B.E. CIVIL ENGINEERING EXAM 2019(Old)

(1st Year, 2nd Semester)

FLUID MECHANICS- I

Time: Three hours (*Answer any **FIVE** questions*) Marks: 100

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 do you mean by viscosity? Explain the causes of viscosity in fluid. 6
   b) Distinguish between Newtonian and non-Newtonian fluids with examples. 4
   c) The dynamic viscosity of an oil, used for lubrication between a shaft and sleeve is 5 poise. The shaft of 0.5m diameter rotates at 400 rpm. Calculate the 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 the Hydrostatic Law. 6
   b) Distinguish between the manometers and mechanical gauges. 4
   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. 10
3. a) Derive an expression for force exerted by static fluid on a vertical plane surface and locate the centre of pressure. 8
   b) 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
   c) you mean by meta-centre and meta-centric height? 4
4. a) What do you mean by steady and uniform flow? Explain with an example. 4
   b) Derive an expression for continuity equation for a three-dimensional fluid flow. 8
   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 a case of possible steady incompressible fluid flow. Calculate the velocity and acceleration at point P [1,2,1]. 8

5. a) Define streamline, pathline and streakline. 6

b) For the velocity components in a fluid flow given by $u = 2xy$ and $v = a^2 + x^2 - y^2$, show that the flow is possible. Obtain the relevant stream function. 7

c) An open circular cylinder 20cm in diameter and 100cm long contains water up to a height of 70cm. find the maximum speed at which the cylinder can be rotated about its vertical axis so that no water spills 7

6. a) Derive the Euler's equation of motion for the steady flow along a stream line. 7

b) State the limitation of Bernoulli's theorem. 3

c) In a smooth pipe of 250*mm* in diameter, a pressure of 50*kPa* was observed at Section 1, which was at elevation of 10*m*. At another Section 2 at an elevation of 12*m*, the pressure was 20*kPa* and velocity 1.25*m/s*. Determine the direction of water flow in the pipe and head loss between the sections. 10

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

a) Stability of floating body

b) Velocity potential function and stream function.

c) Laminar and turbulent flow

d) Free vortex flow

e) Venturimeter