P P SAVANI UNIVERSITY

Fourth Semester of B. Tech. Examination

May 2022

SECH2050 FLUID FLOW OPERATION

20.05.2022, Friday **Time: 10:30 a.m. To 1:00 p.m.** **Maximum Marks: 60**

Instructions:

1. The question paper comprises two sections.
2. Section I and II must be attempted in same answer sheet.
3. Make suitable assumptions and draw neat figures wherever required.
4. Use of scientific calculators is allowed.

SECTION – I

Q - 1	Answer Any five of the Following: (MCQ/Short Question/Fill in the Blanks)	**[05]**
(i)	Which one of the following is the unit of mass density? a) kg = m^3, b) kg = m^2, c) kg = m, d) kg = ms	
(ii)	The device used to measure the fluid pressure is _____ a) Hygrometer b) Calorimeter c) Manometer d) Thermometer	
(iii)	Which is the cheapest device for measuring flow / discharge rate. a) Venturimeter b) Pitot tube c) Orificemeter d) None of the mentioned	
(iv)	What is unit for flow rate for gases? a) m^3/s, b) litres/s, c) cm^3/s, d) kgf/s	
(v)	If there is bucket full of oil and bucket full of water and you are asked to lift them, which one of the two will require more effort given that volume of buckets remains same? a) Oil bucket, b) Water bucket, c) Equal effort will be required to lift both of them d) None of the mentioned	
(vi)	The continuity equation is based on the principle of a) conservation of mass b) conservation of momentum, c) conservation of energy d) conservation of force	
(vii)	Which one of the following is a major loss? a) frictional loss b) shock loss c) entry loss d) exit loss	
Q - 2 (a)	Explain Newtonian and Non Newtonian fluids in Details	**[05]**
Q - 2 (b)	Explain the U tube manometer in Details	**[05]**
	OR	
Q - 2 (a)	Estimate the pressure in N/m^2 due to a column of a) 5 cm of water b) 20 cm of Hg (specific gravity of mercury is 13.6)	**[05]**
Q - 2 (b)	Define Fanning's friction factor. Give its value for turbulent flow	**[05]**
Q - 3 (a)	Differentiate between variable head meter and variable area meter	**[05]**
Q - 3 (b)	State Bernoulli's principle and List five assumptions made while deriving Bernoulli's equation	**[05]**
	OR	
Q - 3 (a)	Show that N_{Re} is dimensionless.	**[05]**
Q - 3 (b)	Explain Redwood viscometer	**[05]**
Q - 4	Attempt any one	**[05]**
(i)	Water is flowing through a pipe of 3cm diameter at a velocity of 5cm/s. Suddenly it enters a pipe of diameter 5cm.Estimate the frictional loss due to sudden expansion of flow area?	
(ii)	Draw and explain the velocity profile when fluid is flowing through a straight pipe	

SECTION – II

Q - 1 Answer the Any five of Following: (MCQ/Short Question/Fill in the Blanks) **[05]**

(i) With the increase in the flow rate, efficiency of pump _____
a) Decreases, b) Increases, c) Remains same, d) Independent

(ii) Power is most commonly expressed as _____
a) m, b) kW, c) m^3/s, d) /s

(iii) Which of the following represents the Reynolds number for laminar flow?
a) Less than 2000 b) Greater than 4000 c) Infinite d) None of the mentioned.

(iv) _____ measures velocity at a point of fluid in a stream.
a) Venturi meter b) pH meter c) Pitot-Static tubes d) None of the mentioned

(v) The principle of Orificemeter is same as that of Venturimeter.
a) True b) False

(vi) Orifice meter consists of a flat rectangular plate.
a) True b) False

(vii) What is the function of a butterfly valve?
a) On/ off control b) Flow regulation c) Pressure control d) Hydraulic control

Q - 2 (a) Derive equation for theoretical discharge of orifice Meter **[05]**

Q - 2 (b) Water is flowing at a rate of 500 cm^3/s through an orifice of 25 mm diameter installed in a 75 mm diameter pipe. What will be the difference in the level on a mercury manometer connected across the meter ? The coefficient of orifice meter is 0.65. **[05]**

OR

Q - 2 (a) A venturimeter is installed in a pipe line for the measurement of flow rate of water. The pressure drop across the throat and upstream of the meter is ten centimeters of mercury. Calculate the volumetric flow rate of water in m^3/s **[05]**

Q - 2 (b) Acetic acid flows through a 75 mm internal diameter pipe at a rate of 0.015 m^3/s. Calculate the pressure drop in the horizontal pipe of length 70 m.

Data : Viscosity of acid = 2.5 $(mN.s)/m^2$
Density of acid = 1060 kg/m^3

Q - 3 (a) State the advantages of a centrifugal pump **[05]**

Q - 3 (b) Classify the reciprocating pump and explain any one type in details. **[05]**

OR

Q - 3 (a) Water is to be pumped from ground level tank, which is open to atmosphere to a cooling tower. The difference between the level of water in the tank and discharge point is 15 m. The velocity of water through 40 mm internal diameter discharge pipe is 3 m/s. In the pipe line there is a valve which is equivalent to 200 pipe diameters and fitting equivalent to 150 pipe diameters. The length of the entire is 30 meters. Calculate the power requirement of the pump if efficiency of pump is 60%. Data : density of water = 1000 kg/m^3 Viscosity of water = 0.0008 PaS. Friction factor 'f' = 0.004. **[10]**

Q - 4 Attempt any one **[05]**

(i) Give two applications in chemical industries where centrifugal pump cannot be used.

(ii) What are the advantages of Centrifugal pump over Reciprocating pump?

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