| Manmohan Technical University<br>Office of the Controller of Examinations<br>**Exam Year: 2082, Jestha (Model Question)** | Exam Roll No. ……<br>Exam Roll No. in Words. …… | |
|---|---|---|
| School: SOE | Level: BE | Invigilator's Sign…… |
| Program: All | Year/Part: III/II | Superintendent's Sign…… |
| **Subject: Structural Dynamics (EG 661 CE)** | | Code No. …… |

**Group A [10 × 1 = 10] Attempt all Questions**

**Instructions:**

- Choose one answer out of four options
- Use black ball pen for shading only one circle for correct option of a question in Answer Sheet which you have been provided
- No marks will be awarded for cutting, erasing, over writing and multiple circles shading.

1. Which method is used to transform a set of N coupled non homogenous differential equations to set of N uncoupled non homogenous differential equations?
   a. Stodola Method b. Mode-superposition method
   c. Absolute sum method d. square root of sum of squares method
2. The Fourier transform of a structure's impulse response function represents its:
   a. Natural frequency b. Frequency response function c. Damping ratio d. Modal participation factor
3. What is transmissibility ratio (TR)?
   a. Ratio of amplitude of the force transmitted to the support of the amplitude of the applied harmonic force
   b. Ratio of the support of the amplitude of the applied harmonic force to the amplitude of the force transmitted
   c. Ratio of amplitude of the force loss to the support of the amplitude of the applied harmonic force
   d. Ratio of the support of the amplitude of the applied harmonic force to the amplitude of the force loss
4. What is the other name of body-friction damping?
   a. Euler damping b. Coulomb damping c. Newton damping d. Thomson damping
5. What type of roots are obtained for the overdamped case?
   a. Independent of the type of case b. non-real roots c. Real and negative d. Real and positive
6. Which mathematical tool is commonly used to transform a time-domain signal into the frequency domain?
   a. Laplace Transform b. Fourier Transform
   c. Z-Transform d. Hilbert Transform
7. What is a continuous system in structural dynamics?
   a. A system with a finite number of degrees of freedom
   b. A system with an infinite number of degrees of freedom
   c. A system with no degrees of freedom
   d. A system with discrete masses
8. The partial differential equation governing the transverse vibration of a string is:
   a. $\frac{\partial^2 u}{\partial t^2} = C^2 \frac{\partial^2 u}{\partial x^2}$ b. $\frac{\partial^2 u}{\partial t^2} = C^2 \frac{\partial^4 u}{\partial x^4}$
   c. $\frac{\partial^2 u}{\partial t^2} = C^2 \frac{\partial u}{\partial x}$ d. $\frac{\partial^2 u}{\partial t^2} = C^2 \frac{\partial^3 u}{\partial x^3}$
9. The modal superposition method is used to:
   a) Decouple the equations of motion using mode shapes and natural frequencies
   b) Solve the system's equations of motion directly
   c) Calculate the system's damping properties
   d) Determine the system's static equilibrium.
10. In time domain analysis, the Duhamel integral is used to.
    a. Solve the system's equations of motion for arbitrary loading
    b. Calculate the system's natural frequencies
    c. Determine the system's mode shapes
    d. Perform frequency domain analysis

**Multiple Choice Questions' Answer Sheet**

Marks Secured: _____
In Words: _____
Examiner's Sign: _____ Date: _____
Scrutinizer's Marks: _____
In Words: _____
Scrutinizer's Sign: _____ Date: _____

Corrected Fill: (A) ● (C) (D)
Incorrected Fill: ⊗ (B) ● (D)✓

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1. | (A) | (B) | (C) | (D) | 6. | (A) | (B) | (C) | (D) |
| 2. | (A) | (B) | (C) | (D) | 7. | (A) | (B) | (C) | (D) |
| 3. | (A) | (B) | (C) | (D) | 8. | (A) | (B) | (C) | (D) |
| 4. | (A) | (B) | (C) | (D) | 9. | (A) | (B) | (C) | (D) |
| 5. | (A) | (B) | (C) | (D) | 10. | (A) | (B) | (C) | (D) |

MANOMOHAN TECHNICAL UNIVERSITY

OFFICE OF THE CONTROLLER OF EXAMINATIONS

**Exam Year: 2082, Jestha (Model Question)**

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|---|---|---|
| School: SOE | Level: BE | Time: 3 hrs. |
| Program: All | Year/Part: III/II | Full Marks: 50 |
| **Subject: Structural Dynamics (EG 661 CE)** | | Pass Marks: 20 |

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Assume suitable data if necessary.
- ✓ Students are allowed to bring Financial and Risk Analysis Tables with them.

**Group A (Multiple Choice Questions)** in separate paper

**Group B Attempt any eight questions [$8 \times 2 = 16$ ]**

1. Explain types of prescribed or deterministic loading.
2. State and explain Newton's 2nd law of motion and D'Alembert's principle.
3. State difference between transient and steady state response of structures subjected to harmonic excitation.
4. Define dynamic magnification factor, and response ratio. Describe in brief with a neat sketch the influence of frequency ratio and damping ratio on dynamic magnification factor.
5. Demonstrate numerically that the computed mode shapes satisfy the orthogonality conditions with respect to stiffness.
6. what is the significance of orthogonality principle in structural dynamics?
7. What is meant by decoupling of equations in structural dynamics?
8. Explain with appropriate expression for Transverse Vibration of a string
9. Write short note on time domain analysis for general dynamic loading.

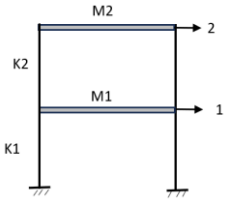
**Group C Attempt all questions 24**

10. Derive the expression for the equation of motion for a traverse vibration of a beam. [4]

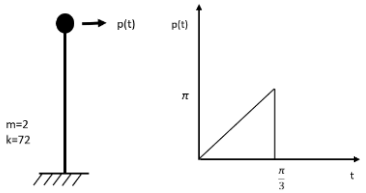
    Or

    Derive the frequency domain representation of the equation of motion for an MDOF system subjected to general dynamic loading.
11. Determine the natural frequencies and mode shapes of the two-storied shear frame shown in the figure given below. Sketch the mode shapes, and also illustrate that the modes shapes satisfy the orthogonality conditions. [6]

    $M_1$ = 1360 kg; $M_2$=660kg; $K_1$ = 11.11x $10^{-3}$ N/m; $K_2$= 19.2 x $10^{-3}$ N/m;




12. Write down the steps to determine frequencies and mode shapes of a system having multi degree of freedom by matrix iteration (Stodola) method. [4]
13. A centrifugal fan running at a constant speed of 1000 rpm weighs 100 kg and has a rotating unbalance of 30 kg-cm. When dampers having damping factor ξ =0.1 are used, specify the spring stiffness for mounting such that only 10% of the unbalance force is transmitted to the floor. Also determine the magnitude of transmitted force. [4]
14. Determine the response of the following system by the applied force prescribed below. The system initially at rest condition. [6]




**The End**