BACHELOR OF CIVIL ENGINEERING EXAMINATION 2017
(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? 3

   b) Define compressibility of fluid. 3

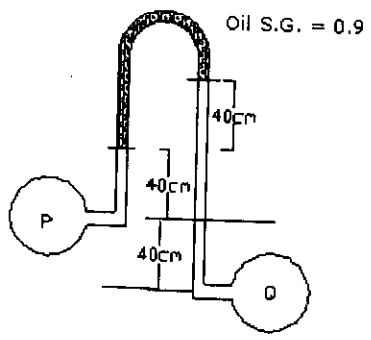
   c) Distinguish between dynamic and kinematic viscosity. Write their SI units. 4

   d) A disc shaped footstep bearing of radius 40 cm rotates at a speed of 1200 rpm. If the lubrication film thickness is 2 mm and its viscosity is 2 poise, find out power loss in the bearing. 10

2. a) State and prove the Hydrostatic law of pressure variation. 6

   b) Differentiate between the manometers and mechanical gauges. 4

   c) Water is flowing through two pipes P & Q to which a differential manometer having an oil of Sp.Gr. 0.9 is connected as shown in figure below. If the pressure head in the pipe P is 5 m of water, determine the pressure in the pipe Q. Manometer readings are in cm as shown below. 10



3. a) Derive an expression for hydrostatic thrust exerted by static fluid on a vertical plane submerged surface and locate the centre of pressure. 6

   b) A horizontal cylindrical barrier of 2.5m diameter retains water up to its top on one side. Calculate the horizontal and vertical forces due to water per meter width of this barrier. 6

   c) With the help of a neat sketch derive the expression of metacentric height for a floating body. 8

4. a) What do you mean by steady non-uniform flow? Explain with example. 4

b) Derive an expression for continuity equation for a three-dimensional fluid flow. 6

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 [1,2,3]. 10

5. a) Define stream function and velocity potential. 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) A closed tank containing water is partly filled with water and the air space above it is under pressure. A 5 cm hose connected to the tank discharges water to atmosphere on to the roof of a building 3 m above the level of water in the tank. If friction losses are 1.5 m of water, what pressure must be maintained in the tank to deliver 15 lps to the roof? 10

7. Write short notes on: 4 X 5 = 20

a) Non-Newtonian fluids

b) Pathline and Streakline

c) Characteristics of laminar and turbulent flow

d) Free vortex flow