Ref. No.: Ex/CE/PE/B/T/421B/2025

B.E. CIVIL ENGINEERING
FOURTH YEAR
SECOND SEMESTER EXAM 2025

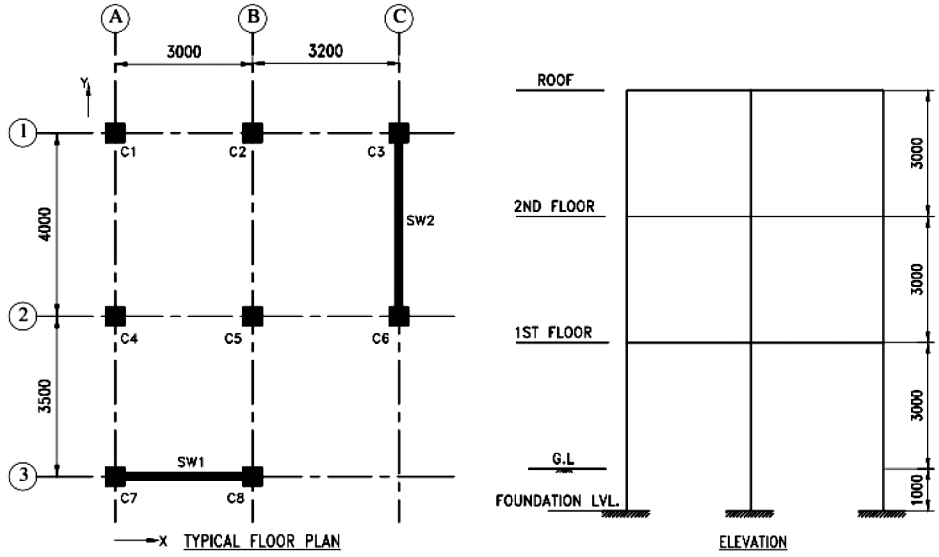
WIND AND EARTHQUAKE ENGINEERING

Part - I
(Use separate answer-script for each Part.)

Time : Three hours — 50 marks for each Part. — Full Marks- 100

Answer any one question
(IS 456,875,1893,13920 and SP 6(1) are allowed in the hall)

1. Calculate the earthquake force at each storey level of the open frame by response spectrum method for earthquake force acting parallel to grid lines A , B and C.



All column sections are 300 mm X 300 mm, shear walls are 150 mm thick. The slabs are 125 mm thick and live load on floors = 1.5 kN/m^2 and that on roof = 0.75 kN/m^2 . You need not consider weight of brickwork. Assume suitable values of other data, if required. Assume M30 concrete and Fe500 steel. 50

2. Design and detail a concrete shear wall 5000mm X 300 mm as per IS 13920 with the following data :
Factored axial load = 6000 kN , factored shear force = 450 kN, factored bending moment = 3000 kN-m.
Assume M40 concrete and Fe500 steel. 50

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Subject : WIND AND EARTHQUAKE ENGINEERING Time : 3 Hours Full Marks : 100

Part II

Instructions : Use Separate Answer scripts for each Part

Question 1. Obtain the peak response of a system in terms of background and resonant components subjected to a random gust load and identify the relation of the same with the IS code specification for gust load. (15)

Question 2. a) Develop the necessary governing equations for a structure of non-circular cross section undergoing 'galloping' phenomenon and state the condition when it will be subjected to galloping.

b) Is it mandatory that galloping is observed only in structure with non-circular cross section? If not under what condition a circular section also can undergo galloping and state the governing equation for the same. (6+4)

OR

Question 2. Explain with neat diagrams the effect of the structural geometry and nature of the flow (Laminar/Turbulent) on the response of bluff bodies. (10)

Question 3. Develop the governing equation to explain the flutter phenomenon in a 2-dof system subjected to fluid loading and explain the conditions for occurrence of flutter in terms of location of the center of mass, elastic center and center of lift. (10)

Question 4. a) Define 'True' Model and 'Distorted' Model. (2)

b) State Reynold's Model Law and its significance in fluid mechanics. (3)

c) A pipe of diameter *1.5 m* is required to transport an oil of specific gravity *0.90* and viscosity $4x10^{-2}$ *poise* at the rate of *3500litre/sec.* Tests were conducted on a *15 cm* diameter pipe using water at 20°C. Find the velocity and rate of flow in the model. (5)

d) The top surface of the passenger car of a train moving at a velocity of 95 km/h is 2.1 m wide and 8 m long. If the outdoor air is at 1 atm and 25°C, determine the drag force acting on the top surface of the car. Ignore any upstream boundary layer from the car(s) in front of this one; in other words, let the boundary layer start at the front edge of the top of the car. Assume reasonable data as applicable. Coefficient of friction = $Re/0.074^{0.2}$. (5)