



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

For all problems ; consider  $q_{sh} = 8 \text{ kg/cm}^2$  ,  $q_p = q_b = 10 \text{ kg/cm}^2$  ,  $k_1 = 0.36$  ,  $k_2 = 1750$

**Question 1 ( 20 degrees )**

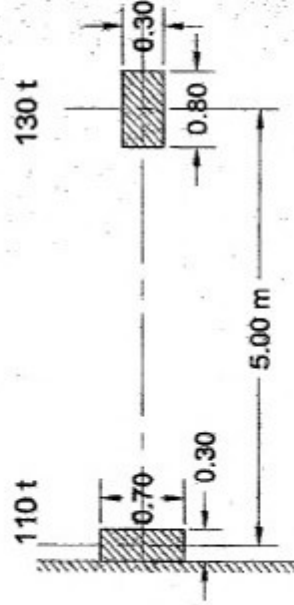
1. Show with clear sketches the different types of shallow foundations . (5 degrees)
2. Fig.1 shows the plan of two adjacent columns , the left column is ( 30 × 80 ) cm and carries 130 t and the right column ( 40 × 40 ) cm and carries 90 t the distance center to center of columns is 6.0 m and the net allowable soil pressure is  $1.0 \text{ kg/cm}^2$  . the thickness of the plain concrete layer = 20 cm . You are required to design suitable combined foundation showing the details of reinforcement in plan and cross section . (15 degrees)



**Fig.1**

**Question 2 ( 25 degrees )**

1. For a 3 - pile - cap , sketch the pile arrangement and reinforcement . show by equations how to compute the steel area of the main reinforcement by using circulative method. (5 degrees)
2. Design a suitable rigid combined footing **with beam** to connect the two columns shown in fig.2 . If the allowable bearing capacity is  $12 \text{ t/m}^2$  . Draw section elevation and plan showing concrete dimensions and details of reinforcement . (20 degrees)



**Fig.2**

### Question 3 ( 20 degrees )

Fig.3 shows a plan of 9 columns . it is required to design a rigid flat raft foundation with uniform thickness to resist the following columns loads ; : C1 = 100 t , C2 = 130 t , C3 = 220 t . assuming the allowable bearing capacity of soil  $12 \text{ t/m}^2$  . Draw the details of reinforcement in plan and sections 1 - 1 & 2 - 2 .

C1 =  $40 \times 40 \text{ cm}$

C2 =  $40 \times 50 \text{ cm}$

C3 =  $40 \times 60 \text{ cm}$

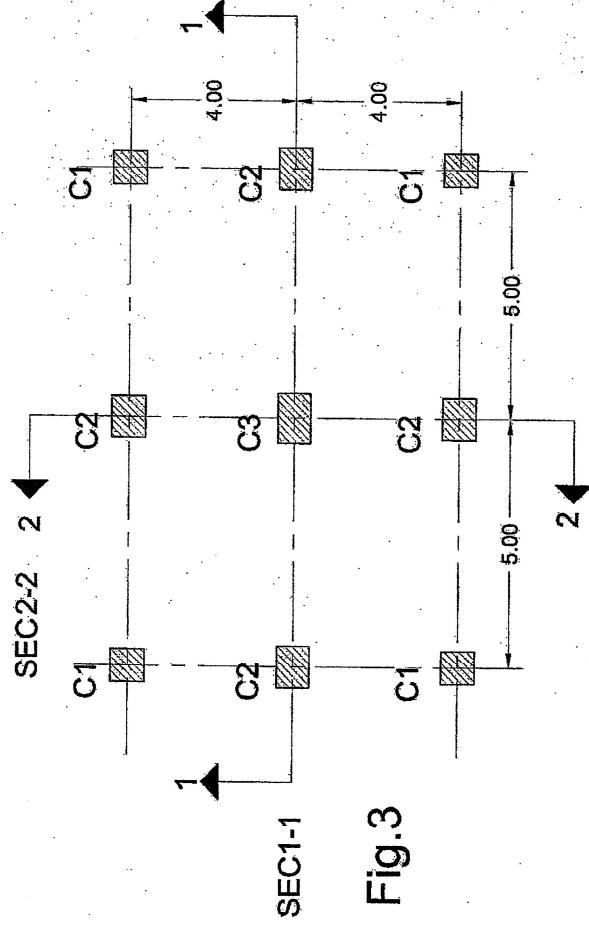


Fig.3

### Question 4 ( 20 degrees )

1. When piles foundations are recommended ? ( 5 degrees )
2. Design a strap beam ( deep foundation ) to support the shown two columns in fig.4 . Piles diameter is 50 cm and the pile working load 60 t . Draw sections elevation and plan showing concrete dimensions and the reinforcement details . ( 15 degrees )

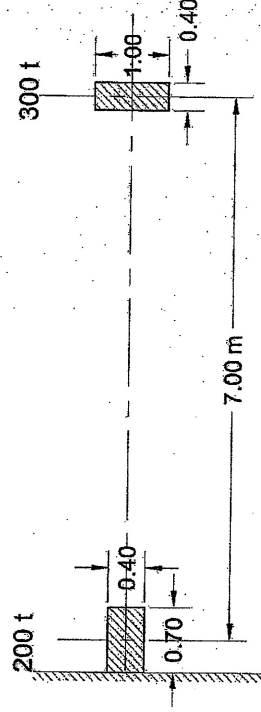


Fig.4

col 1 (  $40 \times 70 \text{ cm}$  )

col 2 (  $40 \times 100 \text{ cm}$  )

مع أطيب التمنيات بالنجاح والتوفيق / د مصطفى عثمان واللجنة