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**Reg. No. :**

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**Question Paper Code: 57103**

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2018

Seventh Semester

Civil Engineering

15UCE703-STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING

(IS 13920:1993, IS 4326:1993 and IS 1893(Part 1):2002 are permitted)

(Regulation 2015)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The maximum deformation of a vibrating system from its mean position is called as CO1- R  
(a) Frequency                      (b) Damping                      (c) Amplitude                      (d) Period
2. For underdamped system, the value of  $\rho$  is CO1- R  
(a) Greater than 1                      (b) Equal to zero                      (c) Less than one                      (d) Equal to one
3. Characteristic vector is also known as CO2- R  
(a) Modal vectors                      (b) Eigen values                      (c) Modal values                      (d) Shape vector
4. The point at which the amplitude changes its sign from positive to negative is called as CO2- R  
(a) Mode                      (b) Node                      (c) Displacement                      (d) Frequency
5. The point of origin of an earthquake below the surface of the earth is called CO3- R  
(a) Epicentre                      (b) Hypocentre                      (c) Isoseists                      (d) Focal depth
6. The quantitative measure of earthquake is CO3- R  
(a) Magnitude                      (b) Ductility                      (c) Intensity                      (d) Moment

7. For RC frame building without infill panels, the natural period of vibration estimated using the expression CO4- R
- (a)  $T_a=0.075h^{0.75}$       (b)  $T_a=0.085h^{0.75}$       (c)  $T_a=0.09h/\sqrt{d}$       (d)  $T_a=0.09/\sqrt{d}$
8. As per IS 1893:2002 “A soft storey is one in which the lateral stiffness is less than \_\_\_\_\_ of that in the storey above or less than 80 percent of the average lateral stiffness of the three storeys above CO4- R
- (a) 75 percent      (b) 80 percent      (c) 95 percent      (d) 70 percent
9. The tension steel ratio on any face, at any section, shall not be less than CO5- R
- (a) 0.24      (b) 0.22      (c) 0.23      (d) 0.21
10. For an ideal Rigid building, Time Period is CO5- R
- (a) Equal to zero      (b) Less than zero      (c) Greater than zero      (d) Greater than 1

PART – B (5 x 2= 10Marks)

11. State D’Alembert’s Principle. CO1- R
12. How is frequency affected in the free vibration of a shear frame? CO2-U
13. Classify earthquakes CO3-R
14. What do you mean by seismic dampers? CO4-U
15. List out the codes prescribed for longitudinal reinforcement requirements. CO5-R

PART – C (5 x 16= 80Marks)

16. (a) A mass of one kg is suspended by a spring having a stiffness of 600N/m. The mass is displaced downwards from its equilibrium position by a distance of 0.01m find, CO1 App (16)
- (i) Equation of motion of the system
- (ii) Natural frequency of the system
- (iii) The response of the system as a function of time
- (iv) Total energy of the system

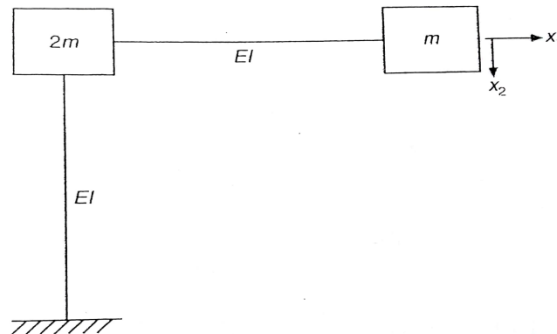
Or

- (b) A single cylinder diesel engine of 500kg mass is mounted on springs  $k=200\text{kN/m}$  and damped with  $\varepsilon =0.2$ . The mass of the equivalent reciprocating part is 10kg and stroke length is 0.2m, find the
- (i) Dynamic amplitude of vertical motion
  - (ii) Transmissibility
  - (iii) Force transmitted to the foundation, if the engine operated at 200rpm.

17. (a) State and Prove the orthogonality property of mode shapes. CO2- U (16)

Or

- (b) Determine the natural frequencies and mode of vibration of the given system. CO2- App (16)



18. (a) What are seismic waves? Explain the types of seismic waves with neat sketches. CO3-U (16)

Or

- (b) Explain with neat sketches, the theory of plate tectonics and the geological features of earth to prove the same. CO3-U (16)

19. (a) Explain briefly how the Reinforced and Prestressed concrete structures behave during the Earthquakes CO4 U (16)

Or

- (b) Explain the performance of structures during past earthquakes with some examples. CO4 U (16)

20. (a) The two bay square three-storey RCC school building is located in seismic zone V. The height of each floor is 3.5m and total floor dimension is 8m X 8m. The type of soil encountered is medium stiff and it is proposed to design the building with a special moment resisting frame. The intensity of dead load is  $10\text{kN/m}^2$  and floors are catered to an imposed load of  $3\text{kN/m}^2$ . Determine the design seismic loads on the structure b static analysis. CO5- App (16)

Or

- (b) Briefly describe the type of plan irregularities and vertical irregularities of buildings with neat sketches CO5- U (16)