Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III • EXAMINATION – SUMMER • 2014

Subject Code: 131403 **Date: 26-05-2014**

Subject Name: Food Engineering Transport Phenomenon

Time: 02.30 pm - 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)** Discuss Fick's law of diffusion along with mass transfer Mechanism. **07**

(b) Write a short note on dimensional analysis and discuss in brief about dimensionless ratios. **07**

Q.2 **(a)** Describe differential manometers in detail. **07**

(b) What are the assumptions made while deriving continuity equation? Derive continuity equation in three dimensions for Cartesian co-ordinates. **07**

OR

(b) State and derive Pascal's law. **07**

Q.3 **(a)** 1.At what depth below the surface of oil, relative density 0.8, will produce a pressure of 120 kN/m2? What depth of water is this equivalent to? **03**

2. A simple U-tube manometer containing mercury, it is connected to the pipe in which a fluid of specific gravity 0.8 and having vacuum pressure is flowing. The other end of the manometer is open to atmosphere. Find the vacuum pressure in pipe if the difference of mercury level in the two limbs is 40 cm and the height of the fluid in the left limb from the center of pipe is 15 cm below. **04**

(b) After discarding any integral constants determine the value of the unknown velocities of w and v that satisfies the equation of three dimensional incompressible continuity for: **07**

(a) $u = x^2yz, \quad v = -y^2x;$ (b) $u = x^2 + 3z^2x, \quad w = -z^3 + y^2$

OR

Q.3 **(a)** Prove that Re= (ρvd/μ) is dimensionally homogeneous equation. Where ρ = density, v= velocity, d= diameter, μ= viscosity and Re= Reynold's number. **07**

(b) Write a short note on stream function . Velocity potential function is given by an expression **07**

$Ø = -(xy^3/3) - x^2 + (x^3y/3) + y^2$

(i) Find the velocity components in x and y directions

(ii) Show that Ø represents a possible case of flow

Q.4 **(a)** Discuss in brief about metacentric height and center of buoyancy. **07**

(b) Describe in brief about any two of the followings **07**

1. Fluid properties
2. Newton's law of motion
3. Types of weirs

OR

Q.4 **(a)** Discuss in brief about venturi meter and capillarity. **07**

(b) What is a submerged body? State and explain the conditions of equilibrium for the same. **07**

Q.5 **(a)** Draw velocity distribution curve for flow of viscous fluid through a circular pipe and also derive an equation for the same. **07**

(b) Write a short note on boundary layer concept. **07**

OR

Q.5 **(a)** Define the followings **07**

1. Volume density
2. Rate of discharge
3. Vena contracta
4. Orifice
5. Kinematic viscosity
6. Laminar flow
7. Reynold's number

(b) Answer the followings with appropriate reason **07**

1. A rotameter is a device used to measure
   (a) Velocity of fluid in pipes
   (b) Velocity of gauges
   (c) Vortex flow
   (d) Flow of fluids
2. The continuity equation
   (a) Expresses relationship between hydraulic parameters of flow
   (b) Expresses the relationship, between work and energy
   (c) Is based on Bernoulli's theorem
   (d) Relates the mass rate of flow along a stream line.
3. Which Of the following, dimensionless parameter is
   (a) Pressure coefficient
   (b) Froude number
   (c) Darcy friction factor
   (d) All of the above
4. In laminar flow, maximum velocity at the centre Of pipe is how many times to the average velocity
   (a) Two
   (b) Three
   (c) Four
   (d) None of the above
5. Pascal. Second is the unit of
   (a) pressure
   (b) kinematic viscosity
   (c) dynamic viscosity
   (d) surface tension
6. Center of buoyancy always
   (a) coincide with center of gravity
   (b) coincide with centroid of volume of fluid displaced
   (c) remains above center of gravity
   (d) remains below center of gravity
7. the floating body is said to be in stable equilibrium when
   (a) metacentric height is zero
   (b) metacenter is above the center of gravity
   (c) metacenter is below the center of gravity
   (d) center of gravity is below the center of buoyancy

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