



University Of Technology
Building and Construction Eng. Dept.
Final Exam – First Attempt – 2010/2011

Subject : Concrete structures
Branch : Building and Construction
Management Engineering
Examiner : Dr. Iqbal N. Gorgis

Class: Fourth
Time : 3 Hours

Date : / / 2011

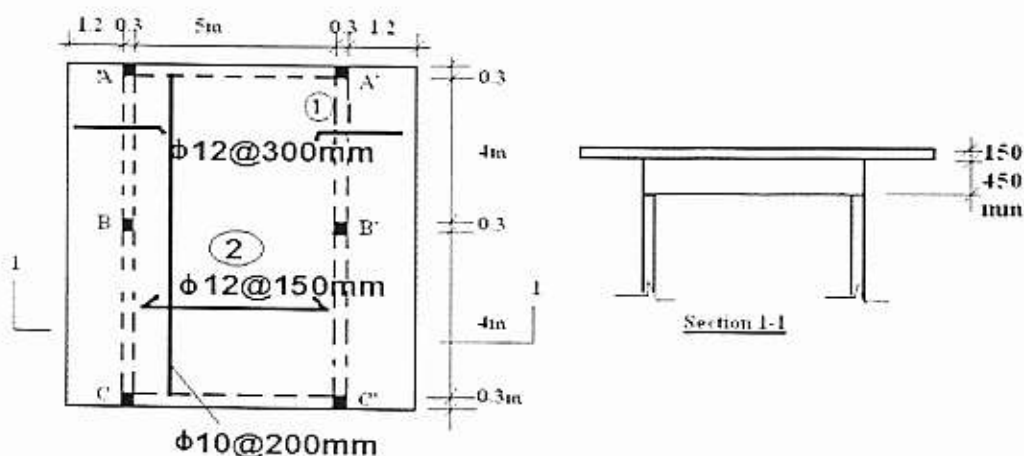


Note: Use $f'_c = 25 \text{ MPa}$ and $f_y = 400 \text{ MPa}$ for solving all the questions.

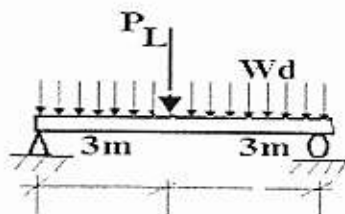
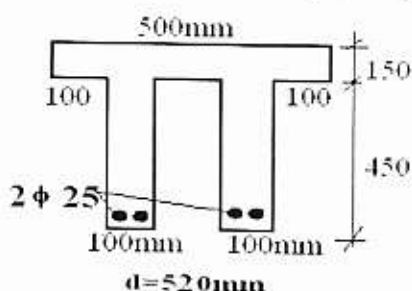
Solve only four questions.

Q.1: A reinforced concrete slab shown below, with 150mm thickness supports service dead load (including its own weight) of 4 kN/m^2 and service live load of 5 kN/m^2 . Solve two of the following:

- 1- Check the adequacy of reinforcement at points 1 and 2.
- 2- Find area of steel required for the beam ABC at critical section ($d = 0.53 \text{ m}$).
- 3- Calculate spacing required for 10mm stirrups for beam ABC at critical section.



Q.2: Check the immediate deflection due to live loads for the beam shown below, the service dead loads including its own weight are 20 kN/m and service concentrated mid span point live load is 50 kN , $\Delta_{im(L.L)} = \frac{L}{360}$, $\Delta_{CL} = \frac{5WdL^4}{384EI_e}$, $\Delta_{CL} = \frac{PL^3}{48EI_e}$?



