



## DEPARTMENT OF CIVIL ENGINEERING

### MAJOR EXAM :CVL861 ANALYSIS AND DESIGN OF MACHINE FOUNDATIONS (2016-17)

**Time allowed:** 2 hours  
**Venue** : LH 623

**Date** : 01 May 2017  
**Max marks** : 40

**NOTE:** (a) This question paper contains six questions and two printed pages 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

If you are called at a machine foundation site (with no information about machine available to you), explain how you would check for safety of vibration amplitude using minimum equipment.

(5 marks)

#### QUESTION 2

- (a) Explain what basic analysis are required to be undertaken for a frame type machine foundation if you have access to 3D finite element method employing brick elements?
- (b) How will you do modelling if instead of 3D FEM, you only have access to a software which can only model 3D beam elements? What additional features need to be taken care of?

(5+5 marks)

#### QUESTION 3

Point out any three differences in design criteria for frame type machine foundations which you feel are different from block type machine foundations.

(5 marks)

#### QUESTION 4

You are tasked to design the rubber paddings for the compressor unit you had visited on 28 April 2017. Your target is to achieve a transmissibility of less than 7.5%. The mass of the machine is 500 kg and the rubber pads, which are four in numbers, are of size 100x100 mm. The rubber has shore hardness 50. Assume 5% damping.

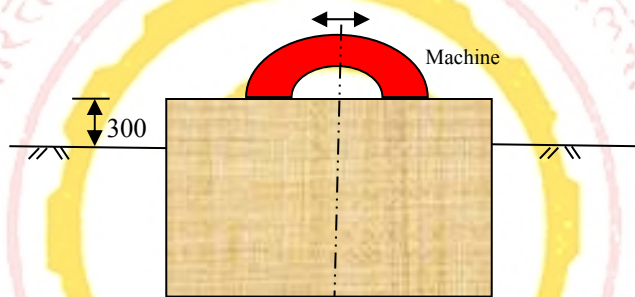
(5 marks)

### **QUESTION 5**

Fig. 1 shows a machine foundation supporting a reciprocating type machine vibrating horizontally at 780 RPM. Mass of piston is 0.75 kg, the connecting rod is 500 mm long (uniform cross section) and weighs 0.5 kg and the crank shaft is 200 mm long (uniform cross section) and weighs 0.2 kg. Assume that here is no other mass associated with the machine. The CG of the machine lies 200 mm above the top of the concrete block. The depth of the block is chosen minimum possible as per soil investigation report, which recommends a minimum depth of 750 mm below the ground level and states that the soil has allowable net bearing capacity of 200 kN/m<sup>2</sup>. The plan dimensions of the block are 1m x 1m.

Determine the adequacy of the foundation against resonance and the amplitude of horizontal vibrations. If you notice any problem, how can it be solved (only suggest do not solve)?

**(10 marks)**



**Fig. 1** Elevation of machine foundation block

### **QUESTION 6**

What are the guidelines for reinforcement detailing of block type foundation? Show using a diagram.

**(5 marks)**