

Fluid Mechanics
(ME-208, DEC 2006)

Time: 3 Hrs
Max. Marks: 60

Note: Section A is compulsory. Attempt any four questions from section B and any two from Section C.

Section-A

1. a) Why petrol evaporates more rapidly than water at ordinary temperature?
b) Differentiate between centre of pressure and centre of buoyancy.
c) Differentiate between tangential and normal acceleration of fluid particle.
d) Define momentum correction factor.
e) Differentiate between free and forced vortex flow.
f) What do you understand by stagnation pressure and dynamic pressure?
g) Define Mach number and its significance.
h) Which among Venturi-meter, orifice and rota-meter is the most accurate and write down coefficient of discharge for each one?
i) What is hydrostatic paradox?
j) What is the difference between a notch and a weir?

Section-B

2. Fig. shows a tank full of water, fig: (a) total pressure at bottom of tank, (b) weight of water in the tank, (c) hydrostatic paradox between results of (a) and (b); width of tank = 2 m.
3. What are the conditions of equilibrium for floating and submerged bodies?
4. A cylindrical container with height 60 cm and radius 10 cm is filled with water up to a depth of 40 cm. The container is sealed both at the top and bottom and is rotated about its vertical axis at 360 rpm. Calculate the height of paraboloid formed? What should be the rotational speed if the parabola is to just touch the centre bottom of vessel?
5. In a steady flow, the velocity components are: $u = 2kx$, $v = 2ky$, $w = -4kz$. Find the equation of a streamline passing through the point (1, 0, 1).
6. Write the impulse momentum equation and the moment of momentum equation? What is the difference between them in terms of variable to be found

Section-C

7. In a vertical pipe conveying oil of specific gravity 0.8, two pressure gauges have been installed at A & B, where the diameters are 16 cm & 8 cm respectively. A is 2 m above B. The pressure gauge readings have shown that pressure at B is greater than at A by 0.1 bar. Neglecting all losses, calculate the flow rate. If gauges at A & B are replaced by tubes filled with same liquid and connected to U-tube manometer containing mercury, calculate the difference of level of mercury in two limbs of manometer.
8. a) What do you understand by major and minor energy losses in pipes? Derive an expression for loss of head due to obstruction in the pipe.
(b) What is an equivalent pipe? Derive an expression for equivalent size of this pipe.
9. a) With Froude number as the criterion of dynamic similarity for a certain flow situation, work out the scale factors for velocity, time, discharge, acceleration, force, work and power in terms of the scale factor for length.
b) In the model test of a spill way, the discharge and velocity of flow over the model were $2\text{m}^3/\text{s}$ and 1.5m/s respectively. Calculate the discharge and velocity over the prototype which is 36 times the model size.