Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VI- EXAMINATION – SUMMER 2016

Subject Code:163503 **Date:09/05/2016**

Subject Name:Fluid Flow & Heat Transfer

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)**	i) Explain any five properties of fluids with relevant units?	**05**
		ii) Define Buoyancy. What is Archimedes' principle?	**02**
	(b)	Explain the basic modes of heat transfer with their governing equations	**07**
Q.2	**(a)**	Discuss the boundary layer separation with the formation of boundary layer when a fluid flows over a flat plate.	**07**
	(b)	Air at 20°C and 1 atm gauge pressure enters a finned tube steam heater through a 50mm tube at an average velocity of 1500mm/sec. it leaves the heater through a 0.065m tube at 90°C and 1.6 atm absolute. What is the average air velocity at outlet?	**07**
		OR	
	(b)	Explain the various type of flow situations.	**07**
Q .3	**(a)**	With a short note on centrifugal pump.	**07**
	(b)	What is the difference between notches and weirs? Derive the equation of discharge of liquid over a triangular notch?	**07**
		OR	
Q.3	**(a)**	The maximum flow through a rectangular channel 1.5 m deep and 2 meter wide is 1.5 m^3/sec. It is proposed to install a full width sharp edged rectangular weir across the channel to measure the flow. Find the maximum height at which the crest of the weir must be placed in order that water may not overflow through the sides of the channel. Take $C_d = 0.62$.	**07**
	(b)	What is the purpose of agitation? What are the types of impellers?	**07**
Q.4	**(a)**	Derive Hagen Poiseuilli's equation for the laminar flow of an incompressible fluid through a pipe.	**07**
	(b)	Derive Bernoulli's equation stating various assumptions used in its derivation.	**07**
		OR	
Q.4	**(a)**	Derive Ergun's equation for the flow of fluid through a packed bed.	**07**
	(b)	Derive the equation representing shear stress distribution for laminar flow through pipe of radius 'r'.	**07**
Q.5	**(a)**	Consider a slab of thickness 'l', the boundary surfaces at x= 0 and x = L are maintained at constant but different temperatures. There is no energy generated within the solid and the thermal conductivity is constant. Develop an expression for one dimensional steady state temperature distribution T(x) and expression for heat flow through the slab	**07**
	(b)	Derive the critical thickness of Insulation for the case of cylinder of radius 'r'.	**07**
		OR	

Q.5 **(a)** i) Explain the classification of heat exchangers with respect to the flow arrangement mentioning the temperature profile for each configuration **04**

ii) Why correction factors are included in the design equation for multi pass heat exchangers? **03**

(b) A solution of 10% of solids is to be concentrated to a level of 50% solids. Steam is available at a pressure of 0.20 MPa [Saturation temperature of 393 K]. Feed rate to the evaporator is 30000 kg/hr. The evaporator is operating at a reduced pressure such that boiling point is 323K. The overall heat transfer co-efficient is 2.9 kW/m^2 K. Estimate the steam economy and heat transfer surface area required if the feed is introduced at 293 K. **07**

Data: Specific heat of the feed = 3.98 kJ/kgK

Latent heat of Condensation of steam at 0.20 MPa = 2202 kJ/kg

Latent heat of vaporization of water at 323 K = 2283 kJ/kg.