INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR
Instructor: Prof Mohammad Saud Afzal
Department of Civil Engineering
Course: CE21003
Submission Deadline:
Total Marks:

Dimensional Analysis

Q1) A laboratory model of a river is built to a geometric scale of 1:100. The fluid used in the model is oil of mass density 900 kg/m^3. The highest flood in the river is 10,000m^3/s. Find the corresponding discharge in the model.

Q2) The flow of glycerin (kinematic viscosity v = 5 ×10^{-4} m^2/s) in an open channel is to be modeled in a laboratory flume using water (v=10^{-6} m^2/s) as the flowing fluid. If both gravity and viscosity are important, what should be the length scale (i.e. ratio of prototype to model dimensions) for maintaining dynamic similarity?

Q3) At low velocities (laminar flow), the volume flow Q through a small-bore tube is a function only of the tube radius R, the fluid viscosity μ, and the pressure drop per unit tube length dp/dx. Using the pi theorem, find an appropriate dimensionless relationship.

Q4) The capillary rise h of a liquid in a tube varies with tube diameter d, gravity g, fluid density ρ, surface tension σ, and the contact angle θ. Find a dimensionless statement of this relation.