Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Third semester B.Tech examinations (S) September 2020

Course Code: CE203

Course Name: FLUID MECHANICS - I

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks.

			Marks
1	a)	A U-tube differential gauge is attached to the two sections A and B in a horizontal pipe in which oil of specific gravity 0.8 is flowing. The deflection of the mercury in the gauge is 60 cm, the level nearer to A being the lower one. Calculate the difference in pressure between sections A and B.	(6)
	b)	Explain convective and local acceleration.	(4)
	c)	What is a flow net? What are its uses?	(5)
2	a)	How is the metacentric height of a body determined experimentally?	(5)
	b)	A solid cylinder of diameter 5 m has a height of 5 m. Find the metacentric height of the cylinder if the specific gravity of the material of the cylinder is 0.7 and it is floating in water with its axis vertical. State whether the equilibrium is stable or unstable.	(10)
3	a)	The velocity vector in a fluid flow is given $V = 4x^3 i — 10x^2y j + 2t k$. Find the velocity and acceleration of a fluid particle at (2, 1, 3) at time t = 1.	(10)
	b)	Describe velocity potential function and stream function.	(5)

PART B

Answer any two full questions, each carries 15 marks.

4	a)	A pipe line carrying oil of specific gravity 0.8, changes in diameter from 300 mm at a position A to 500 mm diameter at a position B, which is 5m at a higher level. If the pressure at A and B are 19.62 N/cm^2 and 14.91 N/cm^2 respectively and the discharge is 150 litres/sec, determine the loss of head and direction of flow.	(6)
	b)	A bend in a pipeline conveying water gradually reduces from 0.6 m to 0.3 m diameter and deflects the flow through an angle of 60°. At the larger end the gauge pressure is 171.675 kN/m^2. Determine the magnitude and direction of the force exerted on the bend when the flow is 876 litres/s.	(9)
5	a)	A venturimeter is used for measuring the flow of petrol in a pipeline inclined at	(9)

35° to the horizontal. The specific gravity of petrol is 0.81 and throat area ratio is 4. If the difference in mercury levels in the gauge is 50 mm, calculate the flow in litres/hour if the pipe diameter is 0.3 m. Take coefficient of discharge of veturimeter as 0.975.

b) Explain Cipolletti weir and proportional weir. (6)

6 a) A weir of length 48 m is divided into 10 equal bays by vertical posts of width 0.5 m. Calculate the discharge over the weir by using Francis formula if the head over the crest of the weir is 1.4 m and the velocity of approach is 2.5 m/s. (7)

b) An orifice in the side of a large tank is rectangular in shape 1.2 m wide and 0.7 m deep. The water level on one side of the orifice is 1.2 m above the top edge and the water level on the other side of the orifice is 0.25 m below the top edge. Compute the discharge if C_d=O.62. (7)

PART C

Answer any two full questions, each carries 20 marks.

7 a) Differentiate between hydraulic gradient line and total energy line. (4)

b) Derive the expression for loss of head for laminar flow between fixed parallel plates. Also show that the maximum velocity is 1.5 times the average velocity. (12)

c) Explain Blasius' boundary layer equations for laminar and turbulent boundary layer. (4)

8 a) What is meant by boundary layer separation? What are the methods for controlling boundary layer separation? (6)

b) Find the displacement thickness and momentum thickness for the velocity distribution in the boundary layer given by $\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - (\frac{y}{\delta})^2$ (8)

c) Explain Pressure drag, friction drag, and profile drag. (6)

9 a) An oil of viscosity 0.1Ns/m^2 and relative density 0.9 is pumped through a 32 mm diameter pipe. If the pressure drop per meter length of the pipe is 20kN/m^2, find (i) the mass flow rate (ii) maximum shear stress iii) type of flow and power required per metre length of the pipe to maintain the flow (12)

b) A flat plate 2m x 2m moves at 40km/hour in stationary air of density 1.25kg/m^3. If the coefficients of drag and lift are 0.2 and 0.8 respectively find the (i) lift force (ii) drag force (iii) resultant force and (iv) power required to keep the plate in motion (8)