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

Total Number of Pages: 03

B.TECH
PBT3I001

3rd Semester Regular Examination 2016-17
UPSTREAM PROCESS ENGINEERING - I
BRANCH: BIOTECH
Time: 3 Hours
Max Marks: 100
Q.CODE: Y708

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*** **(2 x 10)**

a) The normal stress is the same in all directions at a point in a fluid
(A) only when the fluid is frictionless
(B) only when the fluid is frictionless and incompressible
(C) only when the fluid is incompressible
(D) when the fluid is at rest, regardless of its nature

b) **Bernoulli's equation cannot be applied when the flow is**
(A) rotational
(B) turbulent
(C) unsteady
(D) all of the above

c) A Newtonian fluid is defined as the fluid which
(A) Obeys Hook's law
(B) Is compressible
(C) Obeys Newton's law of viscosity
(D) Is incompressible

d) The theoretical velocity of jet at vena contracta is (where H = Head of water at vena contracta)
(A) 2gH
(B) H × √(2g)
(C) 2g × √H
(D) √(2gh)

e) In a centrifugal pump, the liquid enters the pump
(A). At the centre
(B). At the bottom
(C). At the top
(D). From sides

f) For pipes, laminar flow occurs when Reynolds number is
(A) Less than 2000
(B) Between 2000 and 4000
(C) More than 4000
(D) Less than 4000

g) Free surface of a liquid tends to contract to the smallest possible area due to force of
(A) Surface tension
(B) Viscosity
(C) Friction
(D) Cohesion

h) If the diameter of a capillary tube is doubled, the capillary rise will become
(A) √2 times less
(B) Double
(C) Half

(D) √2 times more

i) A manometer is used to measure
(A) Atmospheric pressure
(B) Pressure in pipes and channels
(C) Pressure in Venturimeter
(D) Difference of pressures between two points in a pipe

j) For flow through a horizontal pipe, the pressure gradient dp/dx in the flow direction is
(A) +ve
(B) 1
(C) zero
(D) –ve

Q2 **Answer the following questions: *Short answer type*** **(2 x 10)**

a) Why Newtonian and non-newtonian fluid are different from each other

b) What is stability point parameter for transition from laminar to turbulent flow in a pipe?

c) Discuss the effect of temperature and pressure on viscosity of both liquid and gasses

d) What is the terminal settling velocity of a freely falling body?

e) Explain turbulent and laminar fluid flow

f) A coconut oil having specific gravity of 0.7 is flowing through a venturimeter having inlet diameter 18 cm. The oil-mercury differential manometer shows a reading of 20 cm. Calculate the discharge of oil through the horizontal venturimeter. Take C_d as 0.95.

g) Differentiate between absolute pressure and atmospheric pressure

h) How can you determine the specific weight of a fluid?

i) What is kinetic energy correction factor?

j) State in detail about the Archimedes' principle.

Part – B (Answer any four questions)

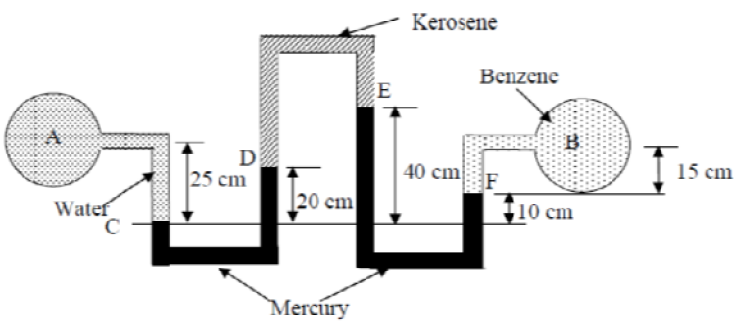
Q3 **a)** Water density 1000kg/m3 and viscosity 0.0008 kg/m.secis pumped at 1000cm/sec through a 25 mm id pipe.Calculate the value of Reynolds number. Derviebernoullis equation for fluid flow mentioning the necessary assumption and correction factor. **(10)**

b) Define the term specific speed of a centrifugal pump and deduce an expression for it in terms of the head H, discharge Q, and the speed N. **(5)**

