R – 639

Seat No.	

Total No. of Pages : 4

S.E. (Civil) (Part - I) (Semester - III) Examination December - 2014

FLUID MECHANICS - I

Sub. Code : 42658

Day and Date : Friday, 12 - 12 - 2014 **Total Marks : 100**

Time : 10.00 a.m. to 01.00 p.m.

Instructions : 1) Question No. 1 and 5 is compulsory

2) Attempt any other two questions from each section.

3) Figures to the right indicate full marks.

4) Assume suitable data if essental.

SECTION - I

Q1) a) Define Ideal fluid & explain the following properties of real fluid. Give their SI units. **[5]**

i) Viscosity.

ii) Bulk modus of elasticity.

b) What do you mean by dimensional homogeneity? Define Reynold's no.& Froude no. State their significance in Fluid mechanics. **[5]**

c) Find total pressure acting on u/s vertical face of dam The total depth of water is 50 m out of which lower 10 m is silt of sp. gravity 1.2. Consider unit length of dam. Draw corresponding pressure diagram. **[5]**

d) If for a 2 dimensional potential flow, the velocity potential is given by $\phi = x(3y - 1)$, determine the velocity at the point P (1, 1). Determine also the value of stream function ψ at point P. **[5]**

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Q2) a) What is Surface tension property? State the significance of this property? Calculate the capillary rise or fall in a glass tube 2 mm. diameter, when immersed in. **[5]**

i) Water &.

ii) Mercury.

$\delta_{water} = 0.0725$ N/m, $\delta_{hg} = 0.25$ N/m. $S_{hg} = 13.6$, contact angle $\theta_{water} = 0°$, $\theta_{hg} = 130°$.

b) Explain stable equilibrium of a floating body. What portion of an ice - berg would be above the free surface in sea? Assume densities of ice & sea water as 920 kg/m^3 & 1030 kg/m^3 respectively. **[5]**

c) Define metacentric height. What is its significance? Explain the experimental method determining. metacentric height. **[5]**

Q3) a) Using Buckingham's π-theorem, show that the velocity through a circular orifice is given by $V = (2gH)^{1/2}\ \phi\ [D/H, \mu/\rho\ VH]$, where H is the head causing flow, D is the diameter of the orifice, μ is co-efficient of viscosity, ρ is the mass density and g is the acceleration due to gravity. **[7]**

b) The characteristics of the spillway are to be studied by means of a geometrically similar model constructed to the scale ratio of 1:10. **[8]**

i) If the maximum rate of flow in the prototype is 28.3 cumecs, what will be the corresponding flow in model?

ii) If the measured velocity in the model at a point on the spillway is 2.4m/s, what will be the corresponding velocity in prototype?

iii) If the hydraulic jump at the foot of the model is 50 mm high, what will be the height of jump in prototype?

iv) If the energy dissipated per second in the model is 3.5Nm, what energy is dissipated in the prototype?

Q4) a) Draw a typical flow net for flow through sudden enlargement in pipe. What are the criteria to draw flow net? Enumerate uses of flow net. **[7]**

b) Derive an expression for continuity equation in three dimensional flow. A 30 cm diameter pipe carries oil of specific gravity 0.85 at a velocity of 4 m/s. At another section the diameter is reduced to 20cm, find the velocity & mass rate of flow pipe at this section. **[8]**

SECTION - II

Q5) (Attempt any four)

a) Explain the principle of venturimeter with a neat sketch.

b) An orifice of 10 mm diameter is fixed 30cm above the bottom of tank. The depth of water in the tank is maintained at 130 cm. Calculate the discharge through the orifice and the distance at which the jet strikes the horizontal plate fixed to the bottom of tank. Assume cd = 0.65, cv = 0.95.

c) Determine the difference in elevation between water surfaces of two reservoirs which are connected by a horizontal pipe of diameter 45 cm and length 10 m. The discharge through the pipe is 500 lps. Consider all losses and assume f = 0.035.

d) Describe the Reynold's Expt and state the significance of Reynold's m number.

e) Explain the Nikurdse's experiment. **[4 × 5 = 20]**

Q6) a) A 20 × 10 cm ventrimeter is provided in a vertical pipeline carrying oil of specific gravity 0.8, the flow being upwards. The difference of elevation between the throat section and entrance section of the venturimeter is 50 cm. the differential U tube mercury manometer shows gauge deflection of 40 cm calculate **[8]**

i) The discharge of oil

ii) The pressure difference between the entrance section and the throat section . Take Cd = 0.98.

b) Write short note on : Pipes in series and in parallel. **[7]**

Q7) a) Derive an equation for the head loss due to laminar flow through two stationary parallel plates. **[8]**

b) A U tube mercury manometer is used to measure the rate of an oil of viscocity 0.4 poise in a 60 mm diameter horizontal pipe. If the ends of manometer are connected at 3 m distance, calculate what rate of flow will indicate a 100 mm difference in mercury level in the mercury - oil manometer? Take sp gravity of oil as 0.85. **[7]**

Q8) a) A pipe 200 mm in diameter and 2000 m long connects two reservoirs having water surface level difference of 30 m. The pipe crosses a ridge whose summit is 7.6 m above the upper reservoir. What must be the minimum depth below the summit of the ridge at which pipe be placed in order that the pressure at the apex of the siphon does not fall 8 m of water below atmosphere? Take length of the pipe from the upper reservoir to the summit of the ridge is 300 m and f = 0.02 What is the rate of flow to the lower reservoir in lps? **[7]**

b) Calculate the equivalent dia of the following compound pipe line. **[4]**

i) 10 cm dia, 200 m long.

ii) 15 cm dia, 300 m long. Assume f to be same for all pipes.

c) What are the different coefficients of orifice? Establish relationship between them. **[4]**

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