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

Subject :Fluid Mechanics — Class : second year
Branch :All Divisions — Time: 3 hours.
Examiner :Fluid Mechanics committee — 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, $v = Kinamitic\ viscosity$ and h_f= major loss.

B) – For a critical flow in a rectangular channel show that: - $S_c = \frac{gn^2}{\frac{1}{y_c^3}}$ 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^0LT^{-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 $7.5 m^3/s$ for the following cases:-

1) Rectangular channel of width 3m.
2) Triangular channel of side slope 1vertical 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.

GOOD LUCK

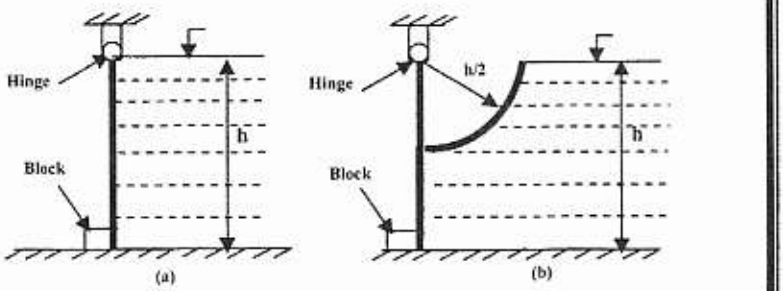

Figure (1).

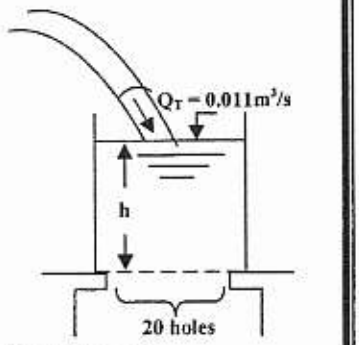

Figure (2).

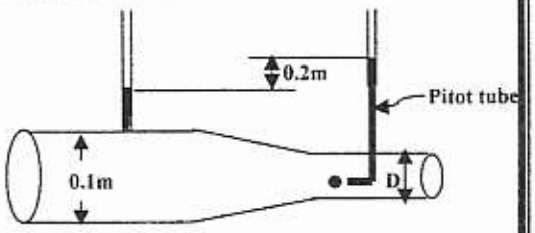

Figure (3).

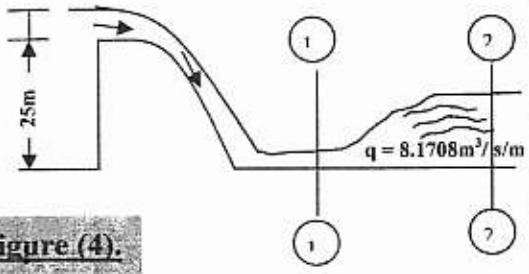

Figure (4).

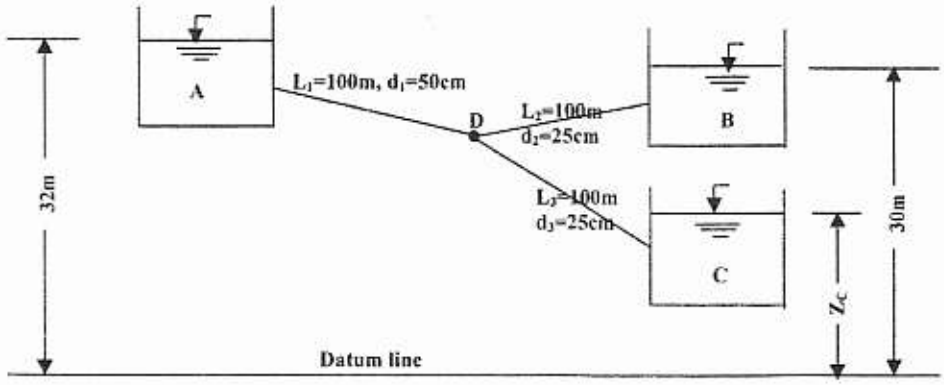

Figure (6).

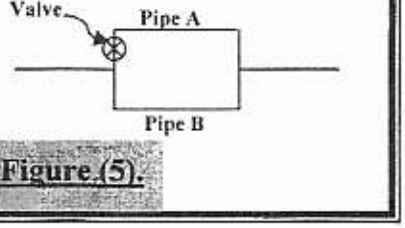

Figure (5).