Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–III EXAMINATION – WINTER 2015

Subject Code:X31901 Date:18/12/2015

Subject Name: FLUID MECHANICS

Time: 10:30pm to 01:00pm Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Define the following terms: **07**

(I) Density (II) Weight density (III) Specific volume
(IV) Viscosity (V) Vapour pressure (VI) Surface tension
(VII) Bulk modulas of elasticity

(b) Derive Darcy-Weisbach equation for the co-efficient of friction in pipes. **07**

Q.2 **(a)** State and prove Pascal's law. Also mention its application. **07**

(b) A U-tube manometer contains the mercury as manometric fluid, and is used to measure vacuum pressure of fluid having specific gravity 0.7 in pipe. The other end of the manometer is exposed to atmosphere. The height of fluid in pipe of left limb 15 cm below the centre of pipe. Calculate the pressure in the pipe when the difference of mercury level in the two limbs is 40 cm. **07**

OR

(b) A U-tube differential manometer containing mercury is connected on one side to pipe A containing carbon tetrachloride (sp. Gravity=1.6) under a pressure of 120 kPa, and on another side to pipe B containing oil (sp. Gravity=0.8) under a pressure of 200 kPa. The pipe A lies 2.5 meter above pipe B and the mercury level in the limb connected with pipe A lies 4 m below the pipe A. determine the difference in levels of mercury in the two limbs of the manometer. Take specific weight of water=9.81 kN/m^2. **07**

Q.3 **(a)** Define following dimensionless numbers and state its significance **07**

(I) Reynold Number (II) Froude Number
(III) Mach Number (IV) Euler Number

(b) The efficiency of fan (η) depends upon diameter of rotor (D), discharge of fluid (Q), density of fluid (ρ), dynamic viscosity of fluid (μ) and angular velocity of rotor (ω). Find the expression of η in terms of dimensionless parameters using Buckingham's π- Theorem. **07**

OR

Q.3 **(a)** Air has velocity of 1000 Km/hr at pressure of 9.81 KN/m^2 vacuum and temperature of 47^0C. Compute its stagnation properties and the local Mach number. Take atmospheric pressure = 98.1 KN/m^2, R= 287J/Kg K and $\gamma = 1.4$ **07**

(b) Prove that the velocity of sound wave in compressible fluid is given by $C=\sqrt{K/\rho}$. **07**

Q.4 **(a)** Derive Euler's equation of motion along a streamline and hence obtain Bernoulli's equation clearly state the assumption made. **07**

(b) A venturimeter with 200 mm diameter at inlet and 100 mm throat is laid horizontally and is used to measure the flow of oil of specific gravity 0.8. The difference of levels in U-tube manometer is 180 mm of mercury whilst 11520 kg of oil is collected in 4 minutes. Calculate the discharge coefficient for the venturimeter. Take specific gravity of mercury as 13.6. **07**

OR

Q.4 **(a)** Define circulation. Prove that circulation $\Gamma = \int \xi \, dA$ with usual notations. **07**

(b) The velocity potential for a two dimensional potential flow is given by $\phi = x(4y-2)$. Calculate the velocity at the point P(2,3). Also calculate the value of stream function ψ at the point P. **07**

Q.5 **(a)** What is Hagen Poiseuille's formula? Derive an expression for Hagen Poiseuille's formula. **07**

(b) Oil of specific gravity 0.82 is pumped through 15 cm diameter and 3 km long horizontal pipe at a rate of 900 liters per minute. This pump has an efficiency of 68% and requires 7.35 kW to pump the oil. Determine the dynamic viscosity of oil and verify whether the flow is laminar. **07**

OR

Q.5 **(a)** Show that the distance between the meta-centre and centre of buoyancy is given by BM=I/∀. **07**

(b) Explain briefly : **07**

(I) Steady flow and unsteady flow

(II) Uniform flow and non uniform flow

(III) Laminar and turbulent flow

(IV) Compressible and incompressible flow.

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