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B.Tech.
THIRD SEMESTER EXAMINATION 2015-16
ECH303

FLUID FLOW OPERATIONS

Time: 3 Hours

Max. Marks: 100

Note:

- Attempt all questions.
- Marks and number of question to be attempted from the section is mentioned before each section.

1. Attempt any FOUR parts of the following : [4x5]

- Ten Liters of a liquid of specific gravity 1.3 is mixed with 6 liters of a liquid of specific gravity 0.8. It the bulk of the liquid shrinks by 1.5% on mixing calculates the specific gravity, density, volume & weight of the mixture.
- Determine the viscosity of a liquid having kinematic viscosity 6 stokes and specific gravity 1.9.
- Explain the different kinds of fluids using neat sketch of Rheogram with one example each.
- Assuming sap in tree rises purely to capillary rise phenomenon; find the diameter of the tube in mm which can carry it to a height of 15 cm. Assume the sap to have the same characteristics as those of water.
- Define surface tension. Establish relationship among surface tension (σ), pressure within the droplet of liquid in excess of outside pressure (p) and dia of droplet d .
- A plate has an area of 1.8m^2 . It slides down an inclined plane, having angle of inclination 45° to the horizontal, with a velocity of 0.7 m/s. Thickness of oil film between the plane and plate is 1 mm. Find the viscosity of the fluid if the weight of the plate is 71.72 N.

2. Attempt any FOUR parts of the following : [4x5]

- Prove that stream function and potential function are orthogonal to each other.
- (A) stream function is given by $\psi=3xy$ Determine-
 - Whether the flow is possible
 - Whether the flow is rotational or irrotational.
 - The potential function ϕ
 - Acceleration component at (1,1)

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- Analyze the flow past a source- sink pair in a uniform flow. Extend the analysis to study the limiting case of doublet in uniform flow.
- Explain the terms distorted and undistorted model. What is the use of distorted models?
- Discuss the importance of model study in fluid flow problem.
- Determine whether the continuity equation is satisfied by the following velocity components for an incompressible fluid: $u = x^2Y$ $v = 2xz - xy^2$; $w = x^2 - z^2$

3. Attempt any TWO parts of the following: [2x10]

- Derive the expression for parabolic velocity profile for a laminar flow in a tube. Show that the friction factor for laminar flow is $16/\text{Reynolds number}$.
- Air ($\rho=1.22\text{kg/m}^3$ and $V=1.5 \times 10^{-5}\text{m}^2/\text{s}$) flow through 250mm. Diameter pipe at 8 m/s as mean velocity. If the equivalent sand grain roughness is 0.5 mm. Calculate wall shear stress and friction factor f . Assume flow to be fully rough turbulent and neglect compressibility.
- Derive Darcy Weibach equation:
 - Pipes in parallel
 - Equivalent size of the pipe.

4. Attempt any TWO parts of the following: [2x10]

- What is pilot tube? How is it used to measure velocity of flow at any point in a pipe or channel?
- A venturimeter 100mm x 50mm size is used to measure the flow of liquid of specific gravity 0.8. if the mercury differential manometer head is 200mm. Find discharge through the venturi meter. Find also absolute pressure at the neck if the pressure at the enlarged end is 0.5kg/cm^2 , Take $cd=0.98$.
- Explain how the operating principle of variable area flow meter dictates the tapered shape of the rotameter glass tube.

5. Attempt any TWO parts of the following: [2x10]

- With a neat sketch, explain principle working of centrifugal pump.
- A single acting reciprocating pump, running at 50 rpm, delivers $0.01\text{ m}^3/\text{s}$ of water. The diameter of the piston is 200mm. And stroke length 400mm. Determine -
 - The theoretical discharge of the pump
 - Co-efficient of discharge
 - Slip and the percentage slip of the pump
- What is cavitation? State its effects on the performance of water turbines and also state how to prevent cavitation in water turbines.