M.E DEGREE EXAMINATIONS: JAN 2015

(Regulation 2014)

First Semester

STRUCTURAL ENGINEERING

P14SET104: Structural Dynamics

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Logarithmic decrement is used to measure   [K₁]

   a) Damping factor of an SDOF system   b) Frequency of an SDOF system

   c) Amplitude of an SDOF system   d) Period of an SDOF system

2. Match List I with List II for free damped vibration of an SDOF system and select   [K₂]
   the correct answer using the codes given below:

List I	**List II**
A. Critical damping	1. $c = 1$
B. Overdamping	2. $c > 1$
C. Underdamping	3. $c < 1$
D. Damping ratio	4. $c / c_c = 1$

   a)   A – 1, B – 2, C - 3, D - 4   b)   A – 2, B – 1, C - 3, D – 4

   c)   A – 4, B – 2, C - 3, D - 4   d)   A – 1, B – 3, C - 4, D – 2

3. For an MDOF system, the stiffness k = 100 N/m and mass m = 400 kg the   [K₂]
   angular frequency is

   a) 0.707 rad/sec   b) 0.707 Hz

   c) 0.50 rad/sec   d) 0.675 Hz

4. **Assertion (A):** In mode superposition method, all the 'n' modes for an n-degree   [K₂]

of freedom system are considered in the analysis.

Reason (R): Inclusion of all modes will not yield better accuracy and more computer time will be required without attainment of any significant accuracy.

a) Both A and R are individually true and R is the correct explanation of A.

b) Both A and R are individually true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

5. Consider the simple beam-vibration analysis shown in Figure 1. Choose the correct sequence of angular frequency for zeroth to third mode shapes. [K$_2$]
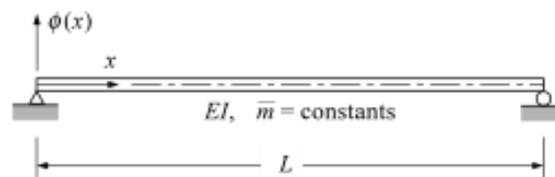

Figure 1

1. 0 2. $\pi^2 \sqrt{\dfrac{EI}{mL^4}}$ 3. $4\pi^2 \sqrt{\dfrac{EI}{mL^4}}$ 4. $9\pi^2 \sqrt{\dfrac{EI}{mL^4}}$

a) 1-2-3-4

b) 1-2-4-3

c) 2-3-4-1

d) 2-4-3-1

6. The stiffness for a simply supported beam of span '*s*ubjected to a central concentrated load 'P' is given by the expression [K$_1$]

a) $k = 5\, EI/384l^3$

b) $k = 48EI/l^3$

c) $k = 3\, EI/l^3$

d) $k = EI/384l^3$

7. In orthogonality principle, the product of mass matrix and the corresponding mode shapes [K$_1$]

a) Exists

b) Is a positive value

c) Is greater than one

d) Vanishes

8. The response obtained using Rayleigh's variational method for an MDOF system is its [K$_1$]

a) Fundamental frequency

b) Acceleration

c) Time period

d) Amplitude

9. The stochastic process is a function of [K₁]

a) Time   b) Frequency

c) Amplitude   d) Velocity

10. Which of these statements are correct? [K₂]

     1. A set of outcomes to which a probability is assigned is called an event.

     2. A collection of individual elements in the domain is a set.

     3. The intersection of two events A and B is the set of elements that does not belong to both sets A and B.

     4. Two events A and B are said to be mutually exclusive if they have common elements.

a) 1,3   b) 3,4

c) 1,2   d) 2,4

PART B (10 x 2 = 20 Marks)

11. Differentiate free and forced vibrations. [K₂]

12. Define Duhamel's integral. [K₁]

13. Describe eigen value and eigen vector. [K₂]

14. Discuss the advantages of numerical integration procedures. [K₂]

15. Define a shear beam. [K₁]

16. Record and explain first two modes of uniform beam having both ends free subjected to free flexural vibration. [K₂]

17. Recall the importance of idealization of structures to mathematical models. [K₁]

18. List the numerical integration procedures available in determining dynamic response of structures. [K₁]

19. Cite examples of random loadings with sketches. [K₁]

20. Define a random variable. [K₂]

PART C (10 x 5 = 50 Marks)

21. A weight W = 15 N is vertically suspended by a spring of stiffness k = 2 N/mm. Determine the natural frequency of the free vibration of the weight. [K₄]

22. Explain the various types of damping with exapmples. [K$_2$]

23. Deduce the orthogonality principle of MDOF system. [K$_4$]

24. Explain the procedure of evaluation of natural frequencies and mode shapes of MDOF systems. [K$_2$]

25. Explain the determination of natural frequencies and mode shapes for continuous beams. [K$_2$]

26. Explain the determination of natural frequencies and mode shapes for uniform beams simply supported at both ends. [K$_4$]

27. Explain mode superposition method. [K$_2$]

28. Distinguish between transient and dynamic response of structures. [K$_4$]

29. Explain random processes in detail. [K$_2$]

30. Explain in detail about the stochastic processes. [K$_2$]

PART D (2 x 10 = 20 Marks)

31. Demonstrate Rayleigh-Ritz method of vibration analysis with a suitable example. [K$_3$]

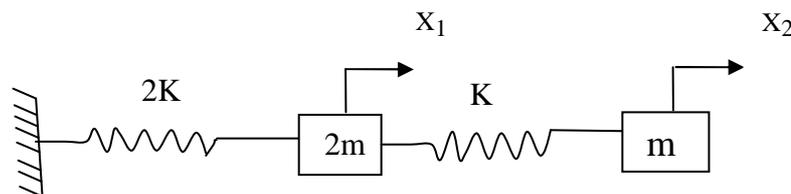32. Calculate the natural frequency and mode shape of the given system shown in Figure 2. [K$_4$]

Figure 2

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