Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER – VI EXAMINATION – WINTER 2015

Subject Code:163503 **Date:08 /12/ 2015**

Subject Name: Fluid Flow & Heat Transfer

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)**	i)	Explain Newtonian and Non-Newtonian fluids with their corresponding stress strain curves and examples?	**04**
		ii)	A point lies 7.5m below free surface of water. Determine the pressure of point in kPa and mm of Hg.	**03**
	(b)	i)	Differentiate Critical and Economic thickness of Insulation	**03**
		ii)	Calculate the rate of heat loss Q, through a redbrick wall [k = 0.70 W/m.K] 5m length and 4m height and 250 mm in thickness, if the wall surfaces are maintained at 373 K and 303 K respectively.	**04**
Q.2	**(a)**		Discuss the case of boundary layer formation for flow of fluid in a pipe involving the concept of transition length,	**07**
	(b)		A body weighs 5N in water and 6.5 N in oil of specific gravity 0.80. Find the volume and weight of the body. Find the density and specific gravity of the body.	**07**
			OR	
	(b)		Define skin friction and form friction. Discuss the various cases of form friction losses in case of steady state flow of incompressible fluid through a pipe.	**07**
Q .3	**(a)**		Describe hydraulic coefficients of orificemeter mentioning the relationship between them	**07**
	(b)		A venturimeter having an inlet diameter of 200mm and throat diameter 120mm is installed in a pipe line carrying water. If the differential manometers installed shows a reading of 200 mm. Find the discharge through the pipe in liters/sec. Take coefficient of discharge for venturimeter as 0.98. The manometric fluid is mercury.	**07**
			OR	
Q.3	**(a)**		An orificemeter consisting of 100mm diameter orifice in a 250mm diameter pipe that delivers oil of specific gravity of 0.8. The pressure difference on the two sides of orifice plate is measured by differential manometer containing mercury which shows a deflection of 800mm of Hg. Find the flow rate of oil in liters/sec. [C_d = 0.65]	**07**
	(b)		With the help of a diagram explain the construction working principle of pitot tube? Derive the equation of discharge through a pitot tube.	**07**
Q.4	**(a)**		Write about i) Drag coefficient ii) Wall drag iii) Terminal Settling Velocity iv) Cavitation v) Priming vi) Equivalent diameter vii) Kinetic Energy Correction factor	**07**
	(b)		Starting from the definition of Kinetic Energy Correction factor prove that $\alpha = 2$ for laminar flow	**07**
			OR	

Q.4	**(a)**	Explain the concept of "Fluidization" with various types involved and its application in industry.	**07**
	(b)	For a trapezoidal notch prove that the net flow is equal to the sum of flow through a rectangular notch and triangular notch.	**07**
Q.5	**(a)**	i) Write a short note on Steady state and Unsteady state heat conduction.	**03**
		ii) Explain the various kind of boundary conditions used for heat transfer studies involving conduction.	**04**
	(b)	Hot oil at a rate of 1.2 kg/s [C_p = 2083 J/kgK] flows through a double pipe heat exchanger. It enters at 360 °C leaving at 300 °C, while cold fluid enters at 30 °C leaving at 127 °C. If Overall heat transfer coefficient is 500 W/m^2 K. Calculate heat transfer areas for parallel flow and counter flow configurations.	**07**

OR

Q.5	**(a)**	Describe the phenomenon of Leidenfrost Mechanism and boiling crisis associated with pool boiling of liquid.	**07**
	(b)	A solution containing 10% of solids is to be concentrated to a level of 50% of solids. Steam is available at pressure of 0.20 MPa [saturation temperature of 393 K]. Feed rate to evaporator is 30000 kg/h. The evaporator is working at reduced pressure such that boiling point is 323 K. If the overall heat transfer coefficient is 2.9 kW/(m^2 K). Estimate the steam economy and heat transfer surface area if the feed is introduced at 293 K. The specific heat of the feed is 3.98 x 10^3 J kg^{-1}K^{-1} Latent heat of vaporization of water at 323 K is 2383 kJ/kg. Latent heat of condensation of steam at 0.20 MPa is 2202 kJ/kg.	**07**

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