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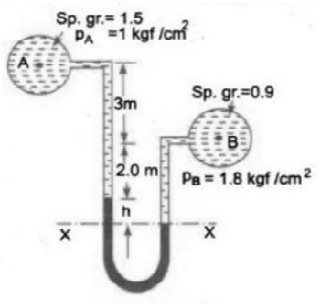
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year II Semester Examinations, 2019
FLUID MECHANICS AND HYDRAULIC MACHINES

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit.

Q. No	Question	Bloom's Level
	PART – A (25 Marks)	
1 a	What is the difference between U-tube differential manometers and inverted U-tube differential manometers? Where they are used?	**L1 / L2**
b	Explain gauge pressure and absolute pressure. Represent positive and negative gauge pressures on a chart.	**L2**
c	Explain momentum equation. How will you apply momentum equation for determining the force exerted by a flowing liquid on a pipe bend.	**L1 / L2**
d	Obtain an expression for continuity equation for a three-dimensional flow.	**L2**
e	What do you mean by boundary layer separation? What is the effect of pressure gradient on boundary layer separation?	**L1 / L2**
f	Derive an expression for the loss of head due to sudden contraction of a pipe.	**L2**
g	What is meant by 'cavitation'? What is Thomas's cavitation factor and what is its significance for water turbines?	**L1 / L2**
h	What are the uses of draft tube? Describe with neat sketches different types of draft tubes.	**L2**
i	If a centrifugal pump does not deliver any water when started, what may be the probable causes and how can they be remedied?	**L1 / L2**
j	Explain the working principles of reciprocating pump with sketches.	**L2**
	PART – B (50 Marks)	
2	A differential manometer is connected at the two points A and B of two pipes as shown in the figure below. The pipe A contains a liquid of Sp.gr=1.5 while pipe B contains a liquid of Sp.gr=0.9. The pressures at A and B are 1kgf/cm^2 and 1.80 kg/cm^2 respectively. Find the difference in mercury level in the differential manometer. 	**L3 / L4**
	OR	
3	The dynamic viscosity of an oil, used for lubrication between a shaft and sleeve is 6 poise. The shaft is of diameter 0.4m and rotates at 190 r.p.m. Calculate the power lost in the bearing for a sleeve length of 90mm. The thickness of the film is 1.5mm.	**L3 / L4**

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4	The stream function for a two dimensional flow is given by$\psi = 2xy$. Find the velocity at the point P(4,2). Also find the velocity potential function.	**L3 / L4**
	OR	
5	A 300mm diameter pipe carries water under a head of 20m with a velocity of 3.5m/s. If the axis of the pipe turns through 45°, find the magnitude of the resultant force at the bend.	**L3 / L4**
6	For the velocity profile in laminar boundary layer as, $$\frac{u}{U} = \frac{3}{2}\left(\frac{y}{\delta}\right) - \frac{1}{2}\left(\frac{y}{\delta}\right)^2$$ Find the thickness of the boundary layer and the shear stress 1.5m from the leading edge of a plate. The plate is 2m long and 1.4m wide and is placed in water which is moving with velocity of 200mm per second. Find the total drag force on the plate if μ for water is 0.01 poise.	**L3 / L4**
	OR	
7	A venturimeter has its vertical axis vertical, the inlet and the throat diameter being 150mm and 75mm respectively. The throat is 225mm above inlet. Petrol of specific gravity 0.78 flows up through the meter at a rate of 0.029 m^3/s. find the pressure difference between the inlet and throat.	**L3 / L4**
8	A jet of water of diameter 7.5cm strikes a curved plate at its centre with a velocity of 20m/s. The curved plate is moving with a velocity of 8m/s in the direction of the jet. The jet is deflected through an angle of 165°. Assuming the plate is smooth, find: (i) Force exerted on the plate in the direction of jet (ii) Power of the jet (iii) Efficiency of the jet	**L3 / L4**
	OR	
9	A conical draft-tube having inlet and outlet diameters 1m and 1.5m discharges water at outlet with a velocity of 2.5m/s. The total length of the draft-tube is 6m and 1.20m of the length of draft-tube is immersed in water. If the atmospheric pressure head is 10.3m of water and loss of head due to friction in the draft-tube is equal to 0.2 X velocity head at outlet of the tube, find; (i) Pressure head at inlet (ii) Efficiency of the draft-tube	**L3 / L4**
10 a	A water turbine develops 130kW at 230 r.p.m., under a head of 16m. Find the scale ratio and the speed of a similar machine which will generate 660kW when working under a head of 25m.	**L2**
b	The diameter and stroke length of a single-acting reciprocating pump are 100mm and 300mm respectively. The water is lifted to a height of 20m above the centre of the pump. Find the maximum speed at which the pump may be run so that no separation occurs during the delivery stroke if the diameter and length of delivery pipe are 50mm and 25mm respectively. Separation occurs if the absolute pressure head in the cylinder during delivery stroke falls below 2.5m of water. Take atmospheric pressure head=10.3m of water.	**L3 / L4**
	OR	

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11 a	Analyze the effect of acceleration of the piston on the velocity and acceleration of the water in suction and delivery pipes?	**L2**
b	Find the power required to drive a centrifugal pump which delivers 40litres of water per second to a height of 20m through a 150mm diameter and 100m long pipeline. The overall efficiency of pump is 70% and Darcy's f=0.06 for the pipeline. Assume inlet losses in suction pipe equal to 0.33m.	**L3 / L4**

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