DEPARTMENT OF CIVIL ENGINEERING

MINOR I :CEL727 DESIGN OF INDUSTRIAL STRUCTURES
(2012-13)

Time allowed: 1hour **Date :** 04 September 2012
Venue : V 216 **Max marks : 20**

NOTE: (a) This question paper contains two questions and one page only. (b) All questions are compulsory. (c) **Assume any data which you deem is necessary but not supplied. (d)** Draw neat and clear sketches wherever required.

Question 1.

For the two columns shown in Fig. 1, under the combination (Dead loads + Earthquake in x-direction), following forces are determined to act at the top of footing by analysis:

P_1 = 800 kN, M_{x1} = 200 kNm, M_{y1} = 50 kNm, H_{x1} = 15 kN, H_{y1} = 3 kN
P_2 = 1200kN, M_{x2} = 250 kNm, M_{y2} = 75 kNm, H_{x1} = 20 kN, H_{y1} = 5 kN

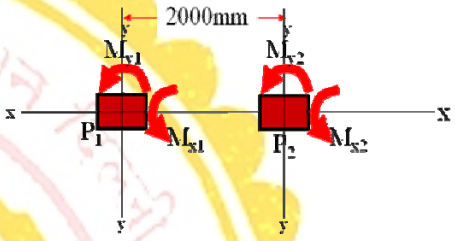

Fig. 1 Layout of columns

The geotechnical report recommends that the foundation be positioned 1.5m below the ground level. The water table starts 0.75m below the ground level. The allowable net bearing pressure at 1.5 m below the ground level is 150 kN/m^2 .

For this footing, work out the following:

1. Suitable plan dimensions of the footing(s) for the two columns.
2. Thickness of footing base and the bottom reinforcement along x direction (**take into consideration bending only**).

Assume M30 concrete and Fe 500 steel.

Question 2.

Fig. 2 shows a machine foundation supporting a reciprocating type machine vibrating horizontally at 828 RPM. Mass of piston is 0.75kg, the connecting rod is 500mm long (uniform cross section) and weighs 0.5kg and the crank shaft is 200mm long (uniform cross section) and weighs 0.2kg. There is no other mass associate with the machine. The depth of the block is chosen minimum possible as per soil investigation report, which recommends a minimum depth of 750mm below the ground level and states that the soil has safe net bearing capacity of 200 kN/m^2. The plan dimensions of the block are 1mx1m.

Determine the adequacy of the foundation against resonance and compute the amplitude of horizontal vibrations. If you notice any problem, how can it be solved (only suggest do not solve)? **Assume that the foundation is under pure sliding and there are no vertical/ rocking forces.**

(**10 marks**)