UTTARAKHAND TECH. UNIVERSITY

UTU

B.TECH SEM III, 2011-2012

SUB- FLUID MECHANICS

Time : 3hr

Total marks :**100**

SECTION A

Q1:- Attempt any **four** of the following :

1. Explain briefly Magnus effect.
2. Define Newton's law of viscosity of fluid.
3. Explain the term vapour press and cavitation. Derive an expression for capillarity fall.
4. Explain the term absolute, gauge, atmospheric and vacuum pressure.
5. Explain the condition of equilibrium of floating and submerged bodies.
6. The diameter of a small piston and a large piston of a hydraulic jack are 5cm and 9cm respectively. A force of 120 N is applied on the small piston. Find the load lifted by the large piston when :
7. (i) The pistons are at same level
8. (ii) Small piston is 40 cm above the large piston. Density of liquid in jack is given as 1000 kg per meter cube.

SECTION B

Q2:- Attempt any **four** of the following :

1. Derive an expression for center of pressure on an inclined plane surface submerged in liquid.
2. Differentiate between
3. (i) Uniform and Non uniform flow
4. (ii) Rotational and Irrotational flow.
5. A circular plate 3m in diameter is immersed in water in such a way that the plane of the plate makes an angle of 60° with the free surface. Determine the total pressure and position of center of pressure when the upper edge of plate is 2m below the free water surface.
6. The velocity potential function is given by $\phi = 5(x^2-y^2)$.Calculate the velocity and its direction at the point (4,5).
7. Derive the Darcy Weisbach Formula.
8. Define Reynolds experiment.

SECTION C

Q3:- Attempt any **two** of the following :

1. Define dimensionless number. Define and derive the mathematical expression for following dimensionless number and also mention the significance.
2. (i) Reynold's Number
3. (ii) Mach's Number
4. (iii) Froude's Number
5. The drag force F an apartially submerged body depends velocity V between the body and the fluid, density ρ, the velocity μ and the acceleration due to gravity g. Obtain an expression for the drag force, using the Buckingham π theorem.
6. Define coefficient of velocity coefficient of discharge, coefficient of contraction. An oil of sp, gr 0.8 is flowing through a venturimeter having inlet diameter 30 cm and throat diameter 15 cm. The oil-mercury differential manometer shows a reading of 25 cm. Calculate the discharge of oil through the horizantal venturimeter. Take C_d=0.98.

SECTION D

Q4:- Attempt any **two** of the following :

1. Derive an expression for discharge for Orifice meter and Pitot tube. State the assumption made in the derivation of Bernoulli's equation.
2. A horizontal pipe line 50 m long is connected to a water tank at one end and discharge freely into the atmosphere at the other end. For the first 35 m of its length from the tank the pipe is 200 mm diameter is suddenly enlarged to 400 mm. The height of water level in the tank is 8m above the center of pipe. Considering all losses of head which occur determine the rate of flow also draw the hydraulic gradient line and total energy line . Take f = .01 for both section of pipe.
3. A pipe line of .8 m in diameter is 1.6 km long. To increase the discharge, another line of same diameter is introduced parallel to the first in the second half of the length. Neglecting minor losses, find the increase in the discharge if 4f=0.04. The head at the inlet is 400 mm.

SECTION E

Q5:- Attempt any **two** of the following :

1. What do understand by local and convective acceleration? A fluid field is given by
2. $V = x^2yi + y^2zj-(2xyz + yz^2)k$ .Prove that it is the case of possible steady incompressible fluid flow.Calculate the velocity and acceleration at the point (2,1,3)
3.
4. For the velocity profile for laminar boundary layer flow $u/U= 3/2(y/\delta) – ½(y/\delta)^3$ Determine the boundary layer thickness and shear stress in terms of Reynold's no.
5. Define displacement thickness. For the following velocity distribution find the momentum and energy thickness. $u/U= 2(y/\delta) – (y/\delta)^2$