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S.E. (Mining) Semester- IV (Revised Course 2007-08)
EXAMINATION NOV/DEC 2019
Fluid Mechanics & Machinery

[Time: Three Hours] **[Max. Marks: 100]**

Instructions:
1) Answer any 5 questions selecting at least one from each Module.
2) Make suitable assumptions if required and state them clearly.
3) Supplement your answers with neat sketches wherever required.
4) All symbols and abbreviations have their usual meaning.

MODULE I

Q.1

a) A stream function for a given flow field is given by $\Psi = 3x^2y - y^3$ **(05)**
Determine the velocities at points (1, 2) and (2, 3)

b) Explain terms dynamic viscosity and kinematic viscosity. **(06)**
Determine the kinematic viscosity of a fluid having density = 1.169 kg/m^3 and dynamic viscosity 1.80×10^{-4} poise.

c) A square plate 4m side has a circular hole, diameter 1m at the center. It is vertically immersed in water. The nearest parallel side of the square is 1m below the free surface of water. **(05)**
Determine: (I) Total force on The plate
(II) Position of center of pressure

d) Explain working principle of Hydraulic Press. **(04)**

Q.2

a) What are the conditions necessary for the stability of a floating body. **(10)**
A rectangular wooden block 2m long, 1m wide and 1m deep floats in water. Find the weight of the body and its metacentric height if depth of immersion is 0.75m. Take specific gravity of the wooden block = 0.6. State whether the body is stable or not?

b) Explain the terms velocity potential function and stream functions. Prove that the equipotential lines and streamlines are orthogonal to each other. **(05)**

c) Explain the following terms: **(05)**
i) Uniform and non uniform flows
ii) Steady and unsteady flows

MODULE - II

Q.3

a) A venturimeter is used for measuring discharge of a liquid (Sp. Gravity = 0.8) through a horizontal pipe line 30 cm diameter. The throat diameter of meter is 10 cm and C_d = 0.96. Determine the discharge if manometer reading is 30 cm of mercury. **(08)**

b) An external cylindrical mouth – piece of 15 cm diameter is fitted to a tank. The head over the mouth piece is 5m maintained constant. Find the discharge through the mouthpiece and pressure head at vena – contracta. **(06)**

c) What is the difference between weir and notch? How are the weirs classified. **(04)**

d) State any two limitations of Bernoulli's Equation. **(02)**

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Q.4

a) Water flows through a 50 cm diameter pipe under the head of 25 m with a velocity of 5 m/s. If the pipe is bend through 60°. Determine the magnitude and direction of resultant force on the bend. **(08)**

b) Write short note on the 3 Hydraulic coefficients for flow through an orifice. **(04)**

c) An open tank 8m long, 2.5m deep and 3.6m wide contains oil of specific gravity 0.85 to depth of 1.5m. If the tank is accelerated along its length on the horizontal track at a constant acceleration 3.2 m/s^2. Determine: **(08)**

1) The new position of the oil surface.
2) Pressures at the bottom of the tank at the front and rear edges.

MODULE - III

Q.5

a) What is an equivalent pipe? For a piping system with three pipes in series following data is available. **(06)**

Length : L1 = 1500m ; L2 = 750 m ; L3 = 500 m

Diameters : D1 = 900 mm ; D2 = 500 mm ; D3 = 250 mm

(i) Determine an equivalent pipe for 2550 m length.

(ii) Transform the piping system to an equivalent 500mm diameter pipe.

b) Two water tanks are connected by a pipe line of 20cm diameter and 300m long. The flow rate is 0.4 m^3/s. Find the difference in head between the two tanks. Take f = 0.008 for the pipe. **(08)**

c) What do you understand by TEL and HGL? Explain their importance in the piping design. **(06)**

Q.6

a) A syphon of 16cm diameter is connected between two reservoirs. The difference in heights of water in two reservoir is 20m. The summit of the syphon is 3m above the free surface of water in the supply reservoir. The total length of the syphon is 400m and length from supply reservoir upto summit is 100m. Find : (1) Flow rate through syphon (2) pressure at summit. **(10)**

Take f = 0.008 for syphon.

b) Explain water hammer effect in pipes **(06)**

c) A pipe of 300m long and 20cm diameter is carrying water. The loss of pressure head measured is 3.2m. Take f = 0.008. Find out the rate of flow through the pipe. **(04)**

MODULE – IV

Q.7

a) Write short note on Multistage Centrifugal pumps. **(08)**

b) Define specific speed of centrifugal pump. Write down the advantages of centrifugal pump over reciprocating pump. **(06)**

c) Define priming. Why it is necessary in centrifugal pump. What are the different methods of priming. **(06)**

Q.8

a) With the help of a neat sketch explain the working of single acting Reciprocating pump. **(08)**

b) What is an Air Vessel? Explain the advantages of fitting Air Vessel to reciprocating pumps. **(06)**

c) A reciprocating pump takes water from 3.5m and delivers to 50m when running at 50rpm. The diameter of bore is 18cm and stroke length of piston is 36cm. Determine the power required to drive the pump. **(06)**