



(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 0009

Roll No.

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B. Tech.

(SEM. V) EXAMINATION, 2007-08

FUNDAMENTALS OF FLUID MECHANICS

Time : 3 Hours]

[Total Marks : 50

- Note :*
- (i) Attempt all questions.
 - (ii) Give neat sketches to support your answers.
 - (iii) Assume missing data suitably, if any, and state assumptions made.

1 Attempt any **four** of the following : 3×4=12

- (a) State Newton's experiment for derivation of viscosity concept and equation. Also, explain the applications of viscosity.
- (b) Define with neat sketches :
 - (i) Path line
 - (ii) Stream line
 - (iii) Streak line
 - (iv) equipotential lines.
- (c) Differentiate between –
 - (i) Steady and unsteady flow
 - (ii) Uniform and non-uniform flow.
- (d) Derive the formula for centre of pressure on an inclined plate submerged in a static fluid.

- (e) Explain the following :
- (i) Meta centric height
 - (ii) Centre of buoyancy
 - (iii) equilibrium of floating bodies.
- (f) The diameters of the limbs of a U-tube are 4 mm and 5 mm which is used to measure the pressure readings in the range of 10 mm to 100 mm. Calculate the percentage error at its lowest and highest readings. Assume, $J=0.0735\text{N/m}$ and $\theta=0^\circ$.

2 Attempt any **four** of the following : 3×4=12

- (a) State Bernoulli's Theorem. Give practical applications of the same.
- (b) Deduce an expression for discharge through a mouthpiece.
- (c) Explain the Buckingham's Z theorem. How are the variables selected?
- (d) Explain dynamic and kinematic similarities between a model and prototype.
- (e) Explain Reynold's experiment for demonstrating the laminar flow with the help of sketches.
- (f) Explain Prandtl's mixing length theory with sketches.

3 Attempt any **two** of the following :

- (a) Define nominal thickness, displacement thickness, energy thickness and momentum thickness of boundary layer. Prove that energy thickness for a boundary layer is given by

$$\delta_E = \int_0^{\delta} \frac{u}{U} \left[1 - \frac{u^2}{U^2} \right] dy \quad \text{where symbols carry}$$

conventional meaning.

- (b) Explain the following :
- (i) Pipes in series
 - (ii) Equivalent pipe
 - (iii) Velocity distribution over smooth surfaces
 - (iv) Branching of pipes.
- (c) Define the following :
- (i) Laminar boundary layer
 - (ii) Turbulent boundary layer
 - (iii) Laminar sub-layer
 - (iv) Atmospheric boundary layer.

Attempt any **two** of the following :

$$6\frac{1}{2} \times 2 = 13$$

- (a) Differentiate between :
- (i) Pressure drag and Friction drag
 - (ii) Stream line body and bluff body
- (b) What do you understand by water hammer? What allowance is usually made for this in penstock design ?
- (c) (i) What do you understand by “Magnus Effect”? Explain.
- (iii) Explain transmission of pressure waves in rigid pipes.