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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Third Semester, B.E. - Civil Engineering

Semester End Examination; March - 2021

Fluid Mechanics

Time: 3 hrs *Max. Marks: 100*

Course Outcomes

The Students will be able to:

CO1: Apply the knowledge of basic science and mathematics to differentiate a fluid and a solid, understand fluid properties, differentiate pressure and pressure head, analyze the fluid particles at rest or in motion and to understand flow measurement phenomenon.

CO2: Formulate, interpret and analyze flow problems related with fluid particles either at rest or at motion.

CO3: Identify and quantify losses in a flow phenomenon for the efficient design of pipe line and various flow measuring devices.

CO4: Apply the knowledge of fluid mechanics in future to find efficient solutions to various problems related to civil engineering either as an individual or as a team member to satisfy the changing professional and societal needs.

Note: ***I) PART - A*** *is compulsory.* ***Two*** *marks for each question.*

II) PART - B*: Answer any* ***Two*** *sub questions (from a, b, c) for Maximum of* ***18 marks*** *from each unit.*

Q. No.	Questions	Marks	BLs	COs	POs
	I : PART - A	**10**			
I a.	State Newton's law of viscosity and write dimension for kinematic viscosity.	2	L1	CO1	PO1
b.	Define atmospheric pressure and gauge pressure.	2	L1	CO1	PO1
c.	Define laminar flow and turbulent flow.	2	L1	CO1	PO1
d.	What is an equivalent pipe? Write Dupuit's equation.	2	L1	CO1	PO1
e.	Define coefficient of discharge and vena contracta.	2	L1	CO1	PO1
	II : PART - B	**90**			
	UNIT - I	**18**			
1 a.	Define; i) Ideal fluid and Real fluid ii) Surface tension and Dynamic viscosity iii) Specific mass and Specific weight Give the units for each of them.	9	L1	CO1	PO1
b.	Dynamic viscosity of oil used for lubrication between a shaft and a sleeve is 6 poise. The shaft is of diameter 0.4 m and rotates at 190 rpm. Calculate the power lost in the bearing for shaft is of diameter 0.4 m and rotates at 190 rpm. Calculate the power lost in the bearing for a sleeve length of 0.09 m. Take thickness of oil as 1.5 mm.	9	L3	CO2	PO2
c.	Define Capillarity. If 5 m^3 of certain liquid weighs 39240 N. Calculate specific weight, mass density, specific gravity. Assume specific weight of water at 4°C as 9810 N/m^3.	9	L3	CO2	PO2

Contd… 2

UNIT - II **18**

2 a.	Show that the center of pressure always lies below the centroid of a plane surface immersed vertically in fluid at rest.	9	L3	CO2	PO2
b.	i) Differentiate between Simple manometer and Differential manometer.				
	ii) Two pressure tanks are filled one inside the other as shown in Fig. 2(b). A bourdon gauge (*M*) connected to the inner tank reads 20 Kpa, another bourdon gauge *N* connected to the outer tank reads 35 Kpa. An aneroid barometer reads 750 mm of mercury. Calculate the absolute pressure recorded at *M* and *N* in terms of mercury.	9	L2	CO1	PO1

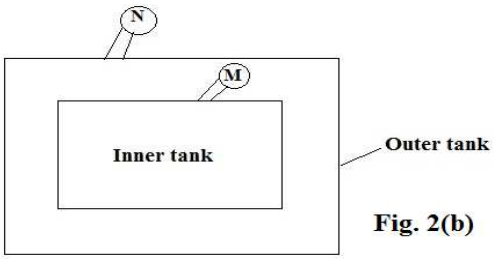

Fig. 2(b)

c.	Define total pressure. Find magnitude and direction of resultant force due to water acting on a roller gate of cylindrical from of 4 m diameter, when the gate is placed in such a way that the water is just going to spill, take the width of the gate as 8 m.	9	L3	CO2	PO2

UNIT - III **18**

3 a.	State continuity equation. Derive the same for three dimensional flows.	9	L3	CO2	PO2
b.	Define velocity potential function. The stream function for a two dimensional flow is given by $\Psi = 2xy$. Calculate the velocity at the points (2, 3). Find also the velocity potential function φ.	9	L3	CO2	PO2
c.	i) State Bernoulli's theorem and mention the assumptions made in derivation of Bernoulli's theorem.				
	ii) A pitot static tube in the center of the pipe of diameter 0.3 m has one orifice facing upstream and the other perpendicular to it. The mean velocity of the flow is 0.8 times the central velocity. Calculate the discharge through the pipe, if the pressure difference between the two orifices is 0.06 m. Take $C_v = 0.98$.	9	L1	CO2	PO2

UNIT - IV **18**

4 a.	Distinguish between;				
	i) Major loss and Minor losses				
	ii) Hydraulic gradient line and Total energy line	9	L2	CO1	PO1
	iii) Pipes in series and Pipes in parallel				

Contd… 3

b.	Derive an expression for head loss due to friction.	9	L3	CO2	PO2
c.	i) Explain water hammer in pipes.				
	ii) Two reservoirs are connected by two parallel pipes their diameters are 300 mm and 350 mm and lengths are 3.15 km and 3.5 km respectively and the respective friction factor are 0.0216 and 0.0325. What will be the discharge from the larger pipe if the smaller pipe carries discharge of 285 Lps?	9	L3	CO3	PO2
	UNIT - V	**18**			
5 a.	Derive an expression for discharge through a triangular notch and mention its advantages.	9	L3	CO2	PO2
b.	I) Distinguish between; i) Orifice and Mouth piece ii) Notch and Weir	9	L2	CO1	PO1
	II) Explain why ventilation of suppressed weirs is necessary?				
c.	Define cipolletti notch. A rectangular 0.4 m long is used for measuring a discharge of 30 Lps. An error of 1.5 mm was made while measuring the head over the notch. Calculate the percentage error in the discharge. Take $C_d = 0.6$.	9	L3	CO4	PO2

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