# B.E. CIVIL ENGINEERING FOURTH YEAR SECOND SEMESTER EXAM 2022

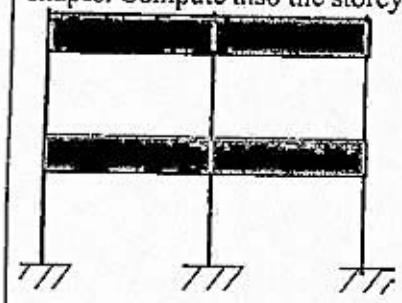
## Structural Dynamics

PART-I

Time: Four Hours | Full Marks 70 | (35 marks for each part)

Use a separate Answer-Script for each part

**[IS1893 is allowed]**

| No. of questions | Part I (Answer all Questions) | Marks |
|---|---|---|
| 1(a) | Consider a two bay two storey R.C. framed building as shown in figure1. The floor is rigid. The mass at the first floor and at roof are 75 kN/m$^2$ and 50 kN/m$^2$ respectively. Area of floor is 10 m$^2$ The column size at ground floor is 250X250 and at first floor is 350X350. Floor to floor height is 3m in each floor. The building is located at Kolkata. Determine the storey stiffness, frequencies and mode shapes. Compute also the storey shears and floor forces. Assume M25 grade of concrete.  | 15 |
| (b) | What are the basic difference between linear static analysis and linear dynamic analysis? | |
| 2 (a) | Derive the equation of motion in free vibration of a flexural uniform beam. | 10 |
| (b) | Determine the natural frequencies and mode shape for uniform beam with both end simply supported. | 10 |

Ref. No. : Ex/CE/PE/B/T/421A/2022

**Name of the Examinations: B.E. CIVIL ENGINEERING FOURTH YEAR SECOND SEMESTER - 2022**

**Subject : STRUCTURAL DYNAMICS** **Time :** **Full Marks : 70**

**Part II**

**Instructions : Use Separate Answer scripts for each part**

Question 1

a) A simple oscillator with mass 'm' is connected to the ground by a spring 'k' and a damper 'c'. It is subjected to a ground movement $v_g$. Obtain the Spectral Displacement, Spectral Velocity and Spectral Acceleration of the oscillator and state the relationship between the same. (5)

b) State the significance of the combined D-V-A spectrum (3)

Question 2

a) Define a Stationary-Ergodic process. (2)

b) State the characteristics of Auto-Correlation function with necessary proof. (5)

Question 3

Using convolution theorem, obtain the response of a SDOF undamped system subjected to a loading shown in Figure 1 and hence obtain the shock spectrum. (10)

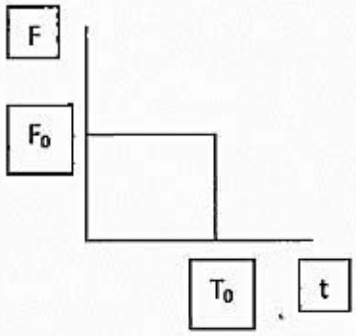



Figure 1

Question 4

A uniform solid circular steel cantilever column of length 40 m and a diameter of 0.5 m fixed on to medium soil is subjected to a base excitation of 0.4g. Assuming the displaced motion of the column to be $1 - \cos(\pi x / 2L)$ obtain the maximum displacement of the column, base shear and the distributed earthquake force. (10)

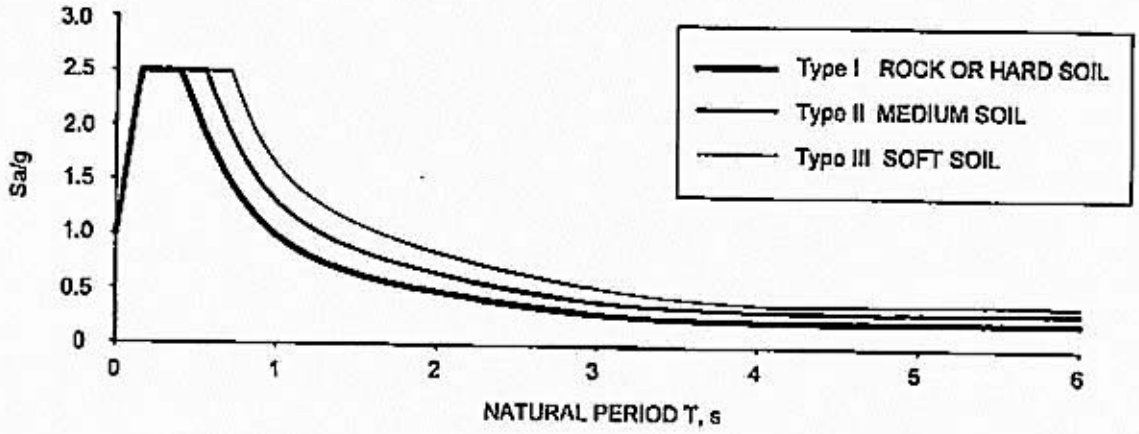



FIG. 2 DESIGN ACCELERATION COEFFICIENT ($S_a/g$) (CORRESPONDING TO 5 PERCENT DAMPING)