JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2024

M.Tech-I Semester (SE)

COURSE CODE(CREDITS):11M1WCE112(3) MAX. MARKS: 35

COURSE NAME: STRUCTURAL DYNAMICS

COURSE INSTRUCTORS: Mr. Chandra Pal Gautam MAX. TIME: 2 Hour

Note: ***(a)*** *All questions are compulsory. (b)Marks are indicated against each question in squarebrackets.(c) The candidate is allowed to make Suitable numeric assumptions wherever requiredfor solving problems*

Q.1. A generator of 2 ton weight is placed at the corner of a cantilever concrete plank of width 300mm, length 3m and width 250mm. Find the static and dynamic deflection of the generator running at 2500rpm. Use M20 grade of concrete and assume 5% of critical damping. **[8]**

Q.2. (a) Derive the relation between R_D, R_V and R_A. Also find the special cases for different value of frequency ratio (r).

(b) A single-degree-of-freedom system has a natural frequency f_n=10 Hz. When subjected to harmonic excitation, the amplitude response curve has peak amplitude X_{max}=5 mm, at the natural frequency f_n. The frequencies at which the amplitude drops to $1/(2)^{1/2}X_{max}$ are f_1=9.5 Hz and f_2=10.5 Hz. Calculate the damping ratio ζ of the system **[4+4 = 8]**

Q.3. A single-degree-of-freedom (SDOF) system with the following properties is subjected to a time-varying force F(t)=100cos(100t) N:

- Mass (m) =5 kg,
- Stiffness (k) =500 N/m
- Damping ratio ζ=0.1

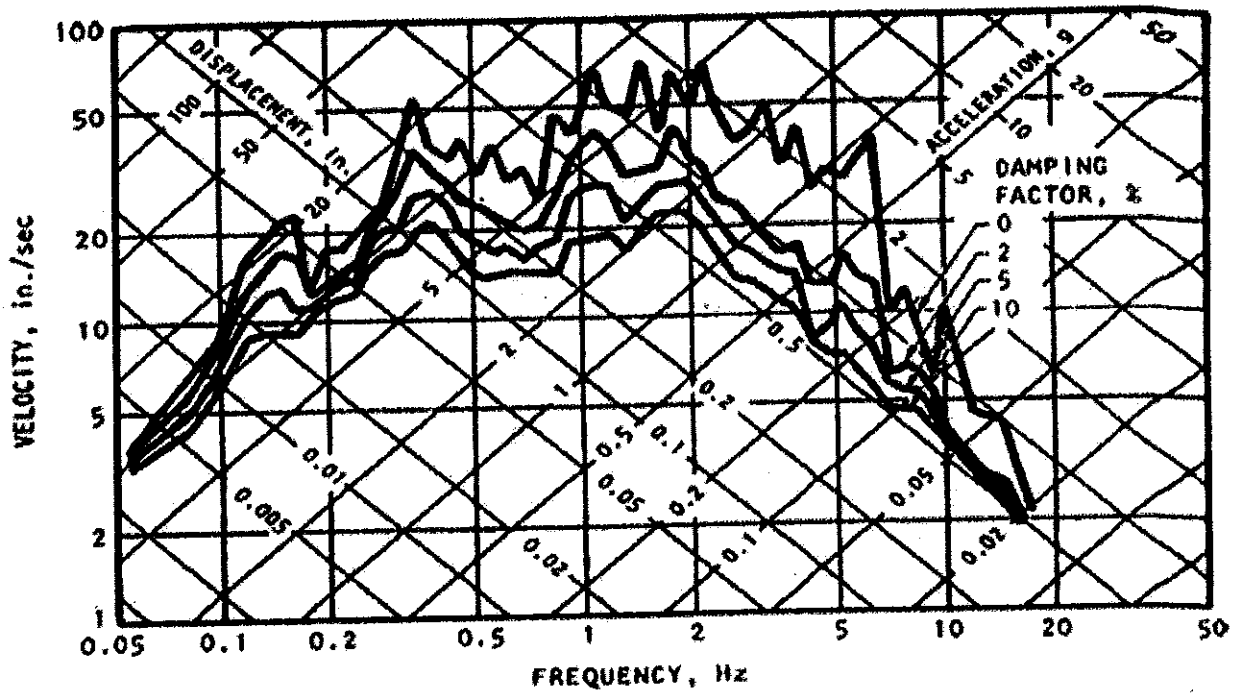
The initial conditions are:

- Displacement u(0)=0m,
- Velocity $\dot{u}(0)$=0 m/s.

Calculate the displacement at t=0.5 seconds using the **central difference method** with a time step Δt=0.1 seconds. **[10]**

Q.4. Write the Mass and Stiffness matrix for a 3 story building with plane area 4mx4m in which floor to floor height is 3m, circular column dimensions = 500 mm diameter, thickness of slab = 120mm, grade of concrete = 35N/mm^2. **[4]**

Q.5. A mass of 5000kg is supported by a column of stiffness k = 100kN/m. let the structure be subjected to ground motion whose spectrum is given below. If the damping is 5% of critical then find the maximum displacement, velocity and acceleration of the mass. **[5]**



Response Spectra, El Centro Earthquake, May 18, 1940,
North-South Direction.