Seat No.: ________ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) EXAMINATION – WINTER 2018

Subject Code:2154002 **Date:20/11/2018**

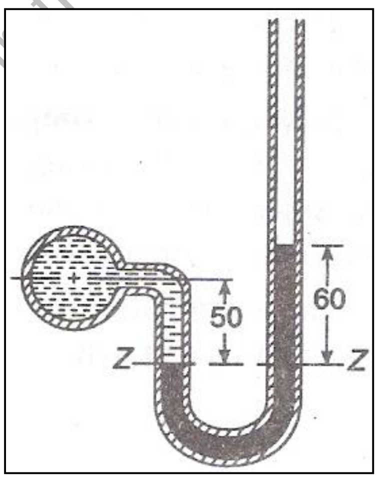
Subject Name:Fluid Mechanics and Hydraulics

Time: 10:30 AM TO 01:00 PM **Total Marks: 70**

Instructions:

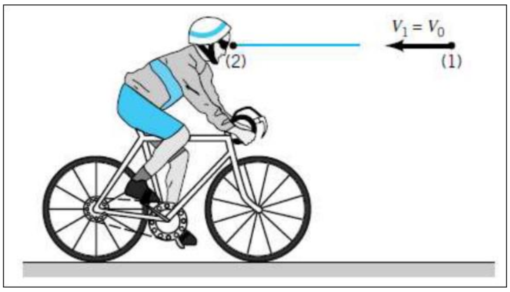
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	What is a syphon? On what principle it works? (explain with neat sketch)	**07**
	(b)	Find an expression for loss of energy head for a hydraulic jump in open channel flow.	**07**
Q.2	**(a)**	State Newton's Law of viscosity. Classify the types of fluid and their properties based on the Newton's Law of viscosity.	**07**
	(b)	What is specific energy curve for open channel flow? Draw specific energy curve, and then derive expressions for critical depth and critical velocity.	**07**
		OR	
	(b)	Due to turbulent flow, pressure difference (Δp) in a pipe of diameter (D) and length (l) depends on the velocity (V), viscosity (μ), density (ρ) roughness (k). Obtain an expression for Δp using Buckingham's π Theoram.	**07**
Q.3	**(a)**	Prove that the center of pressure of a completely sub-merged plane surface is always below the center of gravity of the sub-merged surface or at most coincide with the center of gravity when the plane surface is horizontal.	**07**
	(b)	The stream function for a two-dimensional flow is given by $\psi = 4xy$, Calculate the velocity at the point P (4, 9). Determine the velocity potential function.	**07**
		OR	
Q.3	**(a)**	A U-tube manometer containing mercury is used to measure the pressure of water flowing in a pipeline. The mercury level in the open tube is 60 mm higher than that on the left tube. If the height of water in the left tube is 50 mm, determine the pressure in the pipe in terms of head of water.	**07**



	(b)	Derive an expression for the difference of pressure between two points in a free vortex flow. Does the difference of pressure satisfy Bernoulli's equation? Can Bernoulli's equation be applied to a forced vortex flow?	**07**
Q.4	**(a)**	How are the weirs and notches classified? Derive the expression for the discharge through a trapezoidal notch or weir.	**07**

(b) Consider the flow of air around a bicyclist moving through still air with velocity as is shown in Fig. Determine the difference in the pressure between points 1 and 2. **07**



OR

Q.4 **(a)** Explain the principle of venturimeter with a neat sketch and derive the expression for the rate of flow of fluid through venturimeter. **07**

(b) Describe the construction, operation and use of pitot tube using neat sketch. **07**

Q.5 **(a)** The following data is given for a Francis Turbine. Net head = 60 m; Speed = 700 rpm; shaft power = 294.3 kW; η_0 = 84%; η_h = 93%; flow ratio = 0.20; breadth ratio n = 0.1; Outer diameter of the runner = 2 × inner diameter of runner. The thickness of vanes occupy 5 % of circumferential area of the runner, velocity of flow is constant at inlet and outlet and discharge is radial at outlet. Determine (i) Guide blade angle (ii) Runner vane angles at inlet and outlet (iii) Diameters of runner at inlet and outlet, and (iv) Width of wheel at inlet. **07**

(b) Derive equation for head loss due to friction (Darcy-Weisbach Equation) in flow through pipes. **07**

OR

Q.5 **(a)** Define cavitation. What are the effects of cavitation? Give the necessary precautions against cavitation. **07**

(b) The difference in water surface levels in two tanks, which are connected by three pipes in series of lengths 300 m, 170 m and 210 m and of diameters 300 mm, 200 mm, and 400 mm respectively, is 12 m. Determine the rate of flow of water if co-efficient of friction are 0.005, 0.0052 and 0.0048 respectively, considering (i) Minor losses and (ii) Neglecting minor losses. **07**

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