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

(An Autonomous Institution affiliated to VTU, Belagavi)

Third Semester, B.E. - Industrial and Production Engineering

Semester End Examination; Dec. - 2019

Fluid Mechanics and Hydraulic Machines

Time: 3 hrs *Max. Marks: 100*

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
	I : PART - A	**10**
I a.	Explain the dynamic viscosity with its dimension.	2
b.	What are the conditions of stability of a submerged body?	2
c.	Write the expression for the rate of flow of fluid through orifice meter.	2
d.	What is the loss of head at the exit of a pipe?	2
e.	What is the function of air vessels in reciprocating pumps?	2
	II : PART - B	**90**
	UNIT - I	**18**
1 a.	Differentiate between the following fluid properties giving their SI units: i) Mass density and specific weight ii) Newtonian and Non-Newtonian fluid iii) Surface tension and capillarity	9
b.	i) State and prove PASCAL's law.	4
	ii) A single U-tube manometer containing mercury is connected to pipe in which a fluid of Sp.gr.0.8 and having vacuum pressure is flowing. The other end of the manometer is open to atmosphere. Find the vacuum pressure in pipe if the difference of mercury level in the two limbs is 40 cm and the height of fluid in the left form the centre of pipe is 15 cm below.	5
c.	i) Establish a relationship among absolute, gauge and atmospheric pressure with a simple sketch and explain.	4
	ii) Two plates are placed at a distance of 0.15 mm apart. The lower plate is fixed while the upper plate have surface area of 1.0 m^2 is pulled at 0.3 m/s. Find the force and power required to maintain this speed. If the fluid separating them is having viscosity 1.5 poise.	5
	UNIT - II	**18**
2 a.	Obtain an expression for the total pressure and centre of pressure on an inclined plane when it is submerged in the liquid	9
b.	What is Meta centric height? Derive the expression for a floating body of the same.	9

Contd…2

c. Find the magnitude and direction of the resultant force due to water acting on a roller gate of cylindrical farm of 4 m dia, when the gate is placed on the dam in such a way that water is just going to spill. Take the length of the gate as 8 m. 9

UNIT - III **18**

3 a. Obtain an expression for continuity equation for a three dimensional flow. 9

b. Derive Euler's equation of motion and deduce Bernoulli's equation from it. 9

c. A 20 cm × 10 cm venturimeter is inserted in a vertical pipe carrying oil of $S_p.g_r.0.8$, the flow of oil in upward direction. The difference of levels between the throat and inlet section is 50 cm. The oil mercury differential manometer gives a reading of 30 cm of mercury. Find the discharge of oil Neglect losses. 9

UNIT - IV **18**

4 a. i) Write the different expressions for loss of head due to friction in pipe flow and explain the terms? 4

ii) What do you understand by minor energy losses? List the various energy losses that occurs during pipe flow with relevant equations 5

b. i) Enumerate the classification of turbines. 3

ii) Prove that the work done/sec/unit weight of water in a reaction turbine is given as $\frac{1}{g}[V_{w_1}U_1 \pm V_{w_2}U_2]$ 6

c. Find the loss of head due to friction in a pipe of diameter 300 mm and length 50 m through which water is flowing at a velocity of 3 m/s using, 9

i) Darey's formula

ii) Chezy's formula for which $c = 60$, Take γ for water = 0.01 stoke.

UNIT - V **18**

5 a. Explain with a neat sketch the working principle of reciprocating pumps. 9

b. Drive an expression for work-done by the impeller on water in a centrifugal pump with usual notations. 9

c. The internal and external diameters of the impeller of a centrifugal pump are 200 mm and 400 mm respectively. The pump is running at 1200 rpm. The vane angle of the impeller at inlet and outlet are 20° and 30° respectively. Determine the work done by the impeller per unit weight of water. Draw velocity triangle at inlet and outlet 9

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