

II B.Tech I Semester Supplementary Examinations, May 2005
FLUID MECHANICS
(Civil Engineering)

Time: 3 hours**Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

1. Three cylindrical tubes of internal radii 200 mm, 210 mm and 220 mm, wall thickness 5 mm and length 0.5 m are placed coaxially. The space between the inner and middle cylinders is filled with an oil of viscosity 8.34 poise and the space between the middle and outer cylinders is filled with an oil of viscosity 9.89 poise. What is the torque required to rotate the middle cylinder at 360 rpm.
2. A 1.8 m diameter cylindrical tank is laid with its axis horizontal on a level ground. Each of its ends are closed by a hemispherical dome. The tank contains oil of relative density 0.9 under pressure. If a pressure guage on the top of the tank reads 22 kPa, calculate the resultant force on the spherical end.
3. (a) Differentiate between uniform flow and steady flow.
(b) For the flow of an incompressible fluid, the velocity component in the x-direction is $u = ax^2 + by$ and the velocity component in z direction is zero. Find the velocity component in y direction. To evaluate arbitrary function which might appear in the integration assume that $v = 0$ at $y = 0$.
4. (a) State Impulse-momentum equation. Give practical examples where this equation can be applied.
(b) A pipe of 30 cm diameter conveying 0.20 cumecs of water has a 90° bend in horizontal plane. The pressures at inlet and outlet of the bend are 30 N/cm^2 and 0.28 N/cm^2 respectively. Find the force on the bend.
5. (a) Define displacement thickness. Derive an expression for the displacement thickness.
(b) Oil with a free stream velocity of 1.5 m/sec flow over a thin plate 1.4 m wide and 2.2 m long. Calculate the boundary layer thickness and the shear stress at the trailing end point and determine the total surface resistance of the plate. Take specific gravity of oil is 0.80 and kinematic viscosity as 0.1 stoke.
6. (a) Compute the kinetic energy and momentum correction factors for laminar flow between fixed parallel plates.
(b) Oil flows through a pipe of 15 cm diameter and 650 m length with a velocity of 0.5 m/sec. If the kinematic viscosity of oil at the temperature is 18.7 stokes, find the loss of heat in friction. Assume the specific gravity of oil as 0.9.
7. For the distribution main of a city water supply a 0.3 m main is required. As pipes above 0.25 m dia are not available it is decided to lay two parallel mains of same diameter. Find the diameter of the parallel main.

8. (a) A venturimeter is used for measuring the flow of petrol in a pipeline inclined at 35° to horizontal. The specific gravity of the petrol is 0.81 and the ratio of area at inlet to throat area is 4. If the difference in mercury levels in the gage is 50 mm, find the flow if the pipe diameter is 0.3 m. Take $c_d = 0.975$.
- (b) A venturimeter measures the flow of water in a 75 mm diameter pipe. The difference of head between the entrance and the throat of the venturimeter is measured by U-tube containing mercury, the space above the mercury on each side being filled with water. What should be the diameter of the throat of the meter in order that the difference of the levels of mercury shall be 0.25 m when the quantity of water flowing in the pipe is 0.63 m^3 per minute take $c_d = 0.97$.
