Reg No.:_______________ Name:__________________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: ME203

Course Name: MECHANICS OF FLUIDS (ME)

Max. Marks: 100 Duration: 3 Hours

PART A

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

1 Differentiate the following (10)
(a) Newtonian and Non Newtonian fluid.
(b) Compressible and incompressible fluid.
(c) Ideal and real fluid.
(d) Specific weight and Specific Gravity

2 A rectangular pontoon 10m long 7 m broad & 2.5m deep weights 686.7KN. It carries on its upper deck an empty boiler of 5 m diameter weighing 588.6 KN. The centre of gravity of the boiler and the pontoon are at their respective centers along a vertical line. Find the metacentric height and check the stability of the body. Weight density of sea water is 10.104 KN/m^3 (10)

3 Define the following terms (10)
i. Stream line
ii. Streak line
iii. Path line
iv. Stream tube

4 The velocity vector in a fluid flow is given by $V = 4x^3i - 10x^2yj + 2tk$. Find the velocity and acceleration of a fluid particle at (2,1,3) at time t = 1. (10)

PART B

Answer any three full questions, each carries 10 marks.

5 Find the head loss due to friction in a pipe of diameter 250mm and length 60m, through which water is flowing at a velocity of 3m/s, using (i) Darcy's formula and (ii) Chezy's formula for which C = 55 and kinematic viscosity = 0.1 stoke. (10)

6 A submarine moves horizontally in sea and has its axis below the water surface. A pitot tube is placed in front of the submarine along its axis is connected to the two limbs of a U- tube containing mercury. The difference in mercury level is found to be 170 mm. Find the speed of submarine in km/hr, knowing that specific gravity of sea water is 1.025. (10)

7 Explain briefly major and minor losses in pipe lines. (10)

8 Derive Euler's equation and hence deduce the expression for Bernoulli's Equation. State the assumptions made for such derivation. (10)

PART C

Answer any four full questions, each carries 10 marks.

9 Define momentum thickness. Derive an expression for momentum thickness. (10)

10 Find the ratio ofdisplacement thickness to momentum thickness and momentum thickness to energy thickness for the velocity distribution in the boundary layer is given by $(u/U\infty) = 2(y/\delta) - (y/\delta)^2$ (10)

11 A thin plate is moving in still atmospheric air at a velocity of 5m/s. The length of the plate is 0.6m and width 0.5m. Calculate (i) Thickness of the boundary layer at the end of the plate and (ii) drag force on one side of the plate. Take density of air as $1.25 kg/m^3$ and kinematic viscosity 0.15 stokes. (10)

12 a) State Buckingham's π theorem and mention the conditions for selecting repeating variables. (5)

b) Define the following dimensionless numbers: Reynold's number, Froude's number and Mach's number. Mention its applications in fluid flow problems. (5)

13 The pressure difference ΔP in a pipe of diameter D and length L due to turbulent flow depends on the velocity v, viscosity μ, density ρ and roughness k. Using Buckingham's π theorem, obtain an expression for ΔP (10)

14 A 1:10 scale model of a passenger car is tested in a wind tunnel. The prototype velocity is 40Kmph. If the model drag is 350N, what is the drag and the power required to overcome the drag in the prototype. Assuming the air in the model and prototype has same properties. (10)

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