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Seat No.	

S.Y. B.Tech. (Mechanical) (Semester - III) (CBCS) Examination, January - 2023

FLUID MECHANICS

Sub. Code : 73207

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Day and Date : Thursday, 11-01-2024 **Total Marks : 70**

Time : 10.30 a.m. to 1.00 p.m.

Instructions :
1) **Question no. 3 and Question no. 4 are compulsory from Section - I.**
2) **Question no. 7 and Question no. 8 are compulsory from Section - II.**
3) **Attempt any one question between Question no. 1 and Question no. 2.**
4) **Attempt any one question between Question no. 5 and Question no. 6.**
5) **Figures to the right indicates full marks.**
6) **Draw neat sketches wherever necessary.**

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SECTION - I

Q1) a) Define following fluid properties: **[5]**
i) Viscosity
ii) Mass density
iii) Specific volume

b) Explain with neat sketch **[5]**
i) Buoyance and
ii) Meta centre.

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Q2) a) Derive general continuity equation in 3 dimensions in cartesian coordinate system for compressible and unsteady flow. **[6]**

b) Define velocity potential function and stream function with formulae. **[4]**

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Q3) a) State basic working principle of Venturimeter and derive the expression for rate of flow through Venturimeter. **[6]**

b) What are the different hydraulic coefficients of Orifice? Explain with formulae. **[4]**

P.T.O.

Q4) Solve any two numericals out of the following.

a) Ten liters of liquid of specific gravity 1.3 is mixed with 8 liters of liquid of specific gravity 0.8. If bulk of liquid shrinks by 1% on mixing, Calculate the specific gravity, the volume and the specific weight of mixture. **[7]**

b) Find the convective acceleration at the middle of the pipe which converge uniformly from 40 cm diameter to 20 cm diameter over a length of 2m. The rate of flow is 25 lit/s. **[7]**

c) A horizontal Venturimeter with inlet and throat diameters 0.3 m and 0.1m respectively is used to measure the flow of water. The pressure intensity at inlet is 130 KN/m^2 while the vaccum pressure head at the throat is 350 cm of mercury. Assuming that 3% of head is lost between the inlet and the throat, find **[8]**

(i) The value of Cd (coefficient of discharge)

(ii) Rate of flow.

SECTION - II

Q5) a) Derive an expression for force exerted by flowing fluid on a pipe bend. **[5]**

b) Derive an expression for the velocity distribution for viscous flow through parallel plate. Also sketch the velocity distribution across the section of parallel plates. **[5]**

Q6) a) Explain with neat sketch separation of boundary layer and effect of pressure gradient on boundary layer separation. **[5]**

b) Explain the following terms: **[5]**

i) Pressure drag and friction drag

ii) Streamlined body

iii) Bluff body

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Q7) a) What are the different minor energy (head) losses in pipes? Explain with formula. **[5]**

b) What do you mean by equivalent pipe? Obtain an expression for equivalent pipe (Dupuit's Equation) **[5]**

Q8) Solve any two numericals out of the following.

a) An oil of viscosity 1 poise and relative density 0.9 flows through a horizontal pipe of 25 mm diameter. If the pressure drop per meter length of pipe is 12 KPa. **[7]**

Determine

i) The rate of flow

ii) The shear stress at the pipe wall

iii) Reynold's number of the flow.

b) Experiments were conducted in wind tunnel with a wind speed of 50 Km/hr on a flat plate of size 2 m long and 1 m wide. The density of air is 1.15 Kg/m^3. The coefficients of lift and drag are 0.75 and 0.15 respectively. Determine **[7]**

i) The lift force

ii) The drag force

iii) The resultant force and

iv) Power exerted by air on the plate.

c) Two reservoirs are connected by a pipeline which is 150 mm in diameter for the first 6 meters and 250 mm in diameter for the remaining 15 meters length. The entrance and exit are sharp and the change of cross section is sudden. The water surface in upper reservoir is 6 meters above than that in the lower reservoir. Determin the losses of head which occur and calculate the rate of flow. Take f = 0.04 for both pipes. **[8]**

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