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**Question Paper Code : 31391**

M.E./M.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

First Semester

Structural Engineering

ST 4102 — STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is Simple Harmonic Motion?
2. What is damping?
3. What are normal modes of vibration?
4. Sketch two and multi degree of freedom systems.
5. Define non linear MDOF System.
6. What do you understand by the term virtual work?
7. Define microzonation.
8. What is seismology?
9. Mention the objectives of earthquake resistant designs.
10. What are rigid frames?

PART B — (5 × 13 = 65 marks)

11. (a) (i) Explain the classification of vibrations. (6)
- (ii) Derive an expression for the natural frequency of single degree of freedom system. (7)

Or

- (b) The mass of a single degree damped vibrating system is 7.5 kg and makes 24 free oscillations in 14 seconds when disturbed from its equilibrium position. The amplitude of vibration reduces to 0.25 of its initial value after five oscillations. Determine (i) stiffness of the spring, (ii) logarithmic decrement, and (iii) damping factor, i.e. the ratio of the system damping to critical damping.
12. (a) A machine of mass 75 kg is mounted on springs and is fitted with a dashpot to damp out vibrations. There are three springs each of stiffness 10 N/mm and it is found that the amplitude of vibration diminishes from 38.4 mm to 6.4 mm in two complete oscillations. Assuming that the damping force varies as the velocity, determine (i) the resistance of the dash-pot at unit velocity ; (ii) the ratio of the frequency of the damped vibration to the frequency of the undamped vibration ; and (iii) the periodic time of the damped vibration.

Or

- (b) Explain mode superposition techniques with their applications.
13. (a) Write the step by step procedure for numerical integration algorithms.

Or

- (b) Derive the equations of motion of the spring mass damper system shown in the figure Q.13(b).

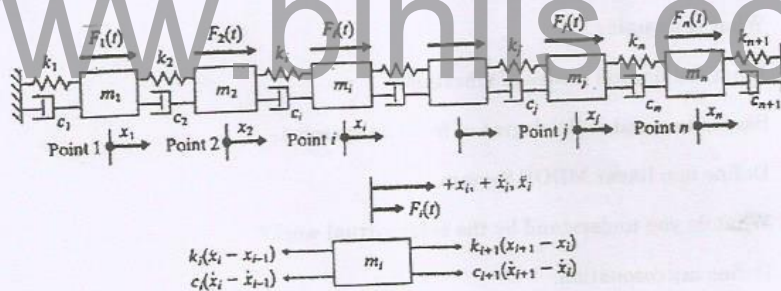


Fig. Q.13(b)

14. (a) Explain the various components of seismic instrumentation and interpretation.

Or

- (b) (i) What is response spectra? (4)
- (ii) Write the functions of spectra design spectra. (4)
- (iii) Explain the lessons learnt from the past earthquake. (5)

15. (a) Analyse the step by step procedure for seismic analysis of RC building.

Or

- (b) (i) Explain two cases of design horizontal earthquake load. (4)  
(ii) Explain "strong column – weak beam" design concept. (5)  
(iii) Explain the causes of damage of structures under earthquake. (4)

PART C — (1 × 15 = 15 marks)

16. (a) A three storey masonry building is to be constructed in a place marked as zone 5. State all the steps for the adequate earthquake resistant design.

Or

- (b) What do you understand by capacity based design and detailing? Explain.

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