Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– IV(NEW) EXAMINATION – SUMMER 2015

Subject Code:2141906 **Date:**08/**06/2015**

Subject Name: Fluid Mechanics

Time: 10:30am-1.00pm **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)** Explain the following terms: **07**

1. Relative density
2. Kinematic viscosity
3. Cavitation
4. Vapour pressure
5. Continuum
6. Compressibility
7. Capillary effect

(b) Calculate the shear stress developed in oil of viscosity 1.2 poise, used for lubricating the clearance between a shaft of diameter 12 cm and its journal bearing. The shaft rotates at 180 rpm and clearance is 1.4 mm. **07**

Q.2 **(a)** State and prove pascal's law with usual notations. **07**
Find the depth of point below sea water surface where the pressure intensity is 404.8 kN/m^2. The specific gravity of sea water is 1.03.

(b) Derive the Hagen – Poiseuille equation for laminar flow in the circular pipe. **07**

OR

(b) Derive the expressions for discharge over (i) Rectangular notch and (ii) Triangular notch. **07**

Q.3 **(a)** Derive expressions for total pressure and centre of pressure for vertically immersed surface. **07**

(b) A pipe AB branches into two pipes BC and BD. The pipe has diameter of 30 cm at A, 20 cm at B, 15 cm at C and 10 cm at D. Determine the discharge at A if flow velocity at A is 2.5 m/s. Also find the velocity at B and D, if the velocity at C is 4.2 m/s. **07**

OR

Q.3 **(a)** Explain clearly: stream line; path line and streak line. **07**

(b) Show that the distance between the meta-centre and centre of buoyancy is given by $BM = \frac{I}{\forall}$ **07**

Q.4 **(a)** Explain the conditions of stability for a submerged and floating body with neat diagrams. **07**

(b) A rectangular pontoon 8 m long, 6 m wide and 2 m deep, floats in sea water (sp. weight = 10000 N/m^3). It carries an empty boiler on its upper dock of 4 m diameter. The weight of pontoon and boiler are 600 kN and 200 kN respectively. The center of gravity of each unit coincides with geometric centre of the arrangement and lie on same vertical line. Find the metacentric height of arrangement and check the stability. **07**

OR

Q.4 **(a)** Distinguish clearly between: **07**

1. Rotational and Irrotational flow
2. Laminar and Turbulent flow

(b) A 300 mm X 150 mm venturimeter is placed vertically with throat 250 mm above the inlet section conveys kerosene of density 820 kg/m^3. The flow rate is 140 litre/sec. calculate the pressure difference between inlet and throat section. Take C_d = 0.97. **07**

Q.5 **(a)** Derive an expression for the loss of head due to friction in pipes. **07**

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

OR

Q.5 **(a)** What are repeating variables? How are they selected for dimensional analysis? **05**

(b) The frictional torque T of a disc of diameter D rotating at a speed N in a fluid of viscosity μ and density ρin a turbulent flow is given by, **09**

$$T = D^5 N^2 \rho \, \varphi \left[\frac{\mu}{D^2 N \rho}\right]$$

Prove this by Buckingham's π method.

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