COLLEGE OF ENGINEERING, PUNE
B. Tech. Civil Engineering

CE-404 - Introduction to Earthquake Engineering
End Semester Examination

Year : 2013-14   Semester :   I
Max. Marks: 60   Time : 3 Hours

Instructions:

1.   All Questions are compulsory.
2.   Use of IS: 456, IS: 1893 and IS: 13920 is permitted.
3.   Assume suitable data wherever required and state it clearly.
4.   Use of non-programmable calculators is allowed.

Q. 1   (a)   What are Iso-Seismals?   (1)

      (b)   At a recording station, a difference in time of arrival between P waves and   (2)
S waves was observed to be 1.5 seconds. What is the approximate distance from
the station at which the event occurred? Assume P wave velocity as 4 km/sec and
S wave velocity as 2 km/sec.

      (c)   What is a shear wall? Sketch various types.   (3)

      (d)   Write a note on classification of earthquakes.   (4)

Q.2   (a)   A vibrating system consists of a mass of 10 kg, spring of stiffness 150 N/m and a   (4)
damper with damping coefficient of 5 N-s/m. Determine (a) damping factor, (b)
natural frequency of damped vibrations, (c) ratio of two successive amplitudes
and (d) the number of cycles after which the initial amplitude is reduced to 25%.

      (b)   Determine the natural frequencies and corresponding normal modes of vibration   (6)
of a two storey frame as shown in Figure. W_1 and W_2 are the weights of the storey
and k_1 and k_2 are storey stiffness.

$W_2 = 26.7$ kN

$W_1 = 44.5$ kN

$k_2 = 7.008 \times 10^6$ N/m

$k_1 = 8.76 \times 10^6$ N/m
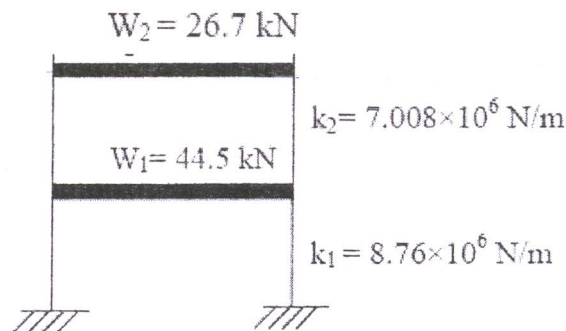
Q. 3   (a)   Explain with sketches about plan irregularities in a building.   (5)

      (b)   What do you understand by ductility? Discuss the main factors affecting the   (5)
ductility of a RC member?

Q. 4   (a)   A special reinforced concrete moment resisting frame building with infill panels   (4)
             is situated in Delhi. Height of building is 15 m. The building is resting on medium
             soil. The base dimension of building at plinth level is 24 m. Determine the design
             vertical seismic coefficient for a damping of 2%.

       (b)   Describe with sketches: how earthquake resistant design philosophy is different   (5)
             than that for vertical loads?

       (c)   Explain with sketch: the working of viscous fluid dampers and metallic dampers.   (6)

Q5   (a)   What do you mean by base isolation?   (3)

       (b)   A column of length 3.5 m in a multistoried R. C. building is subjected to an axial   (5)
             force of 2500 kN and bending moment of 650 kN-m under gravity and earthquake
             loads. Design the column for ductility. Use M 20 concrete and Fe 415 grade steel.
             Show a neat sketch of the column.

       (b)   A three storeyed symmetric RC school building situated in Bhuj with following   (7)
             data:

             Plan Dimensions   :   7 m
             Storey Height   :   3.5 m
             Total weight of beams in a storey   :   130 kN
             Total weight of slab in a storey   :   250 kN
             Total weight of columns in a storey   :   50 kN
             Total weight of walls in a storey   :   530 kN
             Live Load   :   130 kN
             Weight of terrace floor   :   655 kN

       The structure is resting on hard rock. Determine the total base shear and distribute
       it along the height of the building for 5% of damping. Use seismic coefficient
       method.

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