Reg No.:_____   Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
THIRD SEMESTER B.TECH DEGREE EXAMINATION(R&S), DECEMBER 2019
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 U - Tube manometer is used to measure the pressure of water in a pipe line, which is in excess of atmospheric pressure. The right limb of the manometer contains mercury and the contact between water and mercury is in the left limb. Determine the pressure of water