



University Of Technology
Building and Construction Eng. Dept.
Final Exam – First attempt 2010/2011



Subject : Fluid Mechanics
Branch : All Divisions
Examiner : Fluid Mechanics committee

Class : second year
Time : 3 hours.
Date : 12 / 6 / 2011

Notes: - Attempt to answer Five questions, (question Five must be included for Water and Dams Eng. Branch).

- Each question has the same mark.

Q1: A) – For a laminar flow in pipe show that: - $Q = 0.24 \left(\frac{h_f D^4}{Lv} \right)$ where: - Q = discharge, L= length of the pipe, D= diameter, ν = Kinematic viscosity and h_f = major loss.

B) – For a critical flow in a rectangular channel show that: - $S_c = \frac{gn^2}{y_c^3}$ where:-
 S_c = critical bed slope, n=Manning's coefficient, y_c = critical depth.

Q2: - A) – Choose the correct answers: (Show any details required). {Answer five branches only.}

1 -The velocity distribution in a laminar flow through a pipe is given by

$V = (10/\mu)(0.01 - r^2)$. The pipe radius $R=0.1m$. The shear stress at the wall in N/m^2 is:-

- a) Zero. b) 2 . c) $\frac{2}{\mu}$. d) None of these.

2 - In a static fluid, with y as the vertical direction, the pressure variation is given by:-

- a) $\frac{dp}{dy} = \rho$. b) $\frac{dp}{dy} = -\rho$. c) $\frac{dp}{dy} = \gamma$. d) None of these.

3 - The weight density of a fluid is $20000N/m^3$. The pressure (above atmospheric) on a tank bottom containing the fluid to a height of 0.2m is :-

- a) $40000N/m^2$. b) $2000N/m^2$. c) $4000N/m^2$. d) None of these.

4 - For flow over a flat plate, the boundary layer thickness with distance from leading edge of the plate. :-

- a) Decrease. b) Increase . c) Constant . d) None of these.

5- The flow depth behind hydraulic jump. :-

- a) Decrease. b) Increase . c) Constant . d) None of these.

6- The dimension of Chezy constant using F.L.T dimensions is:-

- a) $F^0L^0T^{-1}$. b) $L^{0.5}T^{-1}$. c) $F^0L^{0.5}T^{-0.5}$. d) None of these.

B) - Two gates of negligible weight are used to hold back water in a channel of width (b) as shown in fig.(1). Determine the force (R) against the blocks for the two gates.

Q3:- A) - Water flows into a large tank at a rate of $0.011m^3/s$ as shown in fig. (2). The water leaves the tank through 20 holes at the bottom of the tank, each of which produces a stream of 10mm diameter. Determine the equilibrium height (h) for steady state operation.

B) – Answer one of the following:-

I) List the cases of occurrence of critical depth by sketching for each case?

II) Fluid is moving along the circular stream line with a constant velocity. So, how can you determine the acceleration?

Q4:- A) – What are the differences between the following:-

- 1) Fluid and liquid?
- 2) Cohesive and adhesive force?
- 3) Laminar boundary layer and laminar sub-layer.
- 4) Flow in open channel and flow in closed conduit pipe?

B) – Water flows through the pipe contraction shown in fig. (3). Determine the velocity as a function of the diameter of the small pipe(D). {Neglect all losses}

→ Q5:-

(Water and Dams Eng. Branch must be answered)

A) In fig. (4) the head of water over the crest of the spillway is 2.5m. Find the following:-

- 1) Sequent depths.
- 2) Energy loss due to hydraulic jump.
- 3) The approximation length of hydraulic jump.

B) Calculate the critical depth corresponding of $7.5\text{m}^3/\text{s}$ for the following cases:-

- 1) Rectangular channel of width 3m.
- 2) Triangular channel of side slope 1 vertical to 1.25 horizontal.
- 3) Trapezoidal channel of bottom width 2m and side slope 1 vertical to 1.25 horizontal.

