16/11/13 Reg No.

BE DEGREE END SEMESTER EXAMINATIONS, NOVEMBER/DECEMBER 2013

CIVIL ENGINEERING BRANCH

SEVENTH SEMESTER – REGULATIONS 2008

CE 9402 – STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING

Max Marks: 100 Time : 3 Hrs

Answer all Questions

[IS 1893:2002 (part1), IS 13920:1993, IS 456:2000 are permitted]

Part A

10 x 2 = 20

1. Define degree of freedom. What is degree of freedom for a system having mass less rigid beam with a single lumped mass at the free end and is hinged at the other end?
2. What is effect of gravitational force on the equilibrium equation of motion of system under vibration?
3. What is meant by modal super position?
4. What are the different methods employed for the dynamic analysis of structures?
5. Differentiate between magnitude and intensity of earthquakes.
6. Explain the elastic rebound theory associated with the occurrence of earthquake.
7. What is the significance of Response Reduction Factor?
8. What is meant by liquefaction? What are the effects of Liquefaction
9. What are types of failure experienced by RC structures under seismic loading?
10. Explain the significance of confinement.

Part B

5 x 16 = 80

11. (i) Derive the Equilibrium equation of motion for the structural system shown in Fig.Q.No.11(i). Find out the natural frequency of the system. (10)

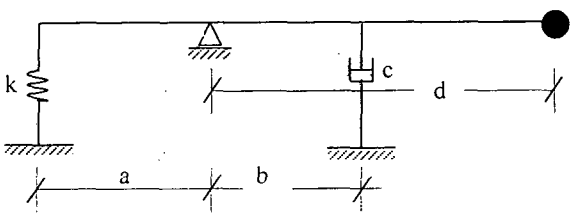


Fig. Q.No.11(i)

(ii) A single degree of freedom system is excited by a sinusoidal force. The displacement observed at resonance is 50 mm. When the frequency ratio is 10, the displacement is 5mm. Estimate the damping ratio of the system. (6)

12.

a. Find out the response of the two degree of freedom system as shown in Fig.Q.No.12(a)with the initial condition $x_1(0) = x_2(0) = 0$ and $\dot{x}_1(0) = \dot{x}_2(0)$

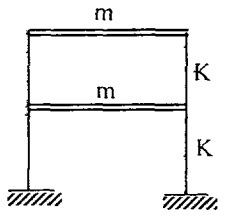


Fig. Q.No.12(a)

OR

b. Plot the mode shapes of MDOF system as shown in Fig. Q.No.12 (b).

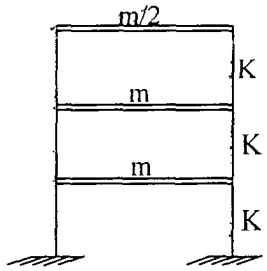


Fig. Q.No.12(b)

13.

(a) (i) What are the causes of earthquake? (4)

(ii) What are the types of waves generated at the source of earthquake? Explain with neat sketches. (12)

OR

(b) Explain the following :

(i) Maximum Considered Earthquake and Design Basis Earthquake. (8)

(ii) Ductility and Energy Dissipation. (8)

14.

a. What is the difference between the performance of Steel and Concrete structures subjected to seismic loading? Explain with the corresponding Hysteretic curves.

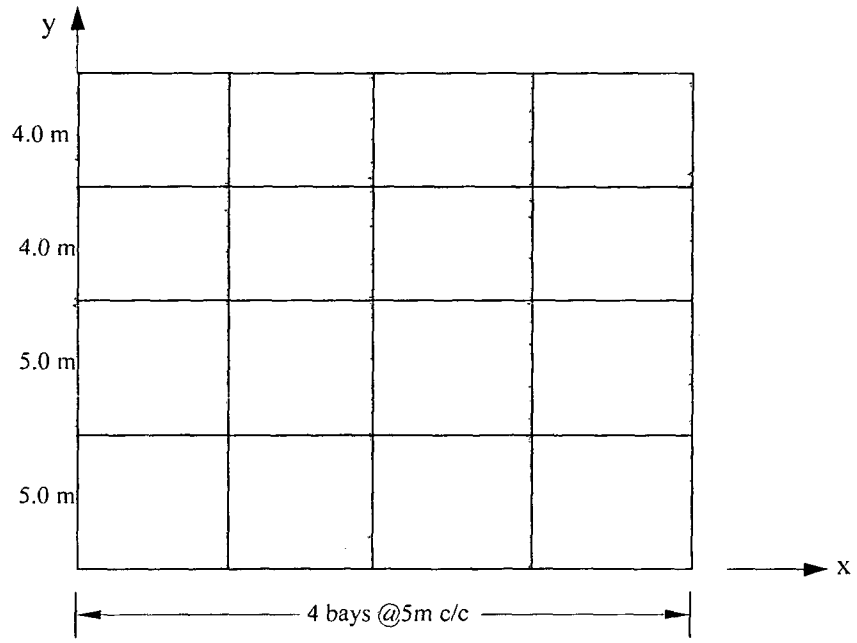
OR

(b) Draw the connection detailing of reinforcement at the beam column joint of concrete structure as per IS 13920. Explain the importance of closely spaced stirrups and ties in around the joint region.

15.

a. Consider a five-storey reinforced concrete (SMRF) residential building plan as shown in Fig.Q.No.15(a). The building floors are at 3m c/c. The building is located at Orissa. The soil condition is hard and the entire building is supported on a raft foundation. The R. C. frames are infilled with brick-masonry. The lumped weight

due to dead loads (including slab, beam and columns) is 13kN/m^2 on floors and 9 kN/m^2 on the roof. The floors are to cater for a live load of 3.5 kN/m^2 on floors and 1 kN/m^2 on the roof. Determine design seismic load on the structure as per IS 1893 :2002 and distribute the earthquake load along the height of the building.



Plan of the building

Fig.Q.No.15(a)

OR

b. Write Short notes on
   i. Amplification Factor
   ii. Critical Damping
   iii. Modal Mass
   iv. Engineering Seismology