

B.E. CIVIL ENGINEERING FIRST YEAR SECOND SEMESTER EXAM 2018 (Old)

HYDRAULICS-I

Time: Three hours

Marks: 100

(Answer any **FIVE** questions)

*Different parts of the same question should be answered together.
All symbols carry their usual meanings unless otherwise mentioned.
Assume any relevant data if necessary.*

1. a) State and explain the Newton's Law of Viscosity. Explain the causes of viscosity in fluid flow. 10
 b) The dynamic viscosity of 5 poise is used for lubrication of journal bearing. The shaft of 0.5m diameter rotates at 400 rpm. Calculate the shear force and power lost in the bearing for a sleeve length of 20cm. The thickness of the oil film is 1mm. 10
2. a) State and prove hydrostatic law? 6
 b) What is manometer? How manometers are classified? 6
 c) An inverted differential manometer connected to two pipes A and B containing water. The fluid in manometer is oil of sp. gr. 0.5 and 40cm reading is obtained. Find the difference of pressure head if pressure at B is more than that of A. Draw the schematic diagram of the manometer. 8
3. a) What is total pressure and centre of pressure on a submerged surface? 4
 b) Derive an expression for force exerted by static fluid on an inclined plane surface and locate the centre of pressure. 8
 c) An isosceles triangular plate of base 4 meters and altitude 4 meters is immersed in fluid with specific gravity 0.7. The base of the triangle is touching the top of the surface of the fluid horizontally and rest of its portion is within the fluid. Determine the total pressure and centre of pressure of the plate. 8
4. a) Distinguish between Lagrangian and Eulerian approach. 5
 b) What do you mean by steady- non-uniform flow with suitable example? 5
 c) The velocity vector in a fluid flow is given by $V = 2x^2\hat{i} - 5x^2y\hat{j} + 4t\hat{k}$. Find the velocity and acceleration of a fluid particle at (1,2,3) at time $t=1$ 10

5. a) Define stream line and path line. 6
b) Define velocity potential and stream function. 6
c) The stream function for a two dimensional flow is given by $\psi = 6xy$. Calculate 8
the velocity at the point $p(1,3)$. Find the velocity potential function ϕ
6. a) State and derive the Bernoulli's theorem with assumptions. 12
b) A horizontal venturimeter with inlet diameter 30 cm and throat diameter 15
cm is used to measure flow of oil of sp. gr. 0.8. The discharge of oil through 8
venturimeter is 50 litres per second. Find the reading of the oil-mercury
differential manometer. (assume $C_d=0.98$)
7. Write short notes on: (any **FOUR**) 4 X 5 20
a) Non-Newtonian fluids.
b) Pitot tube
c) Stability of submerged body
d) Rotational flow and irrotational Flow
e) Continuity equation