21-06-19

Total No. of printed pages = 7

CE 1318 E 041

Roll No. of candidate | | | | | | | | | | |

2019

B.Tech. 8th Semester End-Term Examination

EARTHQUAKE ENGINEERING

Elective – IV (Departmental)

(IS 1893, IS 13920 and seed and Idriss (1971) curves are permitted)

Full Marks – 100 Time – Three hours

The figures in the margin indicate full marks for the questions.
Assume any missing data if required.
Answer question No. 1 and any *six* questions from the rest.

1. Choose the correct options from the following : $(10 \times 1 = 10)$

(i) The record of an earthquake is called as
- (a) Seismograph
- (b) Seismogram
- (c) Seismometer
- (d) Seimoscope

(ii) Isoseismals are contours joining place of equal
- (a) Magnitude
- (b) Intensity
- (c) Energy
- (d) Epicenter

[Turn over

(iii) Equation of dynamic equilibrium is written as

(a) $m\dot{x} + C\ddot{x} + Kx$

(b) $m\ddot{x} + C\ddot{x} + Kx$

(c) $m\dot{x} + K\ddot{x} + Cx$

(d) None of the above

(iv) If the building is flexible then fundamental natural period of building will be

(a) Shorter

(b) Longer

(c) Not effect

(d) None of the above .

(v) The essential properties of an earthquake resistant construction are

(a) Ductility

(b) Damageability

(c) Deformability

(d) All of above

(vi) Strong column-weak beam design leads to

(a) Sudden failure

(b) Strong building

(c) Ductile failure

(d) Non of above

(vii) Special conflicting reinforcement should be provided in the short/captive columns over

(a) one fourth of captive length

(b) half of the captive length

(c) full length of column

(d) one third of captive length

(viii) The anchorage length provided in the exterior beam column joint should not be less than

(a) Ld + 10 times bar diameter

(b) Ld

(c) 20 times bar meter

(d) Ld + 5 times bar meter

(ix) Building with regular configuration can be modeled as

(a) Lumped mass mode

(b) 2-D model

(c) 3-D model

(d) None of the above

(x) For irregular shaped building earthquake lateral force is calculated by

(a) Dynamic analysis

(b) Static analysis

(c) Any of the above

(d) None of the above

2. (a) Explain the different types of seismic waves. (4)

(b) What are the different causes of earthquake? Briefly explain. (6)

(c) What do you mean by intensity and magnitude of an earthquake? How they are measured? (5)

3. (a) Briefly explain the seismic zoning map of India. (6)

(b) Write briefly the principle of Earthquake Resistant Design (EQRD) of building as followed in the IS code. (6)

(c) What do you understand by MCE and DBE? (3)

4. (a) What is liquefaction of soil? Explain the soil liquefaction mechanism. (8)

(b) Briefly explain the consideration of earthquake forces in earth pressure on the retaining walls as per Indian Standard code. (7)

5. (a) What is damping in vibrating system? What are the methods used for evaluation of damping? Explain any one of the methods. (10)

(b) A SDOF system consists of a mass 400 kg and the spring stiffness of 300 kN/m. By testing it was found that a force of 100 N produces relative velocity 12 cm/sec. Find

(i) Damping ratio

(ii) Damped frequency

(iii) Logarithmic decrement

(iv) Ratio of two consecutive amplitude. (5)

6. (a) What do you mean by ductile structure? What is its significance? (5)

(b) Explain with neat sketch the ductile detailing of column and joint. (5)

(c) What are the general requirements of shear walls as a part of the lateral force resisting system of structures? (5)

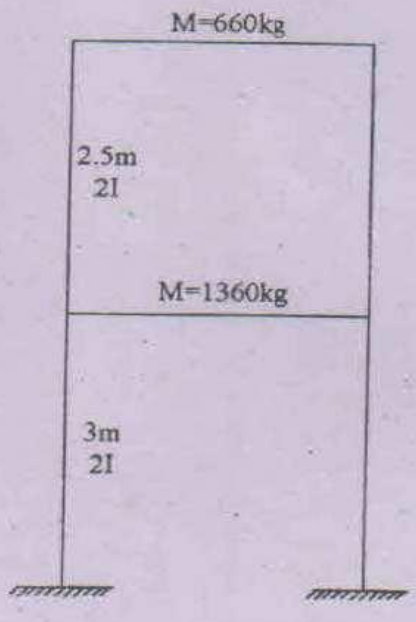
7. (a) What is soil structure interaction? What are the different types and application of soil structure interaction? Explain the interaction between soil and the structure during an earthquake with relevant diagram. (7)

