Dr Ray Civil Mech 7/12/2022 (103)

Roll No..... (M)

NATIONAL INSTITUTE OF TECHNOLOGY HAMIRPUR (H.P.)
DEPARTMENT OF CIVIL ENGINEERING
B.Tech, 3rd Semester, Civil Engineering
End Semester Theory Examination, Nov-Dec 2022

Course Name: Fluid Mechanics Course Code: CE-212
Duration: 3 Hours Max. Marks: 50

Instructions:
- Attempt all questions.
- Assume any other suitable data if required.

Q.1. The water is flowing through a tapering pipe having diameters 300 mm and 150 mm at sections 1 and 2 respectively. The discharge through the pipe is 40 litres/sec. The section 1 is 10 m above datum and section 2 is 6 m above datum. Find the intensity of pressure at section 2 if that at section 1 is 400 kN/m^2. [05]

Q.2. In a pipe of diameter 350 mm and length 75 m water is flowing at a velocity of 2·8 m/s. Find the head lost due to friction using : [05]

(i) Darcy-Weisbach formula;
(ii) Chezy's formula for which C = 55.

Assume kinematic viscosity of water as 0·012 stoke.

Q.3. Two pipes each 300 m long are available for connecting to a reservoir from which a flow of 0.085 m^3/s is required. If the diameters of the two pipes are 0.30 m and 0.15 m respectively, determine the ratio of the head lost when the pipes are connected in series to the head lost when they are connected in parallel. Neglect minor losses. [05]

Q.4. A lubricating oil of viscosity 1 poise and specific gravity 0.9 is pumped through a 30 mm diameter pipe. If the pressure drop per metre length of pipe is 20 kN/m^2, determine: [05]

(i) The mass flow rate in kg/min,
(ii) The shear stress at the pipe wall,
(iii) The Reynolds number of flow, and
(iv) The power required per 50 m length of the pipe to maintain the flow.

Q.5. The velocity distribution in the boundary layer is given by: $\frac{u}{U} = \frac{y}{\delta}$, where u is the velocity at a distance y from the plate and u = U at y = δ, δ being boundary layer thickness. Find : [05]

(i) The displacement thickness (δ^*),
(ii) The momentum thickness (θ),
(iii) The energy thickness (δ_e), and
(iv) The value of $\frac{\delta^*}{\theta}$

(104)

Roll No.....

Q.6. Find the form of the equation for discharge Q through a sharp-edged triangular notch assuming Q depends on the central angle (α) of the notch, head (H), gravitational acceleration (g) and on the density (ρ), viscosity (μ) and surface tension (σ) of the fluid. [05]

Q.7. An oil of specific gravity 0.92 and viscosity 0.03 poise is to be transported at the rate of 2500 litres/sec. through a 1.2 m diameter pipe. Tests were conducted on a 12 cm diameter pipe using water at 20°C. If the viscosity water at 20° C is 0.01 poise, find: [05]

(i) Velocity of flow in the model;
(ii) Rate of flow in the model.

Q.8. A concrete lined circular channel of diameter 3 m has a bed slope of 1 in 500. Work out the velocity and flow rate for the conditions of [05]

(i) Maximum velocity and
(ii) Maximum discharge.

Assume Chezy's C = 50.

Q.9. A 8 m wide channel conveys 15 m^3/s of water at a depth of 1.2 m. Calculate: [05]

(i) Specific energy of the flowing water;
(ii) Critical depth, critical velocity and minimum specific energy;
(iii) Froude number and state whether flow is subcritical or supercritical.

Q.10. Write short notes on: [05]

(i) Laminar and Turbulent flow
(ii) Open and Closed Channels
(iii) Kinematic and Dynamic similarity
(iv) Subcritical and supercritical flows
(v) Boundary layer separation and its control