

Please check that this question paper contains 09 questions and 02 printed pages within first ten minutes.

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Uni. Roll No. ....

Program: B.Tech (Civil Engineering)

Semester: 3<sup>rd</sup>

Name of Subject: Fluid Mechanics

Subject Code: PCCE-103

Paper ID: 16022

26-07-21(E)

**Time Allowed: 02 Hours**

**Max. Marks: 60**

**NOTE:**

- 1) Each question is of 10 marks.
- 2) Attempt any six questions out of nine
- 3) Any missing data may be assumed appropriately

**Q1.** What is a hydraulic jump and how it is used as an energy dissipater? Discuss about the type of jumps based on Froude Number. Also enlist the applications of hydraulic Jump?

**Q2.**

- a) A block of wood of specific gravity 0.7 floats in water. Determine the meta-centric height of block if its size is 2 m x 1 m x 0.8 m. Take unit weight of water as 9810 N/m<sup>3</sup>.
- b) A 30 cm diameter pipe, conveying water, branches into two pipes of diameters 20 cm and 15 cm respectively. If the average velocity in the 30 cm diameter pipe is 2.5 m/s, find the discharge in this pipe. Also determine the velocity in 15 cm pipe if the average velocity in 20 cm diameter pipe is 2 m/s.

**Q3.** Derive Euler's equation of motion along a stream line. Also derive Bernoulli's equation from Euler's equation of motion and list the assumptions made for deriving Bernoulli's equation.

**Q4.** An external cylinder mouthpiece of diameter 200 mm is discharging water under a constant head of 7.25 m. Determine the discharge and absolute pressure head of water at vena-contracta. Take  $C_d=0.855$  and  $C_c$  for vena-contracta =0.62. Atmospheric pressure head = 10.3 m of water. Density of water and air 9810 N/m<sup>3</sup> and 12.26 N/m<sup>3</sup> respectively.

**Q5.**

- a) Discuss about various types of head loss in pipes. Also give their expressions

- b) A smooth brass pipe line of 150 mm diameter and 1800 m long carries water at the rate of 14 litres/sec. Kinematic viscosity is 0.0195 stokes, calculate the loss of head, wall shearing stress, centre line velocity, shear stress and velocity at 50 mm from the centre line and the thickness of laminar sublayer.

**Q6.**

- a) Oil with a free stream velocity of 2 m/sec flows over a thin plates 2 m wide and 2 m long. Calculate the boundary layer thickness and the shear stress at the trailing end point and determine the total surface resistance of the plate. Take specific gravity as 0.86 and kinematic viscosity as  $10^{-5}$  m<sup>2</sup>/sec.
- b) Discuss about boundary layer separation and how it can be controlled.

**Q7.** A venturi-meter is installed in a pipeline 400 mm in diameter. The throat pipe diameter ratio is 1/3. Water flows through the installation. The pressure in the pipe line is 1.405 kg/cm<sup>2</sup> and the vacuum in the throat is 37.5 cm of mercury. If 4% of the differential head is lost between the gauges, find the flow in the pipeline.

**Q8.** Given that the unit discharge in a rectangular channel is 18m<sup>3</sup>/sec and that the head loss across a hydraulic jump that forms in this channel is 1.1 m. Estimate the pre-jump and post-jump depths.

**Q9.** Two discs are placed in a horizontal plane, one over the other. The water enters at the centre of the lower disc and flows radially outward from source of strength 0.628 m<sup>2</sup>/sec. The pressure at radius 50 mm, is 200 kN/m<sup>2</sup>, Find the pressure in kN/m<sup>2</sup> at a radius of 500 mm and stream functions at angles of 30° and 60° if  $\psi = 0$  at  $\theta = 0^\circ$ .

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