University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2012
Program: B. Sc. Engineering (Civil)

Course Title: Design of Concrete Structures II — Course Code: CE 317
Time: 3 hours — Full Marks : 100

Answer any SIX Questions out of EIGHT

1. For the two-way edge supported slabs (t = 6") shown in Fig. 1 the coefficients for middle strip mid-span and support moments are given. Design the slabs. Calculate the required reinforcements and show them in neat sketches (Draw plan and sections showing all the reinforcements). Floor Finish (FF) = 30 psf; Live Load (LL) = 80 psf.

   Given $t = 6"$, $k = 0.378$, $j = 0.88$; $f_s = 24$ ksi; $f_y = 60$ ksi; $n = 9$,
   $+C_{A(DL)} = 0.027$, $+C_{A(LL)} = 0.032$, $-C_A = 0.071$,
   $+C_{B(DL)} = 0.033$, $+C_{B(LL)} = 0.035$, $-C_B = 0.0$

2. A circular column carries a working DL = 800^k and LL = 500^k. Design the spiral column using reasonable percentage of main reinforcement by USD. Given $f'_c = 4$ ksi, $f_y = 60$ ksi, $f_s = 24$ ksi, $n = 9$. Design spirals also.

3(a) Write down the design criteria of a RC footing for a RC column. If the footing is rectangular what are the ways in providing the bars in short direction. Discuss with sketches.

(b) The part plan of a building as shown in Fig. 2 consists of columns A, B, C and D carrying axial loads of 500^k, 800^k, 700^k and 1000^k respectively. Fix the overall size of one combined footing for all the columns. Allowable bearing capacity = 5 ksf. column sizes 24" × 24" (each). Make a layout of the combined footing completely.

4. A 32" column carries a working DL = 1000^k and LL = 700^k. 16" × 16" square precast piles shall be provided for the column. The allowable load carrying capacity of each pile = 120^k. Pile spacing shall be 3 times the least dimension of pile i.e. 4 ft. c/c each direction. Design the pile cap by USD. Make neat sketches (plan and section) showing all the reinforcements and necessary details.
   Given: $f'_c = 3.5$ ksi, $f_y = 60$ ksi, $n = 9$.

5. A column section with the reinforcements is shown in Fig. 3. Draw the interaction diagram for the column with at least five points corresponding to tension, compression and balanced failure conditions. Use USD.
   Given: $f'_c = 4$ ksi, $f_y = 60$ ksi, $n = 9$.

6(a) Why does ACI recommend to design a rectangular slab supported on all sides as a one way slab if the side ratio of the slab is more than 2. Justify your answer with mathematical logic.

(b) A combined footing supporting two columns 'A' and "B" (with working loads as given) is shown in Fig. 4. Effective depth of the footing is 38".
   i) Check the adequacy against punching shears.
   ii) Design the transverse beams under the columns. Use either WSD or USD.
   Given $f'_c = 4$ ksi. $f_y = 60$ ksi, $n = 9$

7(a) A plan and section of a 5-storied building on beams and columns are shown in Fig. 5. All the beams in all floors are 12″×24″ including slab.
Slab thickness in all floors = 6½″
Average lime concrete (LC) on roof = 30 psf
Live load on roof = 20 psf
Floor finish (FF) on each floor = 30 psf
Random wall load on each floor = 40 psf
Live load (LL) on each floor = 80 psf
Given f'_c = 3 ksi, f_y = 60 ksi, n = 9.
Design an interior column section for the load to be calculated.

(b) For the interior column design a square footing if the allowable bearing capacity of soil is 3.5 ksf. Given f'_c = 3 ksi, f_y = 60 ksi, n = 9.

8(a) A cross section of a retaining wall is shown in Fig. 6. The vertical component of the reaction, R_v is 29^k and it acts at a distance of 7.5 ft from the toe as shown in the same figure. Design the reinforcement for the footing of the retaining wall. γ_{soil} =100 #/cft, f'_c = 3 ksi, f_y = 60 ksi, n = 9.

(b) Show the ties as per ACI Code for the following column sections. All main bars shown are 1 inch dia. (Fig. 7)

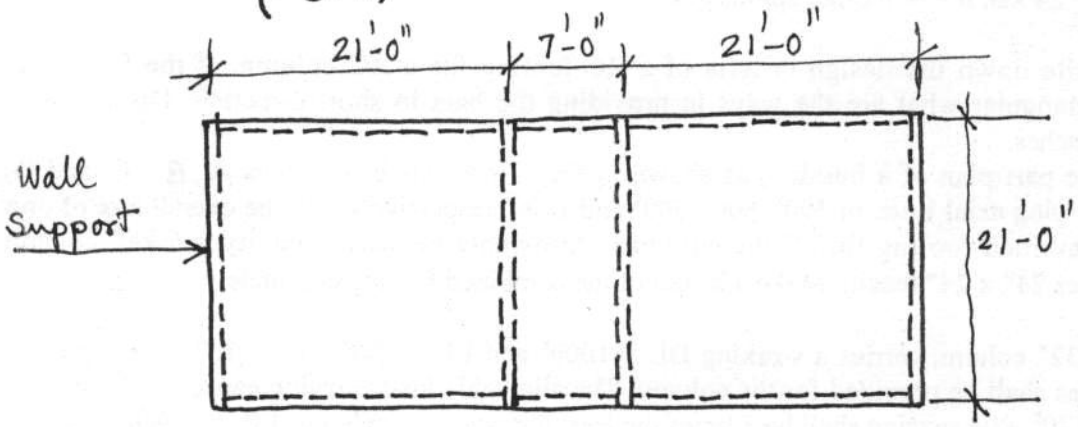
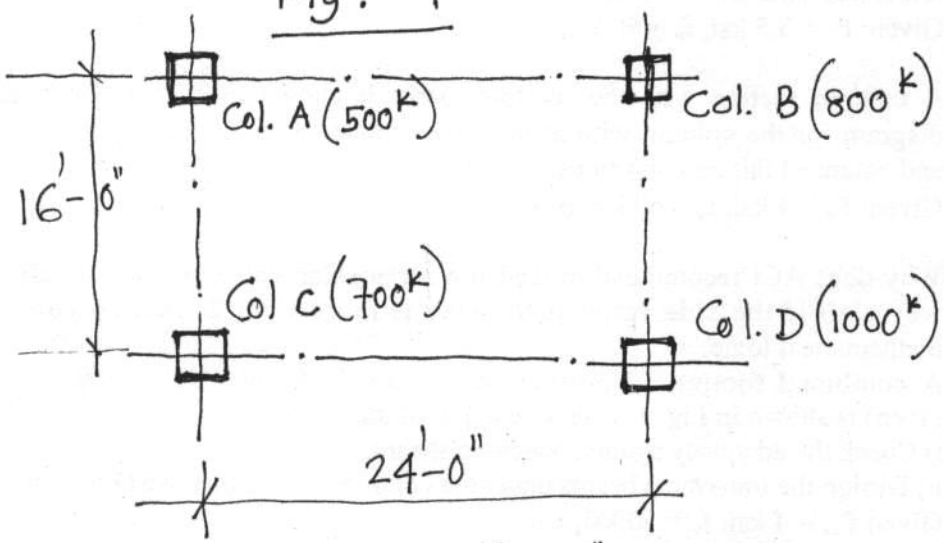


Fig. 1



ALL COLUMNS 24" × 24" IN SIZE
ALL LOADS (TOTAL UNFACTORED)

Fig. 2

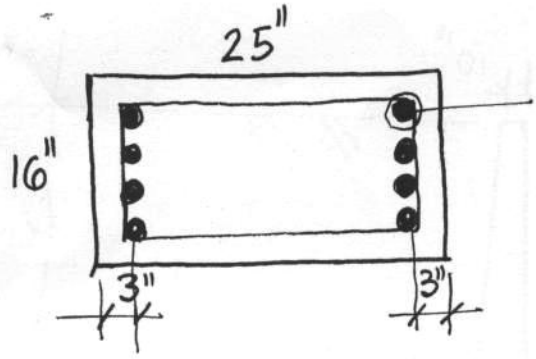


Fig. 3

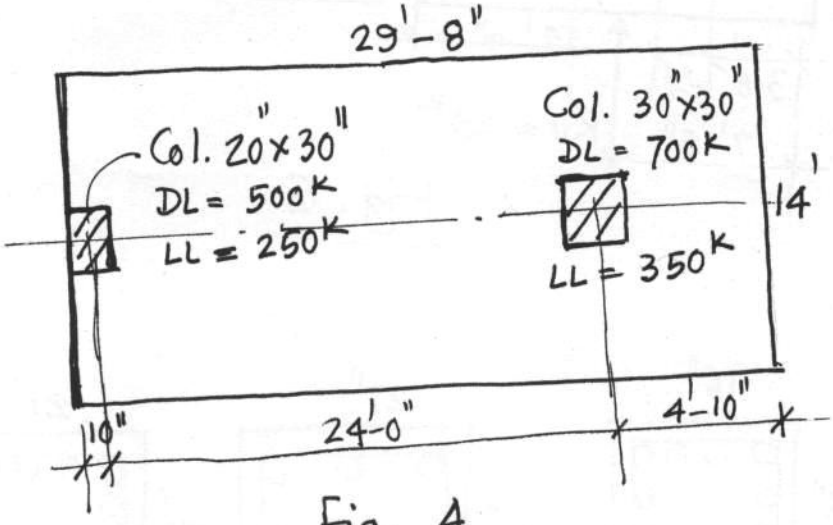
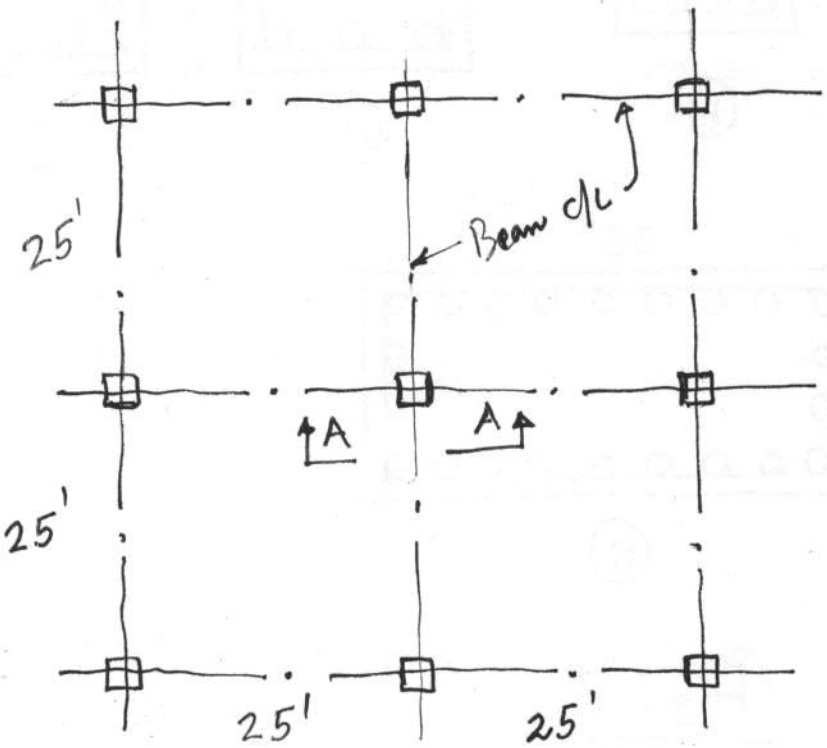
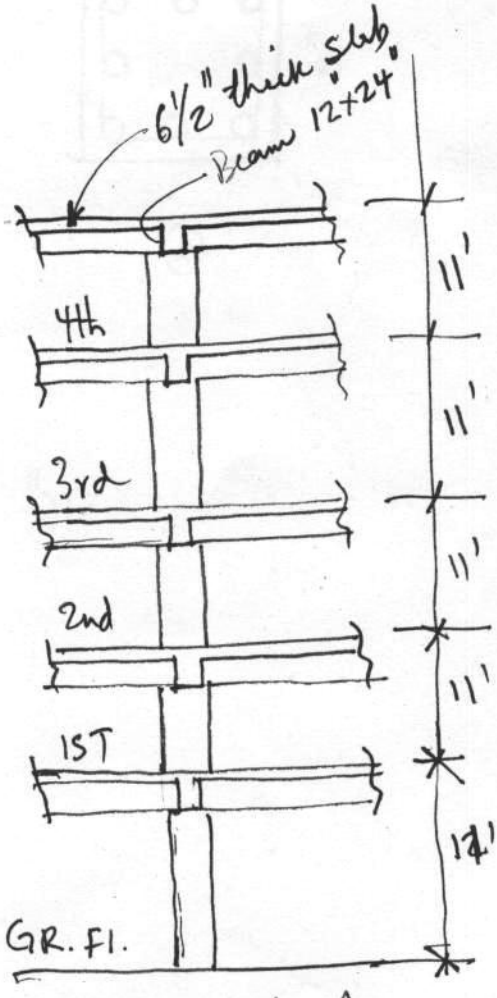


Fig. 4



PART FLOOR PLAN



SEC A-A

Fig. 5

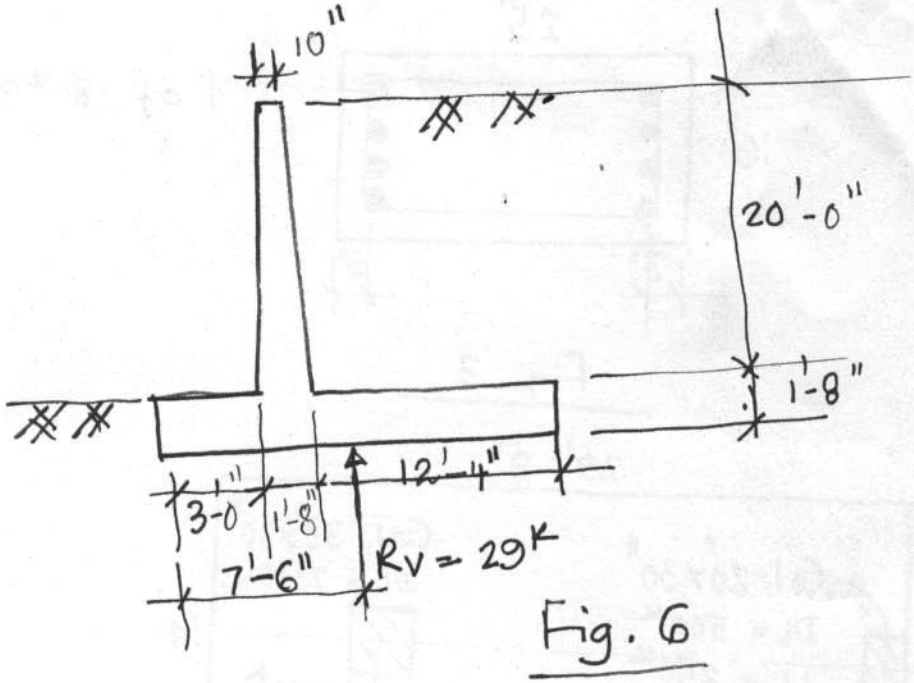


Fig. 6

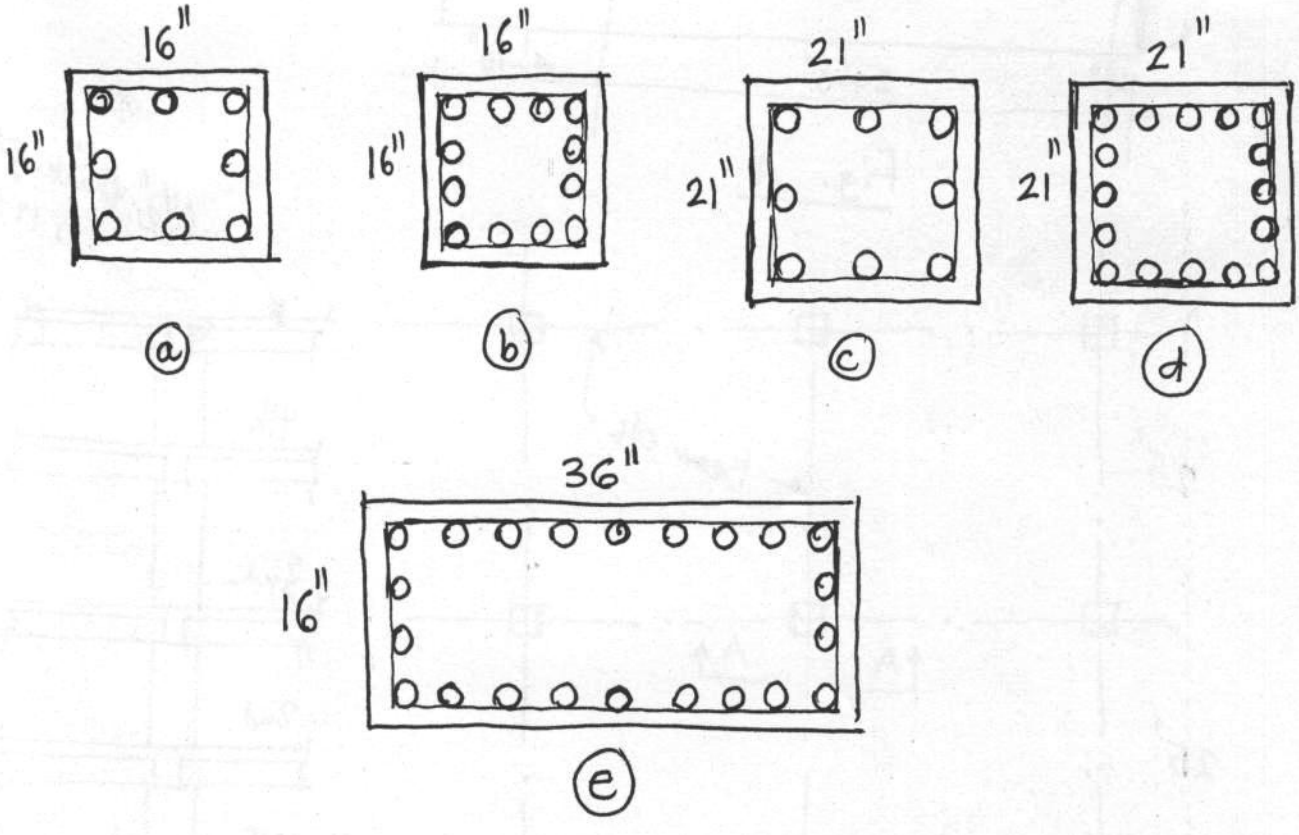


Fig. 7