Registration No: | | | | | | | | | | |

Total Number of Pages: 3 **B.Tech**

PBT3I 001

3rd Semester Regular / Back Examination: 2017-18
UPSTREAM PROCESS ENGINEERING - I
BRANCH: BIOTECH
Time: 3 Hours
Max Marks: 100
Q.CODE: B808

Answer Part-A which is compulsory and any four from Part-B.
The figures in the right hand margin indicate marks.

Part – A (Answer all the questions)

Q1 Answer the following questions: *multiple type or dash fill up type* (2x10)

a) A fluid with constant density is called
- A. compressible fluid
- B. Incompressible fluid
- C. Both A and B
- D. None of these

b) Pressure gradient in a stationary fluid is

A. $dp/dz = \gamma$ B. $dp/dz = -\gamma$ C. $dp/dz = -1/\gamma$ D. $dp/dz = -2\gamma$

c) A fluid contained in a tank that is rotating with a constant angular velocity about an axis will rotate as
- A. rigid body
- B. non-rigid body
- C. free body
- D. None of these

d) Buoyant force has a magnitude equal to weight of fluid displaced by body and is directed vertically upward. This statement is called
- A. Archimedes principle
- B. Fluid principle
- C. buoyancy principle
- D. None of these

e) Flow in which each particle of fluid follows a smooth path is called
- A. laminar flow
- B. turbulent flow
- C. mixed flow
- D. None of these

f) Hydraulic grade line and energy line are
- A. graphical forms of Bernoulli equation.
- B. theoretical forms of Bernoulli equation.
- C. integral forms of Bernoulli equation.
- D. None of these

g) Net pressure force on a particle is determined by
- A. pressure gradient
- B. total pressure
- C. pressure curve
- D. None of these

h) Euler equation is useful for
- A. viscid flow
- B. in viscid flow
- C. rotational flow
- D. None of these

i) Property commonly used to characterize compressibility of fluid is

A. fluid modulus
C. bulk modulus
B. compression modulus
D. None of these

j) $A_1V_1 = A_2V_2$, this equation is called

A. Continuity equation
C. Volume equation
B. Bernoulli's equation
D. Area equation

Q2 **Answer the following questions: *Short answer type*** **(2x10)**

a) Differentiate between an ideal fluid and a real fluid.

b) When a flat plate of 0.1 m^2 area is pulled at a constant velocity of 30 cm/sec parallel to another stationary plate located at a distance 0.01 cm from it and the space in between is filled with a fluid of dynamic viscosity = 0.001 Ns/m^2 , the force required to be applied is?

c) The pressure difference of two very light gasses in two rigid vessels is being measured by a vertical U-tube water filled manometer. The reading is found to be 10 cm. what is the pressure difference?

d) What is the vertical component of the hydrostatic force on a submerged curved surface called?

e) Explain the term metacentre.

f) The buoyant force for a floating body passes through the centroid of the displaced volume.

Reason (R): The force of buoyancy is a vertical force & equal to the weight of fluid displaced.

(a) Both A and R are individually true and R is the correct explanation of A

(b) Both A and R are individually true but R is not the correct explanation of A (c) A is true but R is false (d) A is false but R is true.

Give appropriate explanation for your answer

g) Bernoulli's equation can be applied between any two points on a streamline for a rotational flow field. State whether its true or false

h) Define manometer and write down any two uses of it.

i) Differentiate between guaze pressure and vaccum pressure.

j) Write two methods for separation of solid-liquid mixtures and explain their working principle.

Part – B (Answer any four questions)

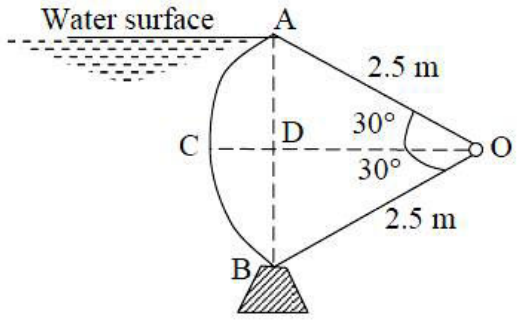
Q3 **a)** Briefly explain the hydrostatic pressure on a horizontal and vertical submerged plane surface. **(10)**

b) Appropriately explain the conditions in which the metacentric height of a given object in floating condition will be positive, negative and zero with diagrams. **(5)**

Q4 **a)** Explain the characteristics which determine the newtonian and non-newtonian behaviour of the fluids. **(10)**

b) Write the derivation for obtaining Bernoulli's Equation. **(5)**

Q5 **a)** Find the horizontal and vertical forces per metre width on the tainter gate which is asector of a circle of radius 2.5 m as shown in the figure below. Density of water is1000 kg/m3 **(10)**



b) A packed bed of spherical particles(dp= 50 μm, ρ_s=400 kg/m^3) is fluidized using air at 870 ^{0}C and pressure =2.76 x 10 ^{4} N/m^2. The packed bed density is 1440 Kg/m^3 and superficial air velocity is 0.3 m/s. Compare Δp From Erguns equation and fluidize bed condition equation. M_{air} =1.28Kg/m/s. **(5)**

Q6 **a)** Describe in detail about the pressure drop and head loss of fluid flow in pipes. **(10)**

b) Define Reynolds number and its relationship with friction factor. **(5)**

Q7 **a)** Determine the Kozney- Carman equation for flow of fluids through packed bed pipes/reactors. **(10)**

b) Explain using a diagram about the principles of two-phase and three-phase fluidization. **(5)**

Q8 **a)** Describe the working of positive displacement, centrifugal and plunger and piston pumps with neat diagram. **(10)**

b) Write short notes on drag force and terminal velocity. **(5)**