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Total No. of Pages : 02

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M.Tech. (Civil Engg.) (2016 Onwards) (Sem.–1)

DYNAMICS OF STRUCTURES

Subject Code : CE-501

M.Code : 35202

Time : 3 Hrs. INSTRUCTIONS TO CANDIDATES : Max. Marks : 100

- 1. Attempt any FIVE questions out of EIGHT questions.
- 2. Each question carries TWENTY marks.
- 3. Assume any missing data.
- 1. The natural period of a SDOF system is 0.75 sec. The system is subjected to some initial displacement 25mm and allowed to vibrate its own. The displacement observed after 2.5 sec was 10mm. If the mass of the system is 500kg, Determine :
  - a) Circular natural frequency,
  - b) Stiffness,
  - c) Damping ratio,
  - d) Damped circular natural frequency
  - e) Critical damping coefficient of the system
  - f) Period and frequency of vibration.
- 2. Find the natural frequency and mode of vibration for the system shown.



## FIG.1

3. Determine the natural frequency of the beam shown in figure. The moment of inertia I of the beam is  $450 \times 106$  mm4 and modulus of elasticity E =  $1.8 \times 105$  N/mm2 and the stiffness of the spring is  $50 \times 106$  N/m. If the system undergoes free vibration with an initial displacement of 2 mm, find the response of the system at time 2 seconds.



4. An undamped SDOF system subjected to following forcing function shown in figure and with initial displacement (ust)0 and initial velocity (ust)0/td, where (ust)0 = P0/k. Write the expression at time td using Duhamel integral.



FIG. 3

5. For a SDOF system with mass kg and stiffness kN/m, the forcing function shown in figure. Evaluate numerically its response.



FIG. 4

- 6. Write step by step numerical integration techniques.
- 7. Find out physical damping ratios and damping matrix by using of direct integration method.
- 8. Use the average acceleration method to obtain the free vibration response of an undamped SDOF system with K = M = U (0) = 1, U (0) = 0. Choose a reasonable time step and perform the integration for 0 [] t [] 1.0 s.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.