GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER– III (New) EXAMINATION – WINTER 2019

Subject Code: 3134005   **Date: 3/12/2019**

Subject Name: Fluid Mechanics and Hydraulics

Time: 02:30 PM TO 05:00 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)**	Why co-efficient of discharge of an orifice-meter is much smaller than that of venturimeter?	**03**
	(b)	Draw a neat sketch of the Reynolds apparatus and explain, how the laminar flow can be demonstrated with the help of the apparatus.	**04**
	(c)	In a two-dimensional and incompressible flow, the fluid velocity components are expressed as: u = 3x + 4y and v = 2x − 3y. Show that the flow satisfies the continuity equation and obtain the expression for the stream function and velocity potential function.	**07**
Q.2	**(a)**	What is fluid? How are fluids classified?	**03**
	(b)	Explain the phenomenon of capillarity. Obtain an expression for capillary rise of a liquid.	**04**
	(c)	Distinguish between notches and weirs. Derive an expression for the discharge over a triangular notch in terms of head of water over the crest of the notch.	**07**

OR

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	(c)	Explain the principle of venturimeter with a neat sketch and derive the expression for the rate of fluid flow through it.	**07**
Q.3	**(a)**	Differentiate laminar and turbulent flow. Sketch the distribution of velocity across a section of the pipe for laminar flow and turbulent flow.	**03**
	(b)	A venturimeter is installed in a pipeline carrying water and is 30 cm in diameter. The throat diameter is 12.5 cm. The pressure in pipeline is 140 kPa and the vacuum in the throat is 37.5 cm of mercury. Four percent of the differential head is lost between the gauges. Find the flow rate in the pipeline in liter/sec assuming the venturimeter to be horizontal.	**04**
	(c)	Derive an expression for the loss of head due to: (i) Sudden enlargement and (ii) Sudden contraction.	**07**

OR

Q.3	**(a)**	What is pitot-tube? Explain the procedure for measuring the velocity at any point using pitot-tube.	**03**
	(b)	A nozzle is situated at a distance of 1.2 m above the ground level and is inclined at an angle of 60° to the horizontal. The diameter of the nozzle is 40 mm and the jet of water from the nozzle strikes the ground at a horizontal distance of 5 m. Find the flow rate of water.	**04**
	(c)	The pressure difference in a pipe due to turbulent flow depends on the diameter, length, velocity, viscosity, density and roughness. Using Buckingham's π-Theoram, obtain an expression for pressure difference.	**07**
Q.4	**(a)**	Define convective acceleration, local acceleration and total acceleration.	**03**
	(b)	Differentiate equipotential line and stream line. Prove that the stream lines and equipotential lines are orthogonal to each other.	**04**

(c) Determine and locate the total pressure and center of pressure on a submerged vertical surface. **07**

<center>**OR**</center>

Q.4 **(a)** State and prove the Hydrostatic law. **03**

(b) A U-tube differential manometer connects two pressure pipes A and B. The pipe A contains carbon tetrachloride having a specific gravity 1.6 under a pressure of 120 kPa. The pipe B contains oil of specific gravity 0.8 under a pressure of 200 kPa. The pipe A lies 2.5m above pipe B. Find the difference of pressure head measured by mercury as a manometric fluid. **04**
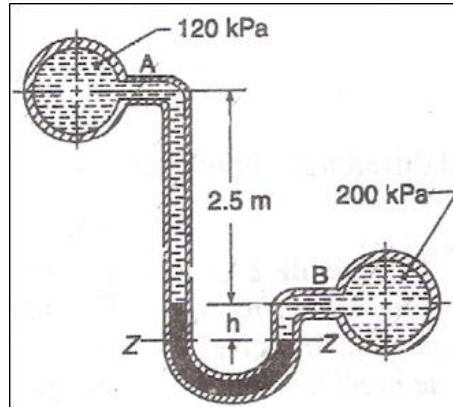
(c) Derive an expression for the difference of pressure between two points in a free vortex flow. Does the difference of pressure satisfy Bernoulli's equation? Can Bernoulli's equation be applied to a forced vortex flow? **07**

Q.5 **(a)** Explain followings:
(i) Water hammer; (ii) Hydraulic gradient lines; and (iii) Total energy line. **03**

(b) Explain hydraulic jump. Derive an expression for head loss for a hydraulic jump. **04**

(c) With neat sketch, explain the principle and working of a centrifugal pump. **07**

<center>**OR**</center>

Q.5 **(a)** Draw the neat sketches of Pelton and Francis turbines. **03**

(b) What is syphon? On what principle it works? **04**

(c) What is specific energy curve? Draw specific energy curve and then derive expressions for critical depth and critical velocity. **07**

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