Q4 **a)** Using Hagen-Poisuelle equation derive an expression for the head loss in a pipe of Diameter D and Length L in terms of Reynolds number and velocity head **(10)**

b) Elaborate in detail about the classification of fluids. **(5)**

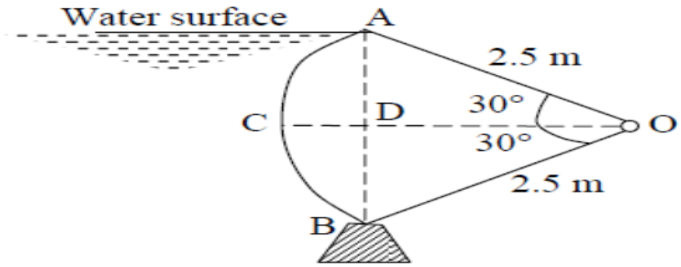
Q5 **a)** A multi-tube manometer is used to determine the pressure difference between points A and B as shown in the figure below. For the given values of heights, determine the ressure difference between points A and B. Specific gravities of benzene, kerosene and mercury are 0.88, 0.82 and 13.6 respectively **(10)**



b) Derive pascal's pressure variation for incompressible fluid **(5)**

Q6 **a)** Derive an equation for determination of metacentric height of a floating body. **(10)**
b) Briefly describe gauge pressure and vacuum pressure for incompressible fluids. **(5)**

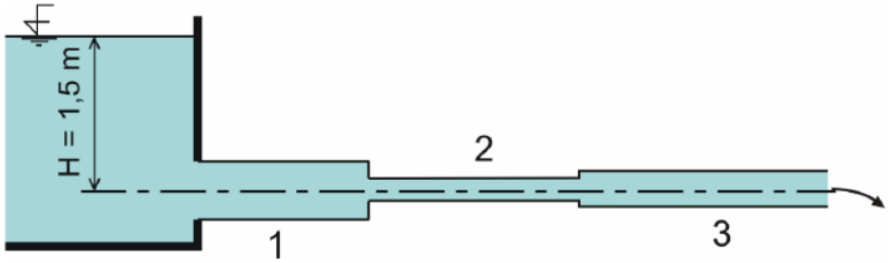
Q7 **a)** Find the horizontal and vertical forces per metre width on the tainter gate which is a sector of a circle of radius 2.5 m as shown in the figure below. Density of water is given as 1000 kg/m3. **(10)**



b) Calculate the atmospheric pressure at the end of troposphere, which extends upto a height of 9 km from sea level. Consider a temperature variation in the troposphere as $T = 288 - 0.006y$, where y is the elevation in m and T is temperature in K. The atmospheric pressure and temperature at sea level are 101.3 kN/m2 and 288 K respectively. **(5)**

Q8 **a)** Give the shematic representation of different types of pumps used and explain briefly the working principle of each of the pumps. **(10)**
b) Elaborate on the drag force and terminal settling velocity of a freely falling body **(5)**

Q9 **a)** A horizontal pipeline is attached to the wall of reservoir. The pipeline has different profiles. The water level in the upper reservoir is in the height H = 1.5 m above the pipeline axis. From the lower end of the pipeline water flows out to the open space. Diameters and lengths of pipeline reaches are: D1 = 0.24 m, L1 = 3 m, D2 = 0.1 m, L2 = 1 m, D3 = 0.12 m, L3 = 2 m. Calculate discharge in the pipeline and draw the course of energy line (EL) and pressure line (PL). **(10)**
Resolve the problem: Neglecting losses (i.e. consider the liquid to be ideal)



b) Write short notes on orifice meter and venture meter. **(5)**