Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Third semester B.Tech examinations (S) September 2020

Course Code: ME203

Course Name: MECHANICS OF FLUIDS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any three full questions, each carries 10marks. Marks

1 a) Explain absolute pressure and gauge pressure with a neat graph. (4)

b) Define Pascal's law and derive its proof. (6)

2 a) Describe what is vapour pressure? How can water boil at room temperature? (4)

b) The right limb of a simple U-tube manometer containing mercury is open to the atmosphere while the left limb is connected to a pipe in which a fluid of Sp.gr. 0.9 is flowing. The centre of the pipe is 12 cm below the level of mercury in the right limb. Find the pressure of the fluid in the pipe if the difference of mercury level in the two limbs is 20 cm. (6)

3 a) Deduce the relation between stream function and velocity potential function. (4)

b) Derive Euler's equation of motion. (6)

4 A fluid flow is given by $V= x^2y\ i + y^2z\ j – (2xyz +yz^2)\ k$, Prove that it is a case of possible steady incompressible flow. Calculate the velocity and acceleration at the point (2,1,4). (10)

PART B

Answer any three full questions, each carries 10 marks.

5 a) State Bernoulli's theorem and any two applications of it. State any one difference between a notch and weir. (6)

b) Write the Bernoulli's equation for real fluids and explain the terms in it. (4)

6 a) State the use of a venturimeter. Derive the expression for the rate of flow through the venturimeter. (6)

b) An oil of sp.gr. 0.8 is flowing through a venturimeter having inlet diameter 20 cm and throat diameter of 10 cm. the oil-mercury differential manometer shows a reading of 25 cm. Calculate the discharge of oil through the horizontal venturimeter. Take $C_d = 0.98$. (4)

7		Derive Hagen-Poiseuille equation.	(10)
8	a)	Explain the phenomenon of water hammer.	(4)
	b)	Determine the rate of flow of water through a pipe of diameter 20 cm and length 50 m when one end of the pipe is connected to a tank and other end of the pipe is open to the atmosphere. The pipe is horizontal and the height of water in the tank is 4 m above the centre of the pipe. Consider all minor losses and take coefficient of friction, f = 0.009.	(6)

PART C

Answer any four full questions, each carries 10 marks.

9	a)	Explain the following terms : i) boundary layer ii) boundary layer thickness iii) drag iv) lift	(6)
	b)	Differentiate between laminar and turbulent boundary layers	(4)
10		Define energy thickness and derive an expression for the energy thickness.	(10)
11	a)	Explain the process of separation of boundary layer with a neat sketch.	(6)
	b)	List the different methods to prevent the separation of boundary layer.	(4)
12		The efficiency η of a fan depends on density ρ, dynamic viscosity μ of the fluid, angular velocity ω, diameter D of the rotor and discharge Q. Express η in terms of dimensionless parameters.	(10)
13		Explain Froude model law and derive the scale ratio for time, acceleration and discharge using this law. List any two fluid flow problems where Froude law is applied.	(10)
14		A 7.2 m height and 15 m long spillway discharges 94 m^3/s discharge under a head of 2.0 m. If a 1:9 scale model of this spillway is to be constructed, determine model dimensions, head over spillway model and the model discharge. If a model experiences a force of 7500 N, determine the force on the prototype.	(10)

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