Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III • EXAMINATION – WINTER • 2014

Subject Code: 131403 Date: 23-12-2014

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)** Derive an equation of continuity for rectangular co-ordinates in three dimensions. **07**

(b) Discuss measurement of pressure by means of manometers and derive an equation of pressure difference for inverted differential U-tube manometer **07**

Q.2 **(a)** Explain the following terms **07**

1. Specific weight
2. Dynamic viscosity
3. Center of buoyancy
4. Loss of head
5. Turbulent flow
6. capillarity
7. Surface Tension

(b) What is a mouthpiece? Explain loss of head in pipe along with calculation formulae. **07**

OR

(b) Explain Archimedes principle of floating. Draw the figures of different stability conditions for floating body. **07**

Q.3 **(a)** Draw conditions of boundary layer for laminar flow of water through a circular pipe. And explain boundary layer concept in brief. **07**

(b) Discuss in detail about velocity potential function. **07**

OR

Q.3 **(a)** Write a short note on mechanism of mass transfer and explain diffusion in detail. **07**

(b) Write a short note on : Bernoulli's equation **07**

Q.4 **(a)** Answer the followings **08**

1. Forces on curved surface
2. Metacentre and metacentric height

(b) Velocity potential function is given by an expression **06**

Ø= - (xy3/3)- x2 + (x3y/3) + y2

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

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

OR

Q.4 **(a)** Explain the followings: **08**

1. Raynold's number with dimensionless number
2. Rotameter

(b) Explain Newton's law of motion and Venacontracta. **06**

Q.5 **(a)** Explain orifice with its types and coefficient of orifice **07**

(b) What is notch? Explain types of notches. Also explain discharge over rectangular and triangular notch. **07**

OR

Q.5 **(a)** Use a dimensional analysis to obtain an expression that allows the calculation of the power of a stirrer as a function of the variables that could affect it. It is known, from experimental studies, that the stirring power depends on the diameter of the stirrer (*D*), its rotation velocity (*N*), the viscosity and density of the fluid being stirred, and the gravity acceleration (*g*). **07**

(b) A 50% sucrose solution at 20 ºC is flowing in a pipe with 0.0475 m inside diameter and 10 m length at a rate of 3 m^3/h. **07**

Find: a) the mean velocity, b) the maximum velocity, and c) the pressure drop of the sucrose solution. The viscosity and the density of the sucrose solution at 20 ºC are 15.43 cp and 1232 kg/m^3 respectively.

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