

**KATIHAR ENGINEERING COLLEGE, KATIHAR**  
**CIVIL ENGINEERING, 2<sup>nd</sup> Year (Semester-IV)**

**Subject: Introduction to Fluid Mechanics**

**Instructor: Dr. Rashid Mustafa**

**Deadline: 27/10/2023**

**Assignment**

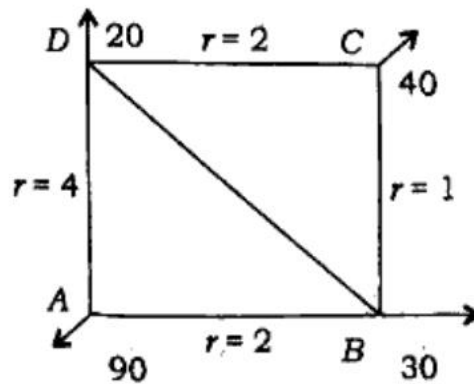
**Q.1** If for a 2-D flow the stream function is given by  $\psi = 2xy$ , Calculate the velocity at the point (3,5). Shows that the potential function  $\phi$  exists for this case and deduce it.

**Q.2** Water flows through a circular pipeline whose diameter varies from 25 cm to 15 cm in a length of 10 m. If the Darcy-Weisbach friction factor is assumed constant at 0.018 for the whole pipe, determine the head loss in friction when the pipe is flowing full with a discharge of 0.06 m<sup>3</sup>/s.

**Q.3** State the Newton's law of viscosity. Explain the effect of temperature on viscosity of water and that of air.

**Q.4** Discuss the relative merits and demerits of venturi meter with respect to orifice meter.

**Q.5** Calculate the discharge in each pipe of the network shown in the figure below. The pipe network consists of 5 pipes. The head loss  $h_f$  in pipe is given by  $h_f = rQ^2$ . The values of  $r$  for various pipes and also the inflow (90 m<sup>3</sup>/s at A) or outflows (20, 40 and 30 m<sup>3</sup>/s at D, C and B respectively) at nodes are shown in the figure:



**Q.6** Oil flows between two parallel plates, one of which is at rest and the other moves with a velocity  $U$ . If the pressure is decreasing in the direction of the flow at a rate of 0.10 lbf/ft<sup>3</sup>, the dynamic viscosity is 10<sup>-3</sup> lbf/ft<sup>2</sup>, the spacing of the plates is 2 inches and volumetric flow  $Q$  per unit width is 0.15 ft<sup>2</sup>/sec, what is the value of  $U$ ?

**Q.7** A plate, 0.025 mm distance from a fixed plate moves at 60 cm/s and requires a force 2 newton per unit area, to maintain this speed. Determine the fluid viscosity between the plates.

**Q.8** Water is flowing through a pipe of 5 cm diameter under a pressure of 29.43 (gauge) and with mean velocity of 2 m/s. Find the total head or total energy per unit weight of water at cross section, which is 5 cm above the datum line.

**Q.9** A fluid flow field is given by

$$V = x^2yi + y^2zj - (2xyz + yz^2)k$$

Prove that it is a possible steady incompressible fluid flow. Calculate the velocity and acceleration at the point (2,2,3).

**Q.10** Write short notes on the following:

- |                                |                               |
|--------------------------------|-------------------------------|
| (a) Pitot tube                 | (b) Circulation and Vorticity |
| (c) Hydraulic Grade Line (HGL) | (d) Flow net                  |
| (e) Navier-Stokes Equation     | (f) Stagnation point          |
| (g) Water hammer               | (h) Types of fluids           |
| (i) Venturimeter               | (j) Major losses in pipe      |
| (h) Syphon                     | (i) Capillary effect          |

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