# C.U.SHAH UNIVERSITY Summer Examination-2016 

Subject Name : Fluid Mechanics-I

Subject Code : 4TE03FLM1
Semester : 3 Date : 30/04/2016 Time : 02:30 To 05:30 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:

a) What is specific gravity? 01
b) What is kinematic viscosity?
c) Define irrotational flow.
d) What is Non-Newtonian fluid? 01
e) What is Mach number? 01
f) Define the term 'buoyancy'. 01
g) Define the term 'meta-centre'. 01
h) Define velocity potential function. 01
i) Define orifice. 01
j) What is siphon? 01
k) What is jet propulsion? 01
l) What is impact of jet? 01
m) Write working principle of Venturimeter. 01
n) What is mouthpiece? 01

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

## (a) Explain the phenomenon of capillarity. Derive an expression for capillary <br> 05

 rise of a liquid.(b) Describe the procedure for solving problem by Buckingham's $\pi$-theorem. 05
(c) Differentiate between: Steady flow and Unsteady flow. 04

Q-3 Attempt all questions
(a) Write a note on ogee weir. 05
(b) In a steady fluid flow, the velocity components are:
$\mathrm{u}=2 \mathrm{kx} ; \mathrm{v}=2 \mathrm{ky}$; w = -4 kz
Find the equation of a stream line passing through the point $(1,0,1)$.
(c) Distinguish between: Laminar flows and Turbulent flows.


## Q-4 Attempt all questions

(a) Derive Darcy's weisbatch equation for loss of head due to friction in a pipe line.
(b) Find the discharge over a rectangular weir of length 100 m . The head of05 water over the weir is 1.5 m . The velocity of approach is given as $0.5 \mathrm{~m} / \mathrm{s}$. Take $\mathrm{C}_{\mathrm{d}}=0.60$.
(c) Explain the principle of impulse-momentum.
(a) Explain with sketch the relationship between the absolute pressure,07 atmospheric pressure and gauge pressure.
(b) The space between tow square flat parallel plates is filled with oil. Each side07 of the plate of 60 cm . the thickness of the oil film is 12.5 mm . The upper plate, which moves at $2.5 \mathrm{~m} / \mathrm{s}$ requires a force of 10 kg to maintain the speed. Determine: (i) The dynamic viscosity of the oil in poise, and (ii) The kinematic viscosity of the oil in stokes if the specific gravity of the oil is 0.95 .

Q-6 Attempt all questions
(a) Derive continuity equation for 2-D incompressible flow in Cartesian form stating the assumption made and principle involved.
(b) A cylinder 1.6 meter diameter, 1.3 meter long and weighing 500 kg floats in07 sea water with its axis vertical. A 50 kg load is placed centrally at the top of the buoy. If the buoy is to remain in stable equilibrium, find the maximum permissible height of the centre of gravity of the load above the top of the buoy. Specific weigh of sea water is $1025 \mathrm{~kg} / \mathrm{m}^{3}$.
Q-7 Attempt all questions
(a) Give classification of notches and weirs. Derive equation for the flow over a triangular notch.
(b) Find the maximum power transmitted by a jet of water discharging freely out of nozzle fitted to a pipe 300 m long and 10 cm diameter with co-efficient of friction as 0.01 . The available head at the nozzle is 90 m .

## Q-8 Attempt all questions

(a) Obtain an expression for the force exerted by a jet of water on a fixed vertical plate in the direction of the jet.
(b) Calculate the discharge through a rectangular orifice 2 m wide and 1.6 m deep fitted to a water tank. The water level in the tank is 2.7 m above the top edge of the orifice. Take coefficient of discharge $=0.62$


