



**B.E DEGREE EXAMINATIONS: APRIL 2015**

(Regulation 2009)

Seventh Semester

**CIVIL ENGINEERING**

CEE202: Basics of Dynamics & Aseismic Design

(Use of IS 1893, IS 4326 and IS 13920 are permitted)

**Time: Three Hours**

**Maximum Marks: 100**

**Answer all the Questions:-**

**PART A (10 x 1 = 10 Marks)**

1. What is the spring factor for a cantilever beam subjected to a point load at its free end?
  - a)  $\frac{5}{384} \frac{wl^3}{EI}$
  - b)  $\frac{3EI}{l^3}$
  - c)  $\frac{48EI}{l^3}$
  - d)  $\frac{l^3}{48EI}$
2. The expression for equivalent stiffness for two springs connected in series is given by
  - a)  $1/K_e = 1/K_1 + 1/K_2$
  - b)  $K_e = K_1 + K_2$
  - c)  $K_e = K_1 + K_2 / (K_1 K_2)$
  - d)  $1/K_e = K_1 + K_2$
3. The eigen vector of a MDOF problem represents
  - a) Damping
  - b) Mode shape
  - c) Amplitude
  - d) Frequency
4. A load that repeats its values after some definite period is
  - a) Aperiodic load
  - b) Impulsive load
  - c) Periodic load
  - d) Static load
5. Which is the fastest seismic wave?
  - a) Love wave
  - b) Primary wave
  - c) Rayleigh wave
  - d) Shear wave
6. Zero period acceleration is recorded for structures with
  - a) Zero rigidity
  - b) Infinite period
  - c) Infinite rigidity
  - d) Resonance
7. What is effect of increasing spacing of stirrups with respect to ductility of the structure?

- a) Increases ductility
  - b) Have no effect
  - c) Decreases ductility
  - d) Increases strength
8. The process that leads to loss of strength or stiffness of the soil is called
- a) Sliding
  - b) Fault
  - c) Liquefaction
  - d) Slip
9. Strong column weak beam concept in structures is called
- a) Capacity design
  - b) Plastic design
  - c) Elastic design
  - d) Limit state design
10. As per IS 13920, the width of for flexure member shall not be less than
- a) 200 mm
  - b) 250 mm
  - c) 150 mm
  - d) 300 mm

**PART B (10 x 2 = 20 Marks)**

11. Differentiate static and dynamic loads.
12. What is Duhamel's integral? Write the expression.
13. List the types of damping.
14. What is the concept of mode superposition?
15. Write the maximum allowable storey drift normally used for buildings under moderate earthquake and mention the IS code.
16. Compare weak storey and soft storey.
17. Define liquefaction of soil.
18. What is a lintel band?
19. List the various types of dampers used for vibration control.
20. Define response reduction factor.

**PART C (5 x 14 = 70 Marks)**

21. a) A system vibrating with a natural frequency of 6 Hz starts with initial amplitude of 2cm and an initial velocity of 2.5 cm/sec. Determine the natural period, amplitude, the time taken to reach the first peak maximum velocity, maximum acceleration and phase angle. Also write the equation of motion of a vibrating system.

**(OR)**

- b) A vibrating system consisting of a weight of  $W = 1000 \text{ N}$  and a spring with stiffness  $K = 80 \text{ KN/m}$  is viscously damped so that the ratio of two consecutive

amplitudes is 1 to 0.85. Determine a) the natural frequency of the undamped system b) the logarithmic decrement c) damping ratio d) the damping coefficient e) the damped natural frequency.

22. a) (i) Write the step by step procedure for determining mode shape and frequency of a multi degree of freedom system. (7)  
 (ii) State and prove the orthogonality condition. (7)

(OR)

- b) Determine the natural frequencies and mode shapes for the model shown in Figure 1.

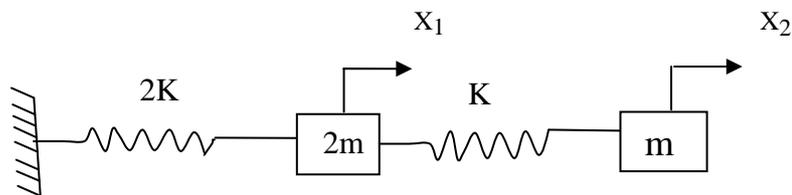


Figure 1

23. a) (i) Explain seismic waves with neat sketches. (7)  
 (ii) Explain geological faults and its types. (7)

(OR)

- b) (i) State and explain the instrument used for recording magnitude of earthquake with neat sketch. (7)  
 (ii) Compare Magnitude and Intensity of earthquake. (7)

24. a) What is response spectrum? Explain the concept with a neat sketch. Also explain the uses and the factors affecting response spectrum.

(OR)

- b) What is special confining reinforcement? Illustrate with neat sketches the provision of special confining reinforcement in various elements as per IS 13920 code.

25. a) What is base isolation? Explain the elements with a neat sketch, working principle, advantages and limitations of base isolation.

**(OR)**

- b) A four storied single building frame is of reinforced concrete situated in zone IV. The height between floors is 3m. Total height of the building is 12 m. The dead load and live loads are lumped at the respective floor levels. The soil below the foundation is hard rock. It is a hospital building. Determine the total base shear and the equivalent lateral loads at various floor levels, using the empirical method of IS 1893 – 2002 (Part I). Stiffness of each column in I, II, III and IV floors are 500 kN/m, 400 kN/m, 300 kN/m and 300 kN/m respectively. The seismic weight of I, II, III and IV floors are 80 kN, 80 kN, 40 kN and 40 kN respectively.

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