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Question Paper Code: 41262

M.E. DEGREE EXAMINATION, MAY 2015.

First Semester

Structural Engineering

14PSE101 – STRUCTURAL DYNAMICS

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions.

PART A - (5 x 1 = 5 Marks)

1. Square root of mass per stiffness is called as
   (a) natural frequency (b) damping coefficient
   (c) fundamental frequency (d) logarithmic decrement

2. The damping coefficient is greater than the value for critical damping called as
   (a) over damped system (b) amplitude
   (c) under damped system (d) logarithmic decrement

3. Which method is most approximate method using multi degree freedom system?
   (a) holzer method (b) stodoloa's method
   (c) both (a) and (b) (d) None of the above

4. Which method is most accuracy of the results using single degree of freedom system?
   (a) Continuous sytem (b) Wilson Θ method
   (c) Direct integration method (d) New mark beta method

5. Non linear analysis of SDOF system has been solved using a step by step linear acceleration method
   (a) Continuous sytem (b) Wilson Θ method
   (c) Direct integration method (d) New mark beta method

PART - B (5 x 3 = 15 Marks)

6. What are the objectives of structural dynamics?

7. Differentiate undamped free vibration and undamped forced vibration.

8. Define mode superposition method.

9. Differentiate linear and nonlinear vibration.

10. Define new mark method.

PART - C (5 x 16 = 80 Marks)

11. (a) A free vibration test was conducted on a SDOF System. It is observed that 60*mm* initial displacement was given by applying a horizontal force of 80*KN* through the cable and then cutting the cable suddenly after 6 complete cycles which is assumed to be 3 *sec*. The amplitude was found to be 90*mm*. Find the following (16)
    (i) Damping ratio.
    (ii) Damping co- efficient.
    (iii) Damped period of vibration.
    (iv) Number of cycles required for the amplitude to decay 3*mm*.
    (v) Logarithmic decrement.

Or

(b) (i) A single degree of freedom system consists of a mass of 20*kg*, spring of stiffness 2200*N/m* and a dashpot with a damping coefficient of 60*Ns/ m* is subjected to a harmonic excitation of F = 200 sin 5t *N*. Write the complete solution of the equation of motion. (8)

(ii) Derive an equation of motion for the damping forced vibration of SDOF system. (8)

12. (a) Determine the modes of vibration and also the steady state response of the given system in Figure.1. (16)

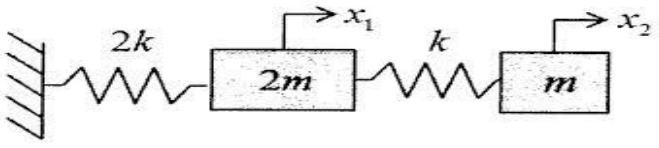


Figure. 1

Or

(b) The stiffness and mass matrix of two degree of freedom system is given by k= $\begin{bmatrix} 200 & -200 \\ -200 & 500 \end{bmatrix}$ N/m, m = $\begin{bmatrix} 2 & 0 \\ 0 & 3 \end{bmatrix}$ kg. Determine the natural frequency and mode shape. (16)

13. (a) Calculate the orthogonality of normal modes shape for a framed structure shown in Figure. 2. (16)

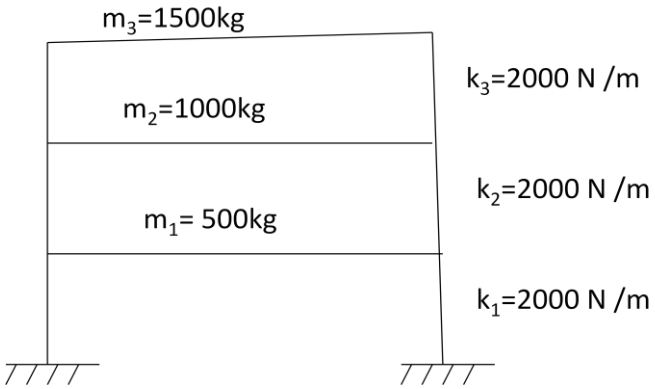


Figure. 2

Or

(b) For a two stored frame with viscous damping shown in Figure. 3. Determine displacement by mode superposition method. The stiffness is equal for all story it is 50 *kN/m*. (16)

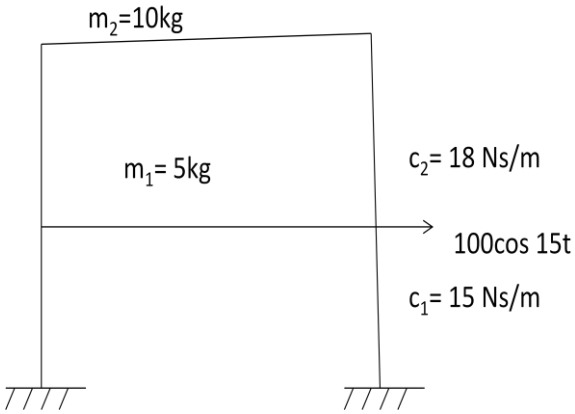


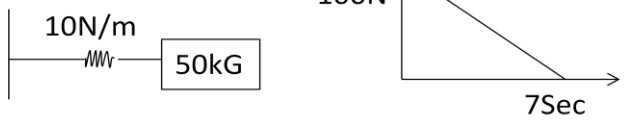
Figure. 3

14. (a) Determine the natural frequency and natural mode shape of uniform beam fixed at one end and hinged at other end subjected to free flexural vibrations. (16)

Or

(b) A mass '*m*' is attached at the midpoint of a beam of length '*l*'. The mass of the beam is small in compression to '*m*'. Determine the spring constant and frequency of free vibration of the beam in vertical direction. The beam has uniform flexural rigidity EI. (16)

15. (a) Compute the response of the single degree of freedom system which is initially at rest by new mark beta method. The initial acceleration is 0.04 and initial velocity is 1.5 *m/s*. (16)



Or

(b) Write short notes on (16)

(i) Wilson Θ method

(ii) The central difference method

(iii) Direct integration method

(iv) Finite difference method