GUJARAT TECHNOLOGICAL UNIVERSITY BE - SEMESTER–IV (New) EXAMINATION – WINTER 2015

Subject Code:2141406 Date:01/ Subject Name: Food Engineering Transport Phenomenon)1/2016	
Time: 2:30pm to 5:00pm Total Mai			70	
Inst	1. 2. 3.	ns: Attempt all questions. Make suitable assumptions wherever necessary. Figures to the right indicate full marks.		
Q.1	(a)	Derive an expression for velocity distribution for viscous flow through a circular pipe. Also sketch the velocity distribution and shear stress distribution	07	
	(b)	State and prove the Pascal's law.	07	
Q.2	(a)	 Give the unit and dimensions of following quantities. i. Force ii. Kinematic viscosity iii. Discharge iv. Density v. Angular velocity vi. Work 	07	
	(b)	vii. Specific weight The efficiency ' η ' of fan depends on the density ' ρ '; the dynamic viscosity ' μ ' of the fluid; the angular velocity ω ; diameter D of the rotor and discharge Q. Express η in terms of dimensionless parameters.	07	
	(b)	Derive equation of continuity for Cartesian co-ordinates.	07	
Q.3	(a)	What are the dimensionless numbers? Explain Reynolds's number and Froude's number in details.	07	
	(b)	What do you mean by mass transfer or diffusion? Explain the Fick's law of diffusion for a binary mixture.	07	
Q.3	(a)	Write a short note on followings: (1) Orifice meter (2) Notches	07	
	(b)	Define the term metacenter and metacentric height. Draw the figures of different conditions for submerged body.	07	
Q.4	(a)	 Calculate; i. The pressure gradient along the flow, ii. The average velocity, iii. The discharge for an oil of viscosity 0.03 Ns/m² flowing between two parallel stationary plates and they are 10 mm a part. Width of plates is 2 mm. the velocity midway between the plates is 2 m/s. 	07	

- (b) Define the term momentum thickness and derive an expression for the same. 07OR
- **Q.4** (a) State the Newton's law of viscosity and give examples of its application.
 - (b) The velocity distribution for flow over a flat plate is given by $u = (3/4 y y^2)$ 07 in which u is the velocity in meter per second at a distance y meter above the plate. Determine the shear stress at y = 0.15 m. Take dynamic viscosity of fluid as 8.6 poise.
- Q.5 (a) If the velocity profile within the boundary layer is linear i.e. $u/U = y/\delta$. Find 07 displacement thickness, momentum thickness and energy thickness.
 - (b) Define model and prototype. What do you understand by similitude? Explain 07 the different types of similitude.

OR

- Q.5 (a) Derive the derivation of Bernoulli's equation and give the assumption made in 07 Bernoulli's equation.
 - (b) Calculate the dynamic viscosity of oil, which is used for lubrication between a square plate of size $0.8 \text{ m} \times 0.8 \text{ m}$ and an inclined plane with angle of inclination 30°. The weight of the square plate is 300N and it slides down the inclined plane with a uniform velocity of 0.3 m/s. the thickness of oil film is 1.5 mm.

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