

R09

Code No: 09A310105

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD
B.Tech II Year I Semester Examinations, May/June-2013

Fluid Mechanics
(Civil Engineering)

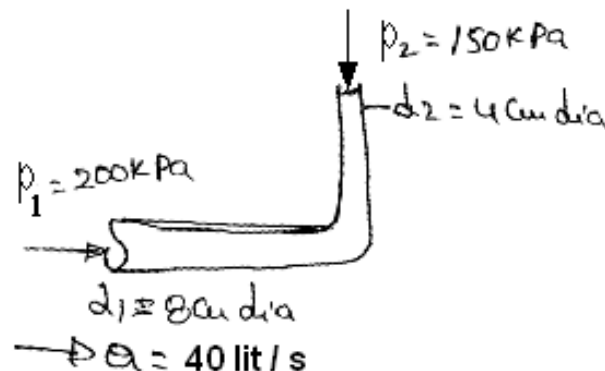
Time: 3 hours

Max. Marks: 75

Answer any five questions
All questions carry equal marks

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- 1.a) Differentiate between no slip condition and viscous resistance offered in fluid motion.
- b) For two 0.2 m long rotating concentric cylinders, the velocity distribution is given by $u(r) = 0.5/r - 1000r$ m/s, if the diameters of the cylinders are 2 cm and 4 cm respectively. Calculate the fluid viscosity if the torque on the inner cylinder is measured to be 0.0026 N-m. [15]
- 2.a) Derive an expression for the resultant force acting on a submerged curved surface.
- b) A water tank is filled with 2 m of water. Its bottom is square and measures 4 m on a side. Two opposite sides are vertical; one end is at 45° and the other makes angle of 60° with the horizontal. Calculate the force of the water on the 45° end and the 60° end. [15]
- 3.a) Differentiate between stream line, path line and streak line.
- b) Define the velocity potential function and streak function and mention and justify their properties. [15]
- 4.a) Derive Bernoulli's equation of motion for a flow along a stream line and state the requisite assumptions clearly.
- b) Find the resultant force of the water on the horizontal bend shown in Figure. [15]



- 5.a) Define boundary layer thickness, displacement thickness and momentum thickness.
- b) Explain the concept of boundary layer separation on an arbitrary body with neat sketch. [15]

- 6.a) Mention the characteristics of laminar and turbulent flows in a pipe.
- b) Lubricating oil is pumped through a pipe of 12 cm diameter and 320 m long at the rate of 20 lit/s. Calculate the average shear stress at the wall of the pipe and power required to maintain the flow if the pipe is horizontal. Take specific gravity = 0.82 and $\mu = 0.12 \text{ N-s/m}^2$ for the oil. [15]
- 7.a) Derive an expression for head loss through a pipe line for sudden contractions.
- b) Two pipes of 30 cm and 120 cm diameter, each 1800 m long are arranged in parallel to supply 90 lit/s. Find the discharge passing through each and also find for what differences in water levels between two reservoirs 3800 m apart would the same pipes be useful if arranged in series to supply the same discharge. Take $f = 0.008$ for all pipes. [15]
- 8.a) Define the concept of measurement of velocity through pitot tube at different conditions of flow.
- b) Derive and expressions for discharge through Broad crested weir. [15]

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