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

CIVE 420 - Reinforced Concrete I

Quiz I

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

Prof/M. Harajli

Problem No. I (20 %)

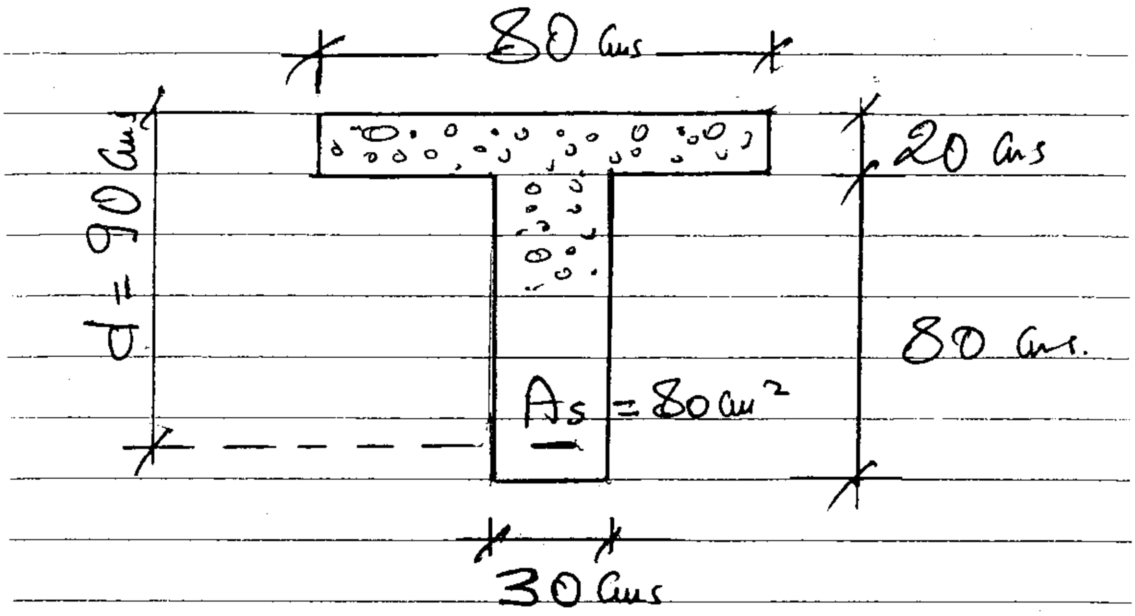
(i) Name three of the most important reasons for using compression steel in concrete members.

(ii) What is meant by ductile behavior and why do we want R/C members to be ductile.

Problem No. II (50%)

Given a simply supported T beam with section dimensions and reinforcement details as shown in the figure below (next page). Given: Span length = 12 m, self-weight w_g = 1.0 T/m, superimposed dead load w_s = 4.0 T/m, w_L = 3.0 T/m, A_s = 80 sq.cm, f'_C = 210 kg/sq.cm; f_y = 4200 kg/sq.cm.

1. Check if the beam satisfies the ultimate flexural strength and ductility requirements of the ACI building code.
2. What is the minimum area of compression steel A'_s (d'_s = 5 cms) such that the depth of stress block (Whitney block) falls within the flange? Compute accordingly the ultimate moment capacity of the section.
3. Considering that concrete cracks in tension at a tension stress (psi) of $7.5\sqrt{f'_{c(psi)}}$, what would be the applied service load moment at the critical midspan section to cause flexural tension cracking in the beam. Based on your calculations, does the beam crack under its own weight? What is the percentage of the moment that causes flexural tension cracking out of ultimate flexural load capacity of the beam calculated in Q. 1 (without compression steel)? ***Hint: Gross section moment of inertia I_g = 3,733,333 cm^4; distance from N.A. of the gross section to the bottom tension fiber y_b = 60 cms.***



Problem No. III (30%)

Given the cantilever section shown in the figure below; superimposed dead load $w_s = 1.5$ T/m, $w_L = 1.0$ T/m, $f_c' = 280$ kg/sq.cm; $f_y = 4200$ kg/sq.cm. Design the beam, i.e., estimate the height h, width b and area of reinforcement A_s. Assume $d = h - 5$ and **Reinforcement ratio ρ as close as possible to $0.4\rho_b$.**

Select No. and size of bars and show reinforcement details in a typical section and along the beam length.