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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

Make-up Examination; May - 2022

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 a Maximum of **18 marks** from each unit.*

Q. No.		Questions	Marks	BLs	COs	POs
		I : PART - A	**10**			
I	a.	Define fluid. List any four fluid properties.	2	L1	CO1	PO1
	b.	State Pascal's Law.	2	L1	CO2	PO2,3
	c.	Write the Bernoulli's equation for real fluids.	2	L1	CO1	PO1
	d.	List the causes of major energy losses and minor energy losses in pipe flow.	2	L1	CO1	PO1
	e.	List out hydraulic coefficients and establish relationship of the same.	2	L1	CO1	PO1
		II : PART - B	**90**			
		UNIT - I	**18**			
1	a.	With a neat sketch, explain classification of fluids.	9	L2	CO1	PO1
	b.	i) State Newton's law of viscosity. ii) An oil film thickness 1.5 mm is used for lubrication between a square plate of size 0.9 m x 0.9 m and an inclined plane having an angle of inclination 20º. The weight of the square is 392.4 N and it slides down the plane with a uniform velocity of 0.2 m/s. Calculate the dynamic viscosity of the oil.	9	1,3	CO2	PO2,3
	c.	Capillary rise in the glass tube is not to exceed 0.2 mm of water. Determine its minimum size, given that surface tension for water in contact with air = 0.0725 N/m.	9	L3	CO2	PO2,3

Contd… 2

UNIT - II **18**

2 a. State and prove hydrostatic pressure law. 9 L3 CO2 PO2,3

b. i) Define manometer and mention its types.

ii) Differential manometer is connected at the two points *A* and *B* as shown in Fig. Q2(b). At *B* air pressure is 7.448×10^4 N/m^2(abs). Find the absolute pressure at *A*. 9 1,3 CO2 PO2,3

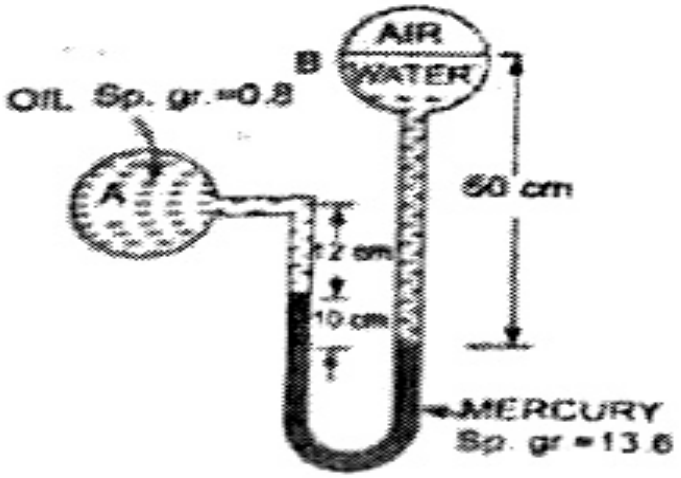

Fig.Q2(b)

c. Fig. Q2(c) shows a gate having a quadrant shape of radius 3.0 m. Determine the resultant force due to water per meter length of the gate. Find also the angle at which total force will act. 9 L3 CO2 PO2,3

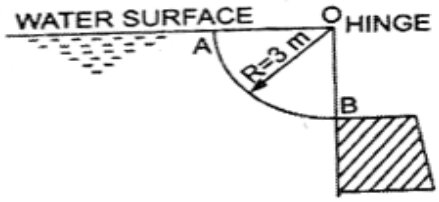

Fig.Q2(c)

UNIT - III **18**

3 a. Define Euler's equation of motion and derive an expression for it. How will you obtain Bernoulli's equation from it? 9 L2 CO2 PO2,3

b. i) Define and derive an expression for continuity equation for incompressible fluids.

ii) A 300 mm diameter pipe carries oil of specific gravity 0.8 at a velocity of 2.0 m/s. At another section of the diameter is 200 mm. Calculate the velocity at the section and also mass rate of flow of oil. 9 L3 CO2 PO2,3

c. A horizontal venturimeter with inlet diameter 300 mm and throat diameter 150 mm is used to measure the flow of oil of sp. Gr. 0.8. The discharge of oil through venturimeter is 50 Lps. Find the reading of the oil-mercury differential manometer. Take $C_d = 0.98$. 9 L3 CO2 PO2,3

Contd… 3

UNIT - IV **18**

4 a.	Define equivalent pipe. Derive an expression for equivalent pipe.	9	1,3	CO2	PO2
b.	A horizontal pipe of diameter 400 mm is suddenly contracted to a diameter of 200 mm. The pressure intensities in the large and smaller pipe are given as 14.7415×10^4 N/m^2 and 12.753×10^4 N/m^2 respectively. If C_C = 0.62. Determine the loss of head due to contraction. Also determine the rate of flow of water.	9	L3	CO3	PO3
c.	i) With neat sketch, explain the phenomenon of water hammer. ii) A valve is provided at the end of a cast iron pipe of diameter 150 mm and of thickness 10 mm. The water is flowing through the pipe, which is suddenly stopped by closing the valve. Find the maximum velocity of water, when the rise of pressure due to sudden closure of valve is 196.2×10^4 N/m^2 and E for cast iron pipe as 11.722×10^{10} N/m^2.	9	L3	CO4	PO5,9,11

UNIT - V **18**

5 a.	Define hydraulic coefficients. With a neat sketch, obtain an expression for coefficient of velocity C_V experimentally.	9	L3	CO2	PO2,3
b.	i) Differentiate between notch and weir. ii) Water flows through a triangular right angled weir first and then over a rectangular weir of 1 m width. The discharge coefficients of the triangular and rectangular weir are 0.6 and 0.7 respectively. If the depth of water over the triangular weir is 360 mm. Calculate the depth of water over the rectangular weir.	9	1,3	1,4	PO1,9,11
c.	Define and derive an expression for discharge over a broad crested weir and classify the same with respect to length and head over the crest.	9	L3	CO2	PO2,3

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