Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III EXAMINATION – WINTER 2015

Subject Code:130101 **Date:23/12/2015**

Subject Name: Fluid Mechanics

Time: 2:30pm to 5:00pm **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**

(1) Mass density
(2) Specific volume
(3) Specific gravity
(4) Weight density
(5) Dynamic viscosity
(6) Kinematic viscosity
(7) Surface tension

(b) Two plates are placed at distance of 0.2 mm apart. Lower plate is fixed while upper plate having surface area one m^2 is pulled at 0.2 m/s. Find force and power required to maintain this speed. If the fluid separating them is having viscosity of 2.0 poise. **07**

Q.2 **(a)** State and explain Pascal's law . **07**

(b) What do you understand by single column manometer ? Deduce an expression for the pressure measurement. **07**

OR

(b) Differentiate between the following : **07**

(1) Absolute Pressure and Gauge Pressure
(2)U-tube differential manometer and inverted U tube differential manometer

Q.3 **(a)** Define total hydrostatic force and centre of pressure. Deduce an expression for both when the surface is vertically immersed. **07**

(b) A rectangular plane surface is 2 m wide and 3 m deep. It lies in vertical plane in water. Determine the total pressure and position of centre of pressure on the plane surface when its upper edge is horizontal and **07**

(1) Coincides with water surface
(2) 3.0 m below the free water surface.

OR

Q.3 **(a)** A rectangular pontoon is 5 m long, 3 m wide and 1.3 m high. The depth of immersion of the pontoon is 0.80 m in sea water. If the centre of gravity is 0.6 m above the bottom of the pontoon, determine the meta centric height. The density for sea water = 1025 kg/m^3 **07**

(b) Deduce an expression for the meta centric height of a floating body experimentally with usual notation **07**

Q.4	**(a)**	Differentiate between the following : (1) Laminar flow and Turbulent flow (2) Compressible flow and Incompressible flow	**07**
	(b)	Give an expression for the continuity equation for unsteady, three dimensional and compressible flow in cartesian co ordinate. Hence deduce it for steady and incompressible fluid in three dimensional flow. A 40 cm diameter pipe carries oil of specific gravity 0.8 at a velocity of 2m/s. At another section the diameter is 20 cm. Find velocity at this section and mass flow rate of oil.	**07**

OR

Q.4	**(a)**	Explain the working of Venturimeter with neat sketch. A horizontal Venturimeter 40 cm x 20 cm is used to measure the water flow through a pipe. The head causing the flow is measured as 16 cm of Hg by mercury U tube manometer. Find the flow rate in liters/min. Take C_d=0.96	**07**
	(b)	Derive an expression for the discharge of water over the V notch with usual notation.	**07**

OR

Q.5	**(a)**	Derive an expression for the Hagen Poiseuille's Formula with usual notation.	**07**
	(b)	A crude oil of viscosity 0.95 poise and relative density 0.9 is flowing through a horizontal circular pipe of diameter 100 mm and a length of 5 meter long. Calculate the difference of pressure at the two ends of the pipe, if flow rate is 0.004 m^3/s	**07**

OR

Q.5	**(a)**	Enlist the various methods of dimensional analysis. Explain Buckingham's π theorem for dimensional analysis with illustration.	**07**
	(b)	State the Bernoulli's theorem for a compressible flow. Derive an expression for Bernoulli's equation when the process is : (1) Isothermal process (2) Adiabatic process	**07**

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