(b) The sand deposit of fine sand of finite thickness is located at a depth of 3m from the ground surface. The strata is located in a seismic prone area where the anticipated PGA is 0.4g. The standard penetration test was performed at a depth of 3m. The correct N value is 8. The unit weight of sand maybe taken as 18.4 kN/m^2 and submerged unit weight of sand as 9.2 kN/m^2. Calculate the factor of safety against liquefaction as per simplified procedure by Seed and Idriss method (1971). (8)

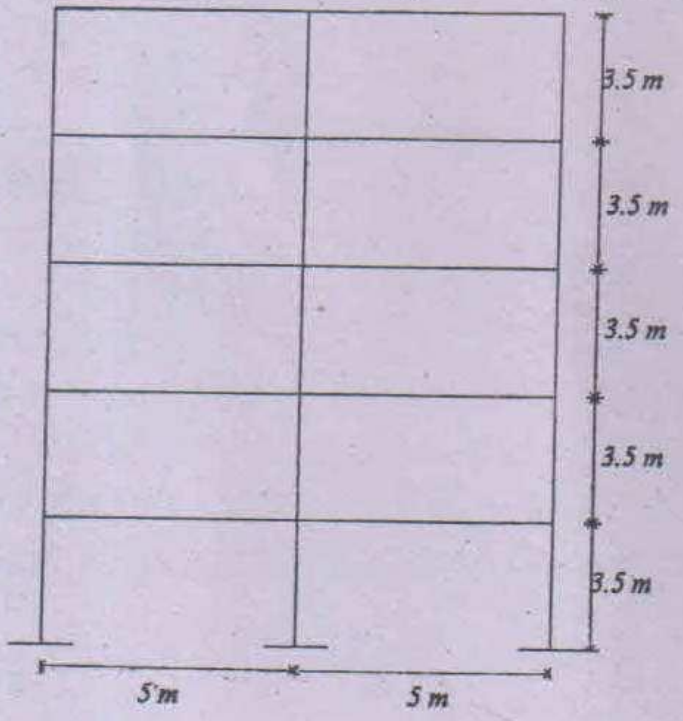
8. (a) Write a short note on response spectrum method. (5)

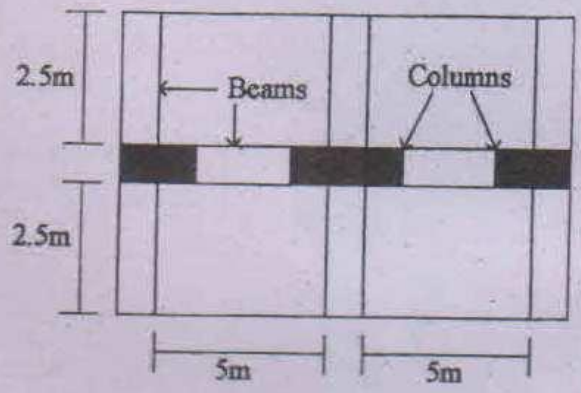
(b) Determine the natural frequencies and mode shapes for the given structure. (10)

Given : $I = 5 \times 10^5 \, mm^4, E = 2.5 \times 10^n \, N/mm^2$



9. (a) One of the plane frame of a four storeyed RC building is shown in the figure. The building is symmetric and regular. It is situated in Guwahati. Calculate the Base Shear of the building for the given specifications.





Given Data :

(i) Floor height: 3.5m

(ii) Brick infill walls: 250mm thick longitudinal walls and 150mm thick transverse walls.

(iii) Live load : 3.5 kN/m^2

(iv) Materials : M20 concrete, F4 15 steel

(v) Columns: 250mm × 450mm

(vi) Beams: 250mm × 400mm

(vii) Slab: 100mm thick

(viii) Unit weight of RCC : 25kN/m^3

(ix) Building : Special RC moment resisting frame

(x) Unit weight of brick: 20kN/m^3

(xi) Type of soil : Rocky

(b) With reference to the Q 9(a), calculate the design lateral forces at each floor. (5)

Declaration I do hereby declare that typing and printing is done by myself and my personal softcopy is protected by password.