Enrollment No: _____ **Exam Seat No:**_____

C.U.SHAH UNIVERSITY
Winter Examination-2015

Subject Name : Fluid Mechanics-I

Subject Code : 4TE03FLM1 **Branch :** B. Tech.(Civil)

Semester : 3 **Date :** 10/12/2015 **Time :** 2:30 To 5:30 **Marks :** 70

Instructions:

(1) Use of Programmable calculator & any other electronic instrument is prohibited.
(2) Instructions written on main answer book are strictly to be obeyed.
(3) Draw neat diagrams and figures (if necessary) at right places.
(4) Assume suitable data if needed.

Q-1 **Attempt the following questions:** **(14)**

a)	State Newton's law of viscosity.	01
b)	What is Newtonian fluid?	01
c)	What is surface tension?	01
d)	Define capillarity.	01
e)	Define stream function.	01
f)	What is center of buoyancy?	01
g)	What is meta-centric height?	01
h)	Define dimensional homogeneity.	01
i)	What is syphon?	01
j)	What is an equivalent pipe?	01
k)	What is mouthpiece?	01
l)	What is Venturimeter?	01
m)	State the Bernoulli's equation.	01
n)	Define steady flow.	01

Attempt any four questions from Q-2 to Q-8

Q-2 **Attempt all questions** **(14)**

(a)	What is meant by manometer? Give its classification.	05
(b)	Derive formulae for calculating loss of head due to sudden contraction.	05
(c)	Differentiate between: Free vortex flow and forced vortex flow.	04

Q-3 **Attempt all questions** **(14)**

(a)	Write short note on water hammer in pipes.	05
(b)	A nozzle is fitted at the end of a pipe of length 300 m and of diameter 10 cm. For the maximum transmission of power through the nozzle, find the diameter of nozzle. Take f = 0.009.	05
(c)	Differentiate between: laminar flow and turbulent flow.	04

Q-4 **Attempt all questions** **(14)**

(a)	Explain the terms dynamic viscosity and kinematics viscosity. Discuss the effect of	07

temperature on viscosity.

(b) Find the minimum size of glass tube that can be used to measure water level if the capillary rise in the tube is to be restricted to 2 mm. Consider surface tension of water in contact with air as 0.073575 N/m. 07

Q-5 Attempt all questions (14)

(a) A rectangular pontoon is 5 m long, 3 m wide and 1.20 m high. The depth of immersion of the pontoon is 0.80 m in sea water. If the center of gravity is 0.6 m above the bottom of the pontoon, determine the meta-centric height. The density for sea water = 1025 kg/m^3. 07

(b) Derive Bernoulli's equation for steady-incompressible fluid flow. State assumptions made in the derivation. 07

Q-6 Attempt all questions (14)

(a) The velocity vector in a fluid flow is given V= $4x^3$ I - $10x^2$y j + 2t k. Find the velocity and acceleration of fluid particle at (2, 1, 3) at time t = 1. 07

(b) The head of water over an orifice of diameter 100 mm is 10 m. the water coming out from orifice is collected in a circular tank of diameter 1.5 m. the rise of water level in this tank is 1 m in 25 seconds. Also the co-ordinate of a point on jet, measured from vena-contracta is 4.3 m horizontal and 0.5 m vertical. Find the Coefficients C_d, C_v and C_c. 07

Q-7 Attempt all questions (14)

(a) Water flows through a pipe AB 1.2 m diameter at 3 m/s and then passes through a pipe BC 1.5 m diameter. At C, the pipe branches. Branch CD is 0.8 m in diameter and carries one third of the flow in AB. The flow velocity in branches is CE is 2.5 m/s. Find the volume rate of flow in AB, the velocity in BC, the velocity in CD and the diameter of CE. 08

(b) A 30 cm x 15 cm venture meter is inserted in vertical pipe carrying water, flowing in the upward direction. A differential mercury manometer connected to the inlet and throat gives a reading of 20 cm. find discharge. take C_d = 0.98 06

Q-8 Attempt all questions (14)

(a) A nozzle of 5 cm diameter delivers a stream of water at 20 m/s perpendicular to a plate that moves away from the jets at 5 m/s. Find the force and work done on the plate. 04

(b) Using Buckingham's π - theorem , show that the velocity through a circular orifice is given by V = $\sqrt{2gH}\ f\left[\frac{D}{H}, \frac{\mu}{\rho VH}, \frac{\sigma}{\rho V^2 H}\right]$ where H is the head causing flow, D is the diameter of orifice, μ is the coefficient of viscosity, ρ is the mass density, σ is the surface tension and g is the acceleration due to gravity. 10