B.E. CIVIL ENGG. FIRST YEAR SECOND SEMESTER EXAM 2017
(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) What is viscosity? State and explain the Newton's Law of Viscosity. 8
   b) The space between two large flat and parallel walls 20 mm apart is filled with an oil of viscosity 1 poise. Within this space, a thin plate (area 300 mm X 300 mm) is towed at a velocity of 15 cm/s at a distance of 8 mm from one wall being parallel to the walls. Assuming linear variations of velocity between the plate and walls, calculate force and power required to overcome the viscous drag. 8
   c) What is non-Newtonian Fluid? 4

2. a) State and proof the 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. 0.8 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 do you mean by total pressure and centre of pressure on a submerged surface? 4
   b) Derive an expression for force exerted by static fluid on vertical plane surface and locate the centre of pressure. 8
   c) An isosceles triangular plate of base 3 meters and altitude 3 meters is immersed in fluid with specific gravity 0.8. 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) What is meta-centric height? 4

b) Describe how meta-centric height is determined experimentally. 8

c) Discuss about the stability of submerged and floating bodies 8

5. a) Explain steady and non-uniform flow with a suitable example? 4

b) Define stream line and streak line. 4

c) A fluid flow is given by : $V = xy^2 i - 2yz^2 j - \left(zy^2 - \frac{2z^3}{3} \right) k$. Prove that it is case of possible steady incompressible fluid flow. Calculate the velocity and acceleration at the point [1,2,3] 6

d) The velocity potential function for a two dimensional flow is given by $\phi = x(3y-1)$. Determine the velocity at the point (3,4) and also calculate the value of the stream function at the same point. 6

6. a) Derive the Bernoulli's theorem with adequate assumptions considering the motion of a fluid element along a streamline. 10

b) The water is flowing through a taper pipe of length 200 m having diameters 200 mm and 150 mm for upper and lower end respectively. Discharge through the pipe is 50liters/s. Calculate the velocity and pressure at the lower end if the pressure at the upper end level is 30 N/cm^2. Assume the slope of the pipe is 1 in 20. 10

7. Write short notes on: (any **FOUR**) 4 X 5 20

a) Rotational flow and irrotational Flow.

b) Stream function

c) Laminar flow and turbulent flow

d) Sluice Gate

e) Pitot Tube