

Answer Any Four (4) Questions

(IS 875 part III is allowed)

1. (a) Define Coriolis force. (5)
 (b) Why are slats added to the outer surface of circular cylindrical chimney? (5)
 (c) Explain the phenomenon of flow separation for a wind flow over a curved surface. (5)
 (d) Consider a flow over two cylinders, one having four times the diameter of the other. The flow over the smaller cylinder has a free stream density, velocity and temperature given by ρ_1 , V_1 and T_1 respectively and the flow over the larger cylinder has the parameters given by ρ_2 , V_2 and T_2 . It is stated that $\rho_2 = \rho_1/4$, $V_2 = 2V_1$ and $T_2 = 4T_1$. Assume that the speed of sound in the fluid and the viscosity are proportional to $T^{1/2}$ show that the flows are dynamically similar. (10)
2. Using Gust Factor approach as per IS 875 (part 3), calculate the wind pressure at 40 m interval of a 120 m tall RCC building with a plan area of 30 m x 30 m. The building is to be constructed in the centre of the city of Mumbai with large number of closely spaced tall structures around. Assume probability factor = 1.0 (25)
3. Show that for a linear system subjected to a random excitation $f(t)$, the power spectral density of response is expressed as

$$S_x(\omega) = |G(\omega)|^2 S_f(\omega)$$
 (25)
4. Develop the expression for Gust Factor (as defined in IS 875 Part III) showing clearly the distinction between the 'Background' and the 'Resonant' part. What is the significance of the 'size reduction factor', S in the expression Gust factor? Explain the significance of the 'Turbulence Correction Factor', ϕ in the expression for the Gust Factor. (25)
5. (a) Define a stationary, ergodic process in the context of stochastic vibration process. (5)
 (b) Prove that for a random variable the variance is equal to the difference of mean square value and the square of the mean value. (5)
 (c) Write short notes on (3 x 5)
 (i) Cross wind excitation due to turbulence
 (ii) Wake Excitation
 (iii) Aerodynamic damping and Galloping