FACULTY OF ENGINEERING AND ARCHITECTURE
AMERICAN UNIVERSITY OF BEIRUT
Department of Civil & Environmental Engineering

CE073 - Reinforced Concrete I

Quiz I

15/10

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Time = 1 1/2 hrs
Closed Book and notes
Use of Programmable Calculators is not allowed

Problem No. I (25%)

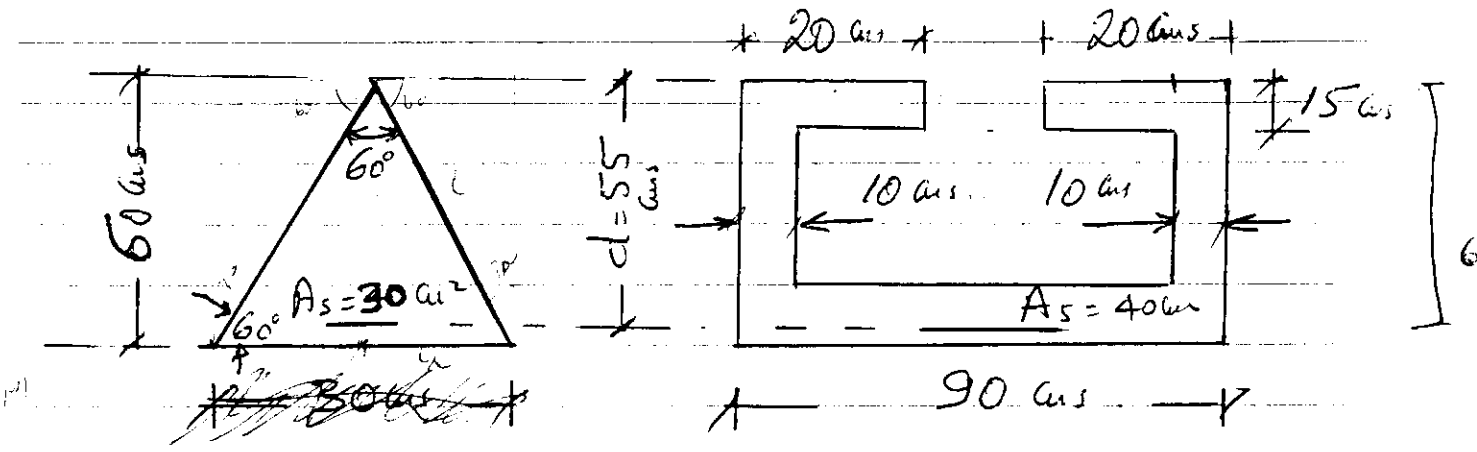
A. Define (in not more than one short paragraph) reinforced concrete indicating the strengths and weaknesses of the constituent materials.

B. Explain briefly why it is important to have ductile reinforced concrete members and list at least three methods that can be used to increase flexural ductility.

C. What is meant by safe and economic design? Explain, based on what you have learned so far, how do you achieve safe and yet economic design.

Problem No. II (25%)

Calculate the nominal flexural capacity for each of the following two sections in accordance with ACI 318-99. Given $f'_c = 280$ kg/cm^2; $f_y = 4200$ kg/cm^2.

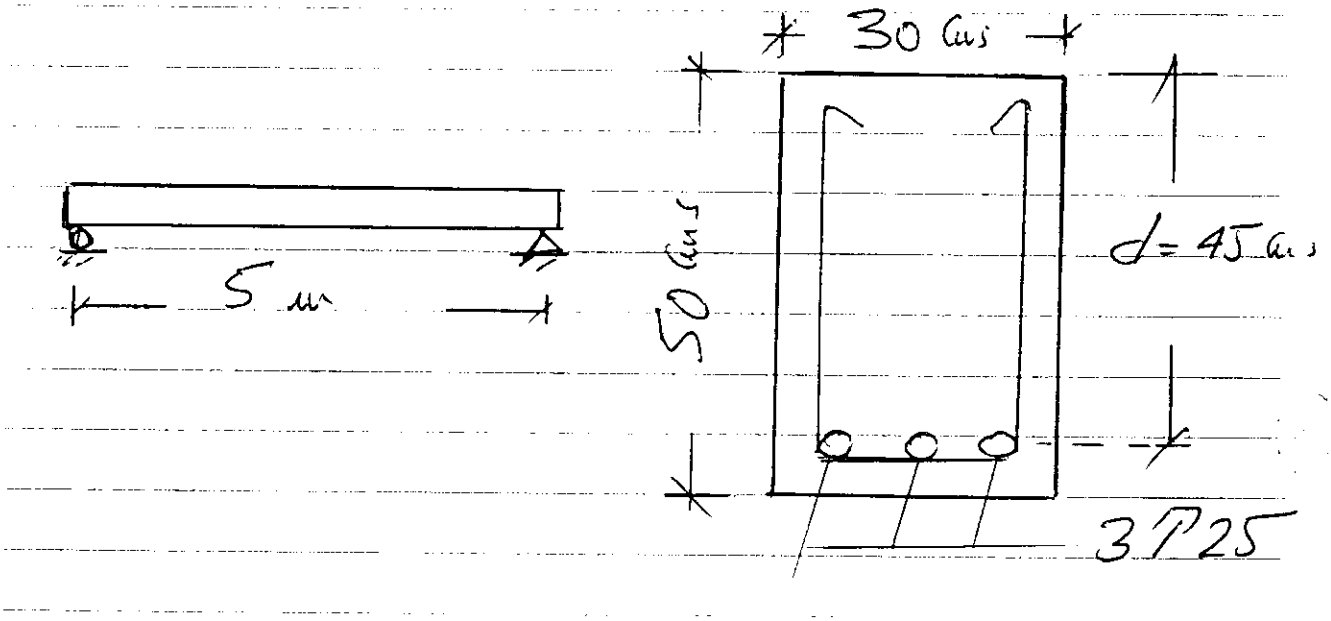


Problem No. III (25%)

Given the simply supported beam with section dimensions and reinforcement details as shown in the figure below. Given also beam self-weight $w_g = 0.38$ T/m, superimposed dead load $w_s = 2.0$ T/m, $w_L = 1.0$ T/m, $A_s = 15$ sq.cm, $f'_c = 210$ kg/sq.cm; $f_y = 4200$ kg/sq.cm. Modulus of elasticity of steel $E_s = 2 \times 10^6$ kg/sq.cm.

Calculate the uniformly distributed load that would initiate flexural tensile cracks in the beam and check if the beam cracks under its own weight. Also, calculate the stresses in concrete and steel under full service load.

Bonus Question (5%): What would happen to the concrete and steel stresses or to the beam in general if the live load increases to, say, 5.5 T/m.



Problem No. IV (25%)

Design a simply supported beam with the following design properties: span length = 8.0 m, superimposed dead load $w_s = 2.0$ T/m, $w_L = 1.5$ T/m, $f'_c = 210$ kg/sq.cm; $f_y = 4200$ kg/sq.cm. **Reinforcement ratio ρ should be close to 0.4 ρ_b.**

Show reinforcement details in a typical section and along the beam length.