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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Third Semester B.Tech Degree (S,FE) Examination December 2020 (2015 Scheme)

Course Code: CH205

Course Name: FLUID AND PARTICLE MECHANICS-I

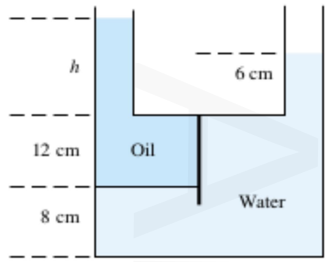
Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks. Marks

Assume density of water is 1000 kg/m^3, viscosity of water is 1 cp, $P_{atmosphere}$= 101 kN/m^2, and viscosity of air is 0.001 cp

1	a)	What are the different properties of fluid, other than temperature and pressure, which are relevant in fluid analysis? Explain relevance of each property.	(5)
	b)	Explain the transport law for fluid flow.	(2)
	c)	What will be the gauge pressure and the absolute pressure of water at depth 20 m below the surface?	(8)
2	a)	Classify fluids based on its property.	(8)
	b)	A continuous gravity decanter is to separate chloro-benzene with a density of 1200 kg/m^3 from an aqueous wash liquid having a density of 1000 kg/m^3. If the total depth in the separator is 2 m and the interface is to be 1.1 m from the vessel floor. What should the height of the heavy-liquid outflow leg be? How much would an error of 10 mm in this height affect the position of the interface? Answer as a percent error.	(7)
3	a)	Obtain the pressure in SI (Pa) necessary for shrinking the volume of water by 2 % at normal temperature and pressure. Assume the compressibility of water $\beta = 4.9 \times 10^{-10}$ Pa^{-1}.	(7)
	b)	In Figure the tank contains water and immiscible oil at 20°C. What is *h* in *cm* if the density of the oil is 750 kg/m^3?	(8)



PART B

Answer any two full questions, each carries 15 marks.

4 a) If a stream function exists for the velocity field of $u = a(x^2 - y^2), v = -2axy, w = 0$ find it. (3)

b) If the stream function is $\varphi = 6x^3y + 12xy^3$, determine the velocity vector assuming $w = 0$. (3)

c) Water is draining from an open conical funnel at the same rate at which it is entering at the top. The diameter of the funnel is 6 cm at the top and 1 cm at the bottom and it is 5 cm high. The mass flow rate of water is 50 kg/h. Determine the volumetric flow rate of the water and the value of the Reynolds number entering and leaving the funnel? (9)

5 a) Water flowing in Potential flow with velocity 2 m/s, suddenly it comes in contact with infinite plate. Determine the length to which laminar flow will be there. Estimate the boundary layer thickness for the above distance. Estimate the distance from the leading edge where there will be turbulent core. (8)

b) Water is flowing from one large tank to another through a 5 cm diameter pipe. The level in tank A is 20 m above the level in tank B. The gauge pressure above the water in tank A is 0.5 Pa, and in tank B it is 2 Pa. Which direction is the water flowing? (7)

6 a) The accepted transition Reynolds number for flow in a circular pipe is $Re_{d,crit}$ = 2100. For flow through a 5 cm diameter pipe, at what velocity will this occur at 20 °C for (*a*) air flow and (*b*) water flow? (6)

b) List an example for Streamlines, Path lines, Streak lines, and Time lines. (2)

c) Stating the assumptions, derive Bernoulli's equation. (7)

PART C

Answer any two full questions, each carries 20 marks.

7 a) Draw the sketch of rotameter. (2)

b) An oil of specific gravity 0.8 is flowing through a horizontal venturimeter having (5) an inlet diameter 200 mm and throat diameter 100 mm. The oil – mercury differential manometer shows a reading of 250 mm, calculate the discharge of oil through the venturimeter. Take Cd = 0.98.

c) Estimate Kinetic Energy Correction Factor and momentum correction factor for Laminar Flow of a Newtonian Fluid. The velocity profile is give as $v(r) = v_{max}\left(1 - \frac{r^2}{R^2}\right)$ where; R is the radius of the pipe. (13)

8 a) Draw the sketch of gate valve. (2)

b) Stating the assumptions, derive the expression for flowrate in a rectangular weir. (5)

c) Explain Universal velocity distribution equation. Explain Friction factor and Reynolds number relationship. (5)

d) Stating the assumptions, derive Shear stress and Velocity distribution of laminar flow through a circular duct. (8)

9 a) Classify the joints in piping. (2)

b) Stating the assumptions, derive the expression for flowrate in an orifice meter. (5)

c) Water flows through a 2 cm diameter 10 m long horizontal pipe at a velocity 1 m/s. Find the total head loss in the system. (13)

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