Hall Ticket No | | | | | | | | | | | Question Paper Code: BST004

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

M.Tech II Semester End Examinations (Supplementary) - January, 2019

**Regulation: IARE–R16**

## STRUCTURAL DYNAMICS

**(Structural Engineering)**

**Time: 3 Hours** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) Obtain the expression for equation of motion x (t) of an under damped SDOF system subjected to free vibration. **[7M]**
   (b) Define **[7M]**
      i. Damped and Undamped vibration.
      ii. Continuous system and discrete systems

2. (a) Explain the concept of Lumped mass idealization in detail. **[7M]**
   (b) Define the following **[7M]**
      i. Natural frequency
      ii. Damped frequency
      iii. Time Period
      iv. Damping ratio
      v. Critical damping

### UNIT – II

3. (a) What are the various methods for solving the differential equation of motion? State the conditions under which these are preferred. **[7M]**
   (b) Give the explanation with their statements for the following.
      i. Principle of virtual work. **[7M]**
      ii. Hamilton's Principle.

4. (a) Derive an expression for the steady state response of an under damped SDOF system subjected to a harmonic excitation $F(t) = FoSin\omega t$ applied to mass. **[7M]**
   (b) Obtain the direct equilibrium equation using Newton's second law of motion. **[7M]**

### UNIT – III

5. (a) Explain the modal superposition procedure in case of multi degree of freedom system. **[7M]**
   (b) Explain the concept of mathematical modeling of a multi degree of freedom system. **[7M]**

6. (a) Derive the governing differential equation and undamped free vibration solution for two storey shear building frame modelled as oscillators. **[7M]**.

   (b) For the Figure 1, obtain the mode shapes of the shear building. **[7M]**
   $M_1 = 110x10^3 kgs; M_2 = 160x10^3 kgs; M_3 = 30x10^3 kgs$
   $K_1 = 40x10^6 N/m; K_2 = 100x10^6 N/m; K_3 = 100x10^6 N/m$

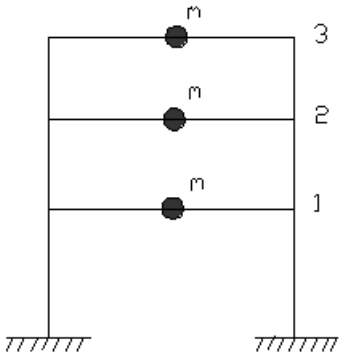


Figure 1

## UNIT – IV

7. (a) Mention the assumptions made in the flexural vibrations of uniform beams. **[7M]**

   (b) State and explain the procedure involved in vibration analysis using Hozler's method. **[7M]**

8. (a) Find the natural frequencies and mode shapes for a beam with one end fixed and other end is free. **[7M]**

   (b) For the multi storey building shown in Figure 2, obtain the natural frequencies using Stodolla's method. **[7M]**
   $M = 5x10^3 kgsandK = 100x10^6 N/m$

## UNIT – V

9. (a) A Harmonic motion has an amplitude of 0.05m and a frequency of 25Hz. Find the time period, maximum velocity and maximum acceleration. **[7M]**

   (b) Explain the lumped mass approach as applied to SDOF systems and MDOF systems. **[7M]**

10. (a) Explain the I.S code methods of analysis for obtaining the response of multi storied buildings shown in Figure 3. **[7M]**

    (b) Distinguish between under damped, critically damped and over damped systems with suitable examples. **[7M]**

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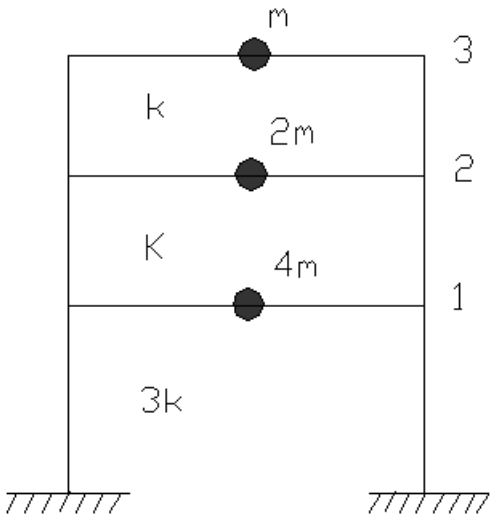


Figure 2

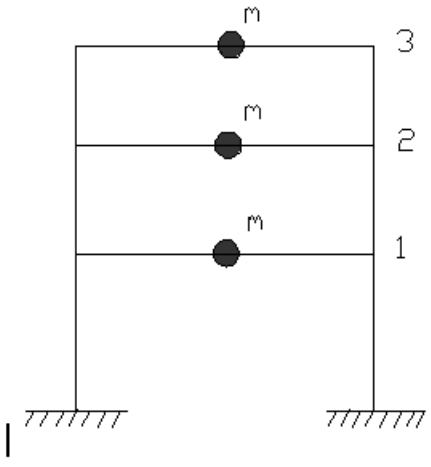


Figure 3