Q6:- Answer *Two branches only*:-

A):- Two pipes A and B are connected in parallel as shown in fig.(5), and the properties of pipes are tabulate below. Due to a partially closed valve in the pipe A, the discharge in pipe A continued to increase 30% than in pipe B. Find the valve coefficient (K). (Neglect other minor loss.)

| Pipe No | Dia. (mm) | Length (m) | Pipe coefficient(f) |
|---------|-----------|------------|---------------------|
| A | 120 | 160 | 0.005 |
| B | 100 | 120 | 0.005 |

B):- 1) State the momentum equation. How will you apply momentum equation for determining the force exerted by flowing liquid on a pipe bend?

2) What is a siphon? On what principle it work?

3) For any machine, how can you distinguish if it is pump or turbine?

C) Three reservoirs A, B and C are connected by a pipe system as shown in fig. (6). Find the discharge into or from the reservoir B and C if the rate of flow from reservoir A is 300 L/s. Also, find the height of water level in the reservoir C. Take $f=0.02$ for all pipes.

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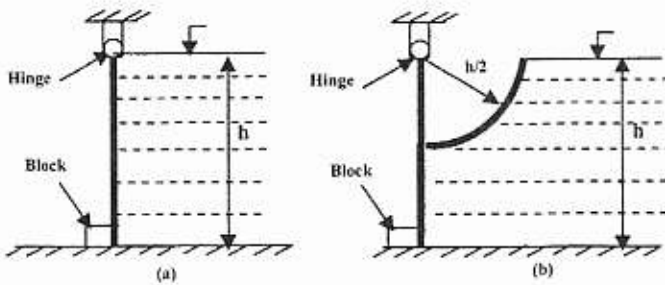


Figure (1).

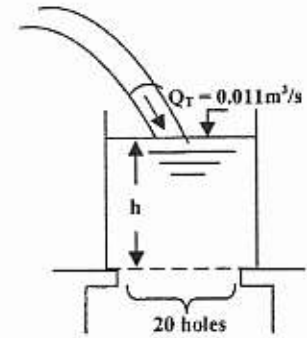


Figure (2).

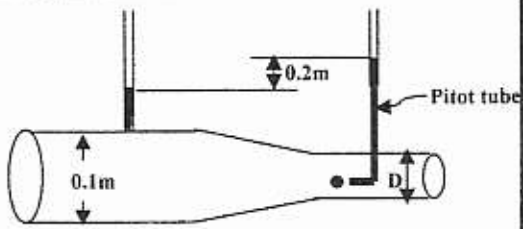


Figure (3).

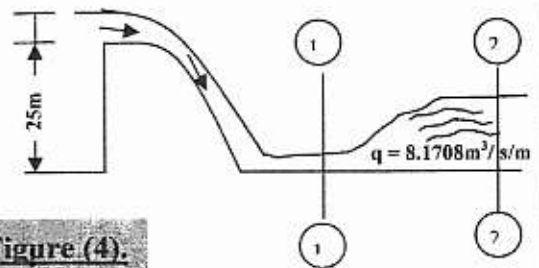


Figure (4).

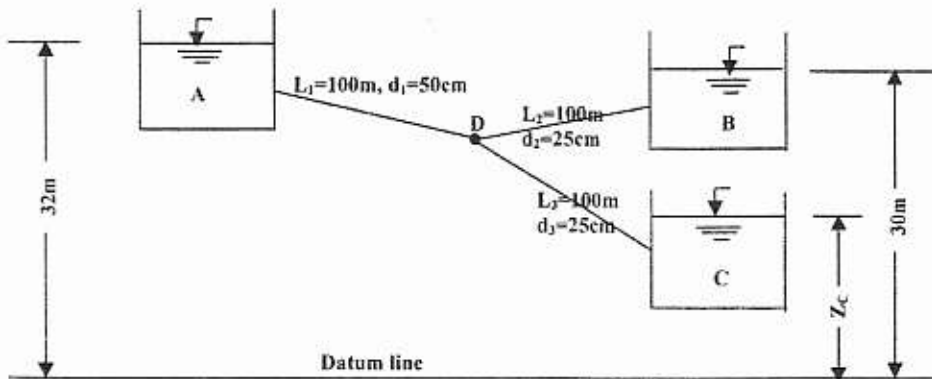


Figure (6).

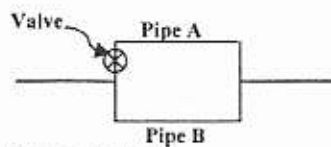


Figure (5).