QPC: RJ19BTECH173 AR 19 Reg. No

GIET UNIVERSITY, GUNUPUR – 765022

B. Tech (Fourth Semester – Regular) Examinations, June – 2021

BESBT4050 / BPCME4010 - FLUID MECHANICS & HYDRAULICS MACHINES

(Common to Biotechnology and Mechanical Engg.)

Time: 2 hrs Maximum: 50 Marks

Answer ALL Questions

The figures in the right hand margin indicate marks.

PART – A: (Multiple Choice Questions) **(1 x 10 = 10 Marks)**

Q.1. Answer *ALL* questions				[CO#]	[PO#]
a.	The specific gravity of a liquid has				
	(i) the same unit as that of mass density	(ii) the same unit as that of weight density		1	1
	(iii) the same unit as that of specific volume	(iv) no unit			
b.	Which of the following contribute to the reason behind the origin of surface tension?			1	1
	(i) only cohesive forces	(ii) only adhesive forces			
	(iii) neither cohesive forces nor adhesive forces	(iv) both cohesive forces and adhesive forces			
c.	Which of the following is the correct relation between centroid (G) and the centre of pressure (P) of a plane submerged in a liquid?			1	1
	(i) G is always below P	(ii) P is always below G			
	(iii) G is either at P or below it.	(iv) P is either at G or below it.			
d.	What will be the shape of the pathline for a one-dimensional flow be like?			2	1
	(i) straight line	(ii) parabolic			
	(iii) hyperbolic	(iv) elliptical			
e.	When is orifice called ‘large orifice’?			2	1
	(i) If the head of liquid is less than 5 times the depth of orifice	(ii) If the head of liquid is less than 2.5 times the depth of orifice			
	(iii) If the head of liquid is less Hence, 4 times the depth of orifice	(iv) If the head of liquid is less than 1.5 times the depth of orifice			
f.	Which is the cheapest device for measuring flow / discharge rate.			3	2
	(i) Venturimeter	(ii) Pitot tube			
	(iii) Orificemeter	(iv) None of the mentioned			
g.	Which among the following is the correct formula to find out the shear modulus(G)?			3	2
	(i) E/2	(ii) v/2			
	(iii) E/2(1+v)	(iv) 2E(1+v)			
h.	Which among the following is an assumption of Hagen-Poiseuille equation?			4	2
	(i) Fluid is compressible	(ii) Fluid is uniform			
	(iii) Fluid is laminar	(iv) Fluid is turbulent			
i.	A reciprocating pump is a class of _____			4	2
	(i) Negative displacement	(ii) Positive displacement			
	(iii) Zero displacement	(iv) Infinite displacement			
j.	The force analysis on a curved vane is understood using_____			4	2
	(i) Velocity triangles	(ii) Angle of the plate			
	(iii) Vane angles	(iv) Plate dimensions			

PART – B: (Short Answer Questions) **(2 x 5 = 10 Marks)**

Q.2. Answer ***ALL*** questions	[CO#]	[PO#]
a. Define Surface Tension.	1	1
b. List the instruments works on the basis of Bernoulli's equation.	1	1
c. Mention the range of Reynold's number for laminar and turbulent flow in a pipe.	2	1
d. Define Priming of a centrifugal pump.	3	2
e. What is mean by Draft Tube?	4	2

PART – C: (Long Answer Questions) **(6 x 5 = 30 Marks)**

Answer ***ANY FIVE*** questions	Marks	[CO#]	[PO#]
3. A tank of 1m length and of cross-section shown in fig. 3.a contains water. The tank is made of 4 mm steel plates. (i) What is the force on the bottom due to water? (ii) What are the longitudinal tensile stresses in the side walls AB if (a) the tank is suspended from the top and (b) it is supported at the bottom?	(6)	1	2

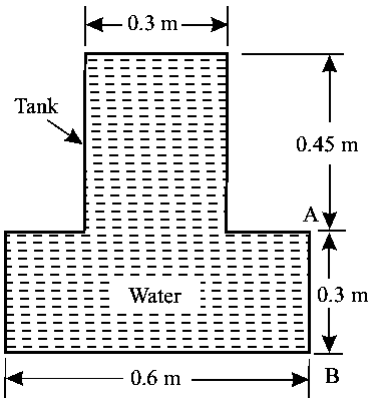

Figure 3.a

4. For the hydraulic jack shown in Fig. 3.b find the load lifted by the large piston when a force of 400 N is applied on the small piston. Assume the specific weight of the liquid in the jack is 9810 N/m^3.	(6)	1	2

