BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BE **SEMESTER : VII**
BRANCH: CIVIL **SESSION : MO/19**

SUBJECT: CE7001 EARTHQUAKE RESISTANT DESIGN

TIME: **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) How the zone factors are assigned to different seismic zones in Seismic zoning map of India as per IS:1893: 2016. [4]

Q.1(b) What do you mean by Earthquake Intensity and how it varies from Earthquake Magnitude? [4]

Q.1(c) How do you classify Surface waves? How the characteristics of those surface waves vary from each other? [4]

Q.2(a) Consider one square slab of area 16 sqm and thickness 150mm which is supported by 4 columns each at one of its corner symmetrically. All of the columns are 3.5m long each. Column size is 300mm x 250mm. If all the columns and the slab is made up of only by M20 concrete, considering the slab as rigid, determine stiffness, natural frequency and time period for the entire system along both possible primary directions. [8]

Q.2(b) Obtain the differential equation of motion of the system (without damping) shown in Fig. 1 and determine the system natural frequency. [4]

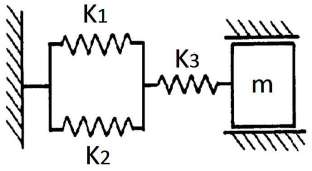

Figure: 1

Q.3(a) Derive the expression for time domain solutions of dynamic equation of motions by Central Difference method **[7]**

Q.3(b) If same structure is designed in a particular place only varying the soil type from soft soil to rock, what difference may occur while taking design acceleration coefficient corresponding to time period if you use response spectrum method for the analysis? [5]

Q.4 Determine the natural frequency and mode shape of a three storey reinforced concrete building with plan shown in Figure:2 (a) and elevation shown in Figure:2(b). Dimensions of column = 250mm x250mm; Roof slab thickness= 125mm; intermediate slab thickness= 135mm. Consider the building frame as a shear building. If the building is made on soft soil, what will be the design acceleration coefficient as per design response spectrum? [12]

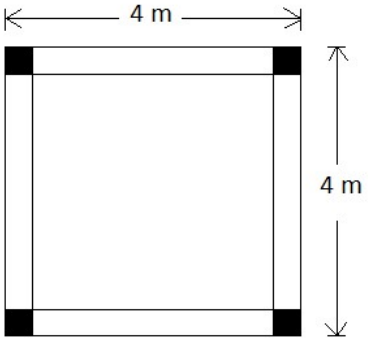

Figure: 2(a)

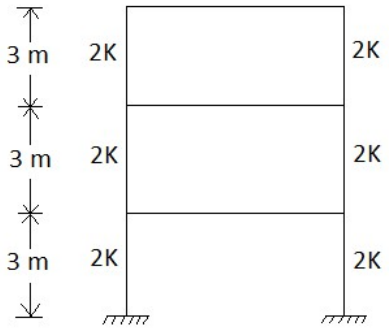

Figure: 2(b)

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Q.5(a) How the shape of any structure affects its stability while resisting earthquake? [4]
Q.5(b) What is the significance of Strong column-Weak beam principle in our structure? [4]
Q.5(c) How the ductility consideration of Earthquake Resistant design helps building's performance when the building is practically facing an earthquake? [4]

Q.6 Consider a Reinforced Concrete School building (having ordinary moment resisting frame) which is situated at Mumbai on soft soil and contains masonary infills in it. Consider Dead load 14 KN/sqm for floors and 8 KN/sqm for roof. Consider live load of 6 KN/sqm for floors and 1.5 KN/sqm for roof. Determine design seismic loads for each floor level. Plan and elevation of the building is shown in Figure:3(a) and Figure:3(b) Respectively. [12]

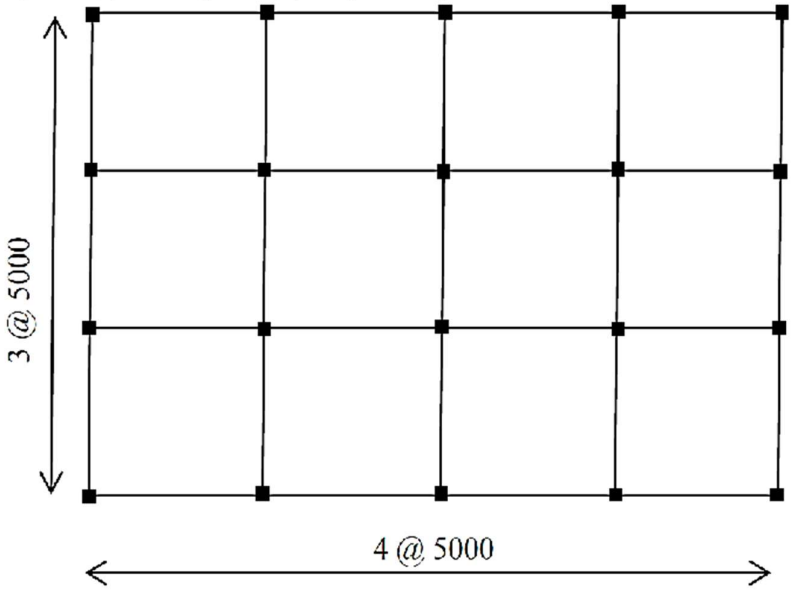

Figure 3 (a)

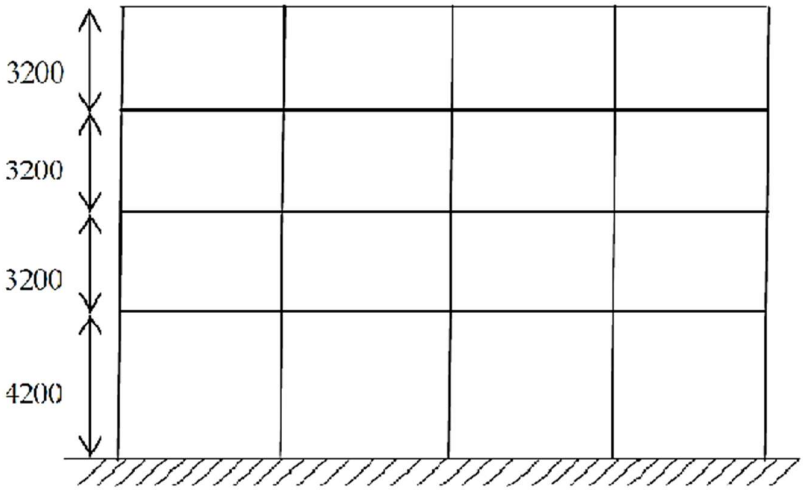

Figure: 3 (b)

Q.7(a) Describe any three Global retrofitting strategies for buildings. [6]
Q.7(b) Mention few retrofitting strategies for Masonary buildings. [6]

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