Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III (OLD) EXAMINATION – WINTER 2017

Subject Code:131403 **Date:21/11/2017**

Subject Name: Food Engineering Transport Phenomenon

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)** Answer the followings

1. Velocity potential function is given by an expression **4**

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

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

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

2. What is a meta centre and what is the necessity to know meta centric height of a ship? **3**

(b)

1. Classify manometers. Derive an equation of pressure for inverted U-tube differential manometer. **5**

2. Explain capillarity in detail. **2**

Q.2 **(a)**

1. The right limb of a simple U-tube manometer containing mercury is open to the atmosphere while the left limb is connected to a pipe in which a fluid of specific gravity 0.9 is flowing. The center of the pipe is12 cm below the level of mercury in the right limb. Find the pressure of fluid in the pipe if the difference of mercury level in the two limbs is 20 cm. **3**

Derive the continuity equation for three dimensions using rectangular co-ordinates.

2. **4**

(b) Define the following terms **7**

1. Centre of buoyancy

2. Rotational flow

3. Surface tension

4. Compressible flow
5. Reynold's number
6. Momentum thickness
7. What is the value of Reynold's number at critical velocity?

OR

(b)

1. Derive the hydrostatic law for determination of pressure in a fluid at rest. **4**
2. Describe in brief about stream function. **3**

Q.3 (a)

1. State Newton's law of viscosity and explain non-Newtonian fluids. **4**
2. Two horizontal plates are placed 1.25 cm apart, the space between them being filled with oil of viscosity 1.4 N.s/m^2. Calculate the shear stress in oil if upper plate is moved with a velocity of 2.5 m/s. **3**

(b) Describe in detail about principle, construction and working of Venturi meter. **7**

OR

Q.3 (a) Explain conditions of stability for a floating and a submerged body in detail. **7**

(b) Derive an equation of pressure difference for U-tube manometer. Draw velocity and shear stress profile for a viscous fluid flowing through two parallel plates. **7**

Q.4 (a)

1. Differentiate between primary and secondary units of measurement. **3**
2. Define the following terms **4**

    1. Boundary layer
    2. Specific volume
    3. viscosity
    4. fluid density

(b)

1. Prove that $t = 2\Pi (L/g)^{1/2}$ is dimensionally homogeneous equation Where t=time, L = length of pendulum and g= gravity acceleration 3

2. Explain centre of buoyancy and buoyant force in brief. 4

OR

Q.4 **(a)** State and Derive an expression for Pascal's law. **7**

Q.4 **(b)** Draw and explain in detail about variable area meter. **7**

Q.5 **(a)** The water is flowing through a pipe having diameters 20 cm and 10 cm at sections 1 and 2 respectively. The rate of flow through pipe is 35 lit/sec. the section 1 is 6m above datum. If the pressure at section 2 is 4m above the datum. If the pressure at section 1 is 39.24 N/cm^2, find the intensity of pressure at section 2. **7**

(b) Derive an equation of Discharge for flow of viscous fluid through circular pipe. **7**

OR

Q.5 **(a)** What is diffusion? Explain Fick's law of diffusion in detail. **7**

(b) Describe in detail about laminar boundary layer. **7**

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