dead load of 60 kN/m and a total uniform live load of 80 kN/m. The beam dimensions are 750x500 mm (HxB). The beam is supported by 500x500 mm columns. Use $\phi 12$ Closed loop stirrups.

Prepare your work according to the following steps:

1. Draw shear and moment diagrams and calculate, M_u, V_u
2. Determine the required reinforcement in the longitudinal direction.
3. Calculate the concrete shear strength ϕV_c and locate the region where no shear reinforcement is needed.
4. Calculate the maximum shear force to be carried by steel reinforcement (V_s) and calculate the maximum allowable spacing between stirrups (S_{max}).
5. Calculate the shear force carried by the stirrups if S_{max} is used ($\phi V_{s(smax)}$). And then locate the region where only S_{max} is required.
6. Calculate the stirrups spacing required for the maximum shear $V_{u@d}$.
7. Calculate the number of stirrups required for the entire beam.
8. Calculate the number of stirrups using practical approaches.
9. Draw the necessary cross-sections and side views.

Use $f_c' = 36$ MPa, $f_y = 420$ MPa