King Saud University **CE 472 Reinforced Concrete II**
College of Engineering **Final Exam 1st Sem. 1429-1430 H**
Civil Engineering Department **Duration: 3 hrs**

Material data f_c' = 25 MPa f_y = 420 MPa Concrete density γ = 24 kN/m^3

Problem 1 (35 %)

The slab shown in Fig.1 is 185 mm thick. All beams / girders have 300 x 600 mm sections. All columns have 300 x 300 mm sections. Superimposed dead load = 2 kN/m^2, live load = 3 kN/m^2. No walls used.

a) Check the slab thickness for the SBC-Code deflection requirements.
b) Determine the ultimate uniform load on a 1-m wide typical slab strip.
c) Determine ultimate negative and positive moments in the slab strip.
d) Determine the main reinforcement for the slab and the bar spacing, assuming a negative moment of 20 kN.m and using 12-mm bars
e) Check the shear for the slab assuming 12-mm main bars.
f) Calculate the ultimate uniform load on beam BE.
g) Calculate the force transferred from beam BE to girder DF.

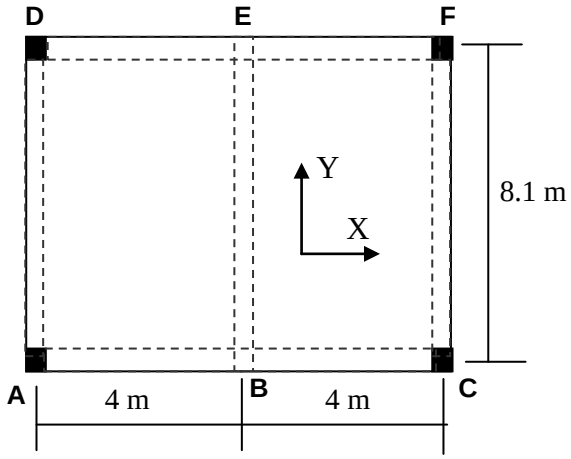

Fig. 1

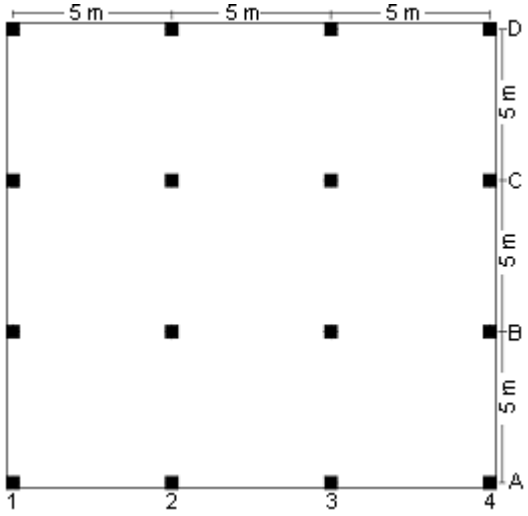

Fig.2

Problem 2: (15%)

The 190 mm flat plate in Figure 2 is subjected to the same dead and live loads as in problem 1, and all column sections are 300 x 300 mm. All panels have the same centre-to-centre length of 5 m.
Determine the slab ultimate load and the static moment in the exterior panel spanning between columns B1 and B2, as well as the negative and positive moments in the column strip.

Problem 3: (25%)

For the tied column of section (300 x 300 mm) shown in Figure 3,
A_{st} = 4ϕ20, Clear cover = 40 mm, Tie diameter = 10 mm
a) Determine for the *P-M* interaction curve the following nominal and design points:
i) Point with steel strain = 0.006 ii) Point with neutral axis depth = 150 mm
b) The braced column has a clear height of 3 m and is subjected to two equal moments of 100 kN.m at bottom and top ends, with double curvature.
Check whether it is short or slender (k =1).

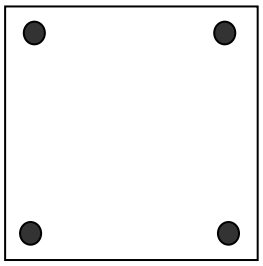
Fig. 3

Problem 4: (25%)

A square spread footing supports a square column 400 x 400 mm which transfers a service axial dead load of 1500 kN and a service live load of 1300 kN. The footing supports also a 400 mm soil layer with density $\gamma_s = 16 kN/m^3$. The soil allowable bearing pressure is $q_a = 280 kN/m^2$. The footing thickness is 800 mm.

a) Determine the minimum area of the footing
b)/ Assuming an actual footing area of 12.25 m^2 (3.5 x 3.5), determine the ultimate net soil pressure and the ultimate maximum moment in the footing
c)/ Check the two-way shear in the footing assuming an average steel depth $d = h - 90$ = 710 mm.