For analysis of T or L beam section, let $y = hf$ then find moment of area:

$$A = bf * hf * \frac{hf}{2} \quad \text{Compression area moment.}$$

$$B = n * As * (d - hf) \quad \text{Tension area moment.}$$

if $A > B$ then rectangular section and neutral axis within the flange

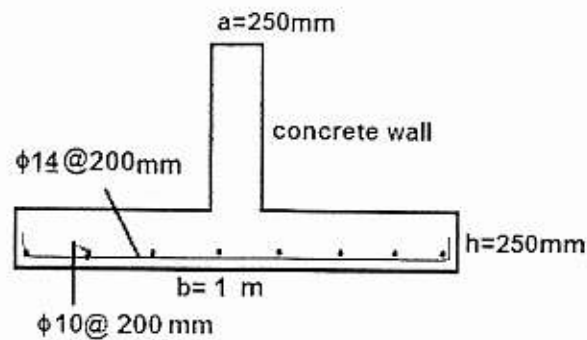
$$\text{Then } \frac{b * y^2}{2} = n * As * (d - y) \quad \text{and } I_{crack} = \frac{b * y^3}{3} + n * As * (d - y)^2$$

if $A < B$ then T - section and neutral axis within the web

$$\text{Then } bf * hf * \left(y - \frac{hf}{2} \right) + bw * \frac{(y - hf)^2}{2} = n * As * (d - y)$$

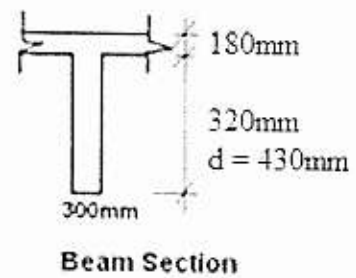
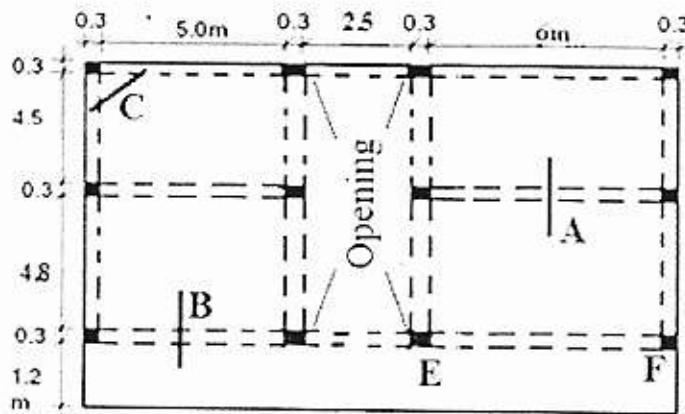
$$\text{And } I_{crack} = \frac{bf * y^3}{3} - \frac{(bf - bw)(y - hf)^3}{3} + n * As * (d - y)^2$$

Q.3: Determine the live load that the footing shown will support if the dead loads were 30kN/m. The bearing capacity of the soil with $\gamma_{soil} = 16 \text{ kN/m}^3$ is 80kN/m² at depth of 0.75m .



Q.4: A concrete slab with 180 mm thickness supports service dead load of 6 kN/m² including its own weight and service live loads of 3 kN/m², find:

- 1- Area of steel reinforcement required for the slab at point A, B and C, using $\Phi 12$ mm.
- 2- Total loads on beam EF?

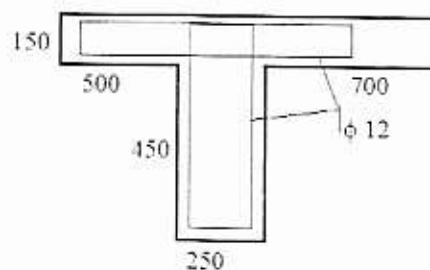


Q.5: Answer either A or B:

5. A) A short tied column with size 300x300mm supports service live loads of 2200kN and service dead loads of 1800kN. The load are applied with eccentricities of $e_Y = 180 \text{ mm}$, find area of steel required using bars with 30 mm diameter for longitudinal and 10mm for ties, then draw the section details (use $d' = 60\text{mm}$)?

5. B) For the T- beam with cross section shown, find:

- 1- Maximum torsion according to ACI-Code that the section can carry without using torsion reinforcement.
- 2- Calculate the pure torsion that the section could with stand.



$$K_n = \frac{P_n}{f_c A_g} = \frac{P_u}{\phi f_c A_g}$$