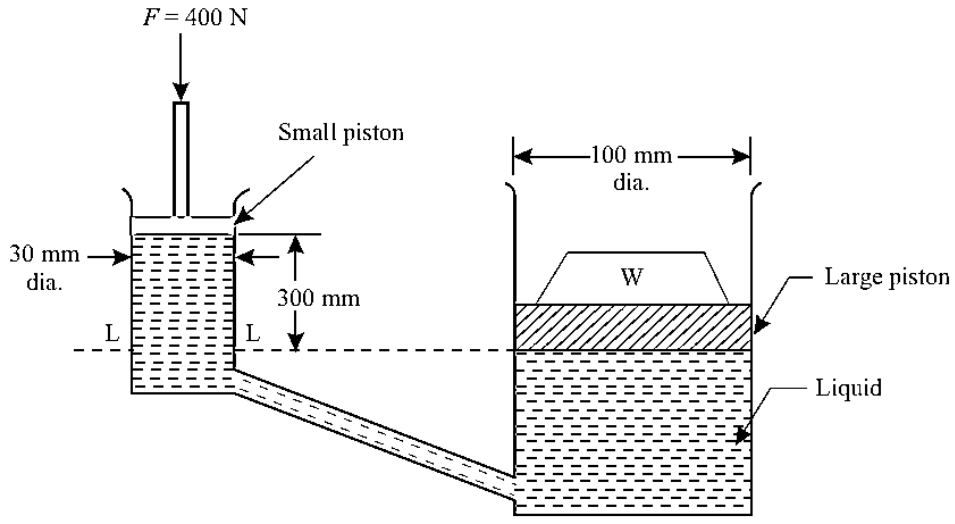

Figure 3.b

5.	A wooden block of specific gravity 0.75 floats in water. If the size of the block is 1 m × 0.5 m × 0.4 m, find its metacentric height.	(6)	2	2
6.	In a fluid, the velocity field is given by $V = (3x + 2y)\,i + (2z + 3x^2)\,j + (2t - 3z)\,k$ Determine: (i) The velocity components u, v, w at any point in the flow field; (ii) The speed at point (1, 1, 1); (iii) The speed at time t = 2s at point (0, 0, 2). Also classify the velocity field as steady, or unsteady, uniform or non-uniform and one, two or three dimensional.	(6)	2	2
7.	A Francis turbine of specific speed 100 develops $15.2 * 10^3$. kW under a head of 200 m. The overall efficiency is 0.86 and the velocity of flow is constant and is equal to 10 m/s. The hydraulic efficiency is 0.89, the ratio of width to diameter of wheel at the inlet is equal to 0.1 and the area occupied by the thickness of the blades is equal to 5% of the area of water way. Workout the area, guide blade angle, vane angle, peripheral velocity and velocity of whirl at the inlet. Assume axial discharge.	(6)	3	2
8.	A Kaplan turbine develops $50 * 10^3$ kW under a net head of 30 m with an overall efficiency of 85%. Taking the value of speed ratio = 2, flow ratio = 0.6 and diameter of the hub = 0.35 times of the diameter of the runner, then calculate (i) the diameter of the runner, (ii) speed of the turbine and (iii) specific speed of the turbine.	(6)	3	2
9.	The impeller of a centrifugal pump is of 0.3 m diameter, 0.05 m width at the periphery and has blades whose tip angle inclines backwards 60° from the radius. The pump delivers 15 m3/min and the impeller rotates at 1000 rpm. Assume that the pump is designed to admit radially and calculate (i) the speed and direction of water as it leaves the impeller, (ii) torque exerted by the impeller in water, (iii) shaft power required and (iv) lift of the pump. Take mechanical efficiency as 95% and hydraulic efficiency as 75%	(6)	4	2
10.	A single acting reciprocating pump delivers 9 litres per second of water against a suction head of 4 m and a delivery head of 16 m while running at a speed of 60 rpm. The diameter and stroke of the piston are 200 mm and 300 mm, respectively. Determine (i) the theoretical discharge, (ii) coefficient of discharge, (iii) slip, (iv) percentage slip and (v) power required to drive the pump.	(6)	4	2

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