

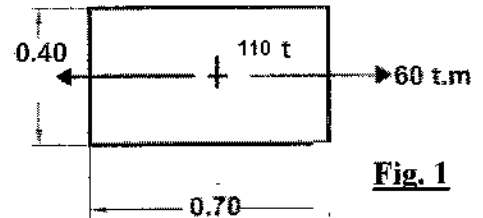
Course Related Program Competencies (A1, A2, and B2).

**Answer all questions. Any missing data to be reasonably assumed**

$F_{cu} = 250 \text{ kg/cm}^2$ ,  $q_{sh} = 4.50 \text{ kg/cm}^2$ ,  $q_{cp} = 9 \text{ kg/cm}^2$ ,  $q_b = 12 \text{ kg/cm}^2$ ,  $k_1 = 0.30$ ,  $k_2 = 1800$

**Question (1) (40 Points)**

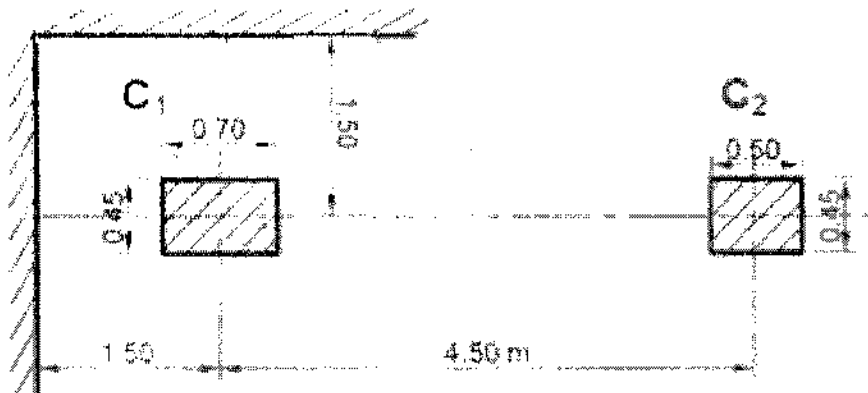
**(A). (10 Points)** It is required to design a rectangular footing to support a R.C column (Fig.1) of Dimensions (40\*70 cm). The column load is 110 ton, the footing subjected to reverse moment  $M_y = 60 \text{ t.m}$ . Knowing that : The allowable net bearing capacity in footing site is  $1.4 \text{ kg/cm}^2$ ,  $q_{sh} = 6 \text{ kg/cm}^2$ ,  $q_p = 9 \text{ kg/cm}^2$ ,  $q_b = 12 \text{ kg/cm}^2$  and thickness of plain concrete equals to 40 cm. Draw details of reinforcement to scale 1:50.



**Fig. 1**

**(B). (15 Points)** Design a rectangular combined footing for supporting a R.C two columns in (Fig.2).  $C_1$  (45\*70 cm) carries a load 110 ton and column  $C_2$  (45\*50 cm) carries a load 155 ton. The spacing between the center line of the two column is 4.5 m.

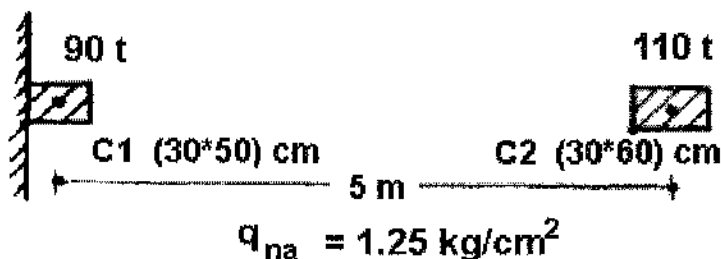
Knowing that : The allowable net bearing capacity in footing is  $1.5 \text{ kg/cm}^2$ , and thickness of



**Fig. 2**

plain concrete equals to 40 cm .Finally draw details of reinforcement (plan and elevation).

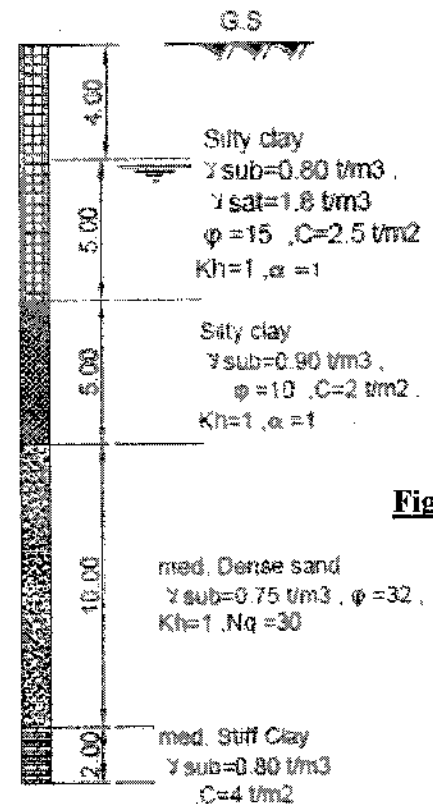
**(C). (15 Points)** It is required to design a strap footing for the condition shown in (Fig.3). Finally draw details of reinforcement (plan and elevation). The net allowable bearing capacity is  $1.25 \text{ kg/cm}^2$ ,  $\gamma_{soil} = 1.7 \text{ t/m}^3$ , plain concrete thickness =40 cm, and  $D_f = 1.5 \text{ m}$ .



**Fig. 3**

## Question (2) (50 Points)

**(A). (10 points)** Calculate the pile capacity of the single pile for subsoil profile shown in (Fig.4) for pile diameters 50 cm and 60 cm. Use pile length equal to 17 m from ground surface.

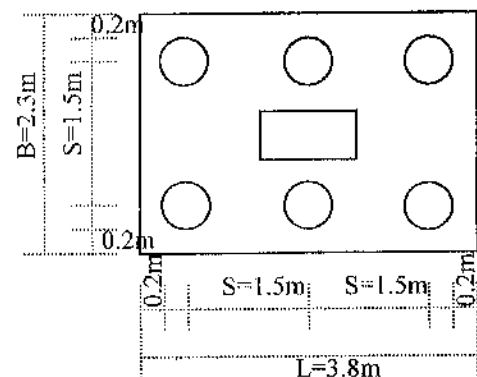


**Fig. 4**

**(B). (10 points)** a frame column is subjected to 180 t vertical load, 10 t, 30 m.t permanent moment and 30 m.t reversible moment. If the allowable pile load is 60 t and pile diameter is 50 cm. it is required:

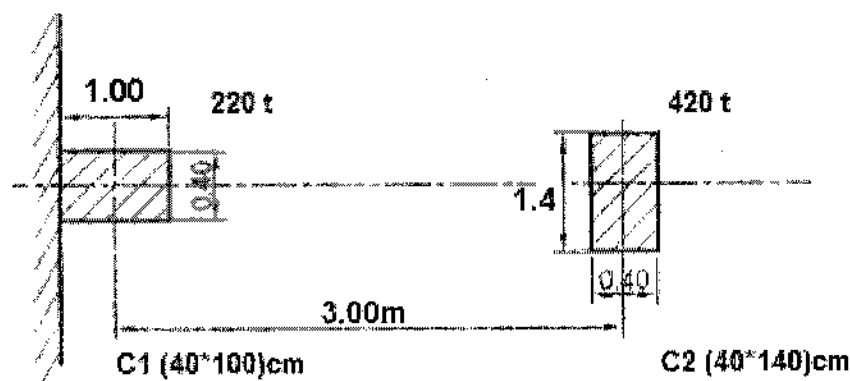
- Determine the number of piles under pile cap.
- Design the pile cap.
- Draw all the necessary sections showing the details of reinforcement.

**(C). (10 points)** For the shown plan of the six pile cap in Fig. 5, if the thickness of the pile cap is 80 cm and the bottom reinforcement in both directions is 8Ø22/m. it is required to find out the safe column load can be supported by this cap if the column dimension 80×80 cm.



**Fig. 5**

**(D). (20 points)** Design a combined footing (deep foundation) to support the shown two columns in (Fig.6). Piles diameter is 50 cm and the pile working load 90 t. Draw sections elevation and plan showing concrete dimensions and the reinforcement details.



**Fig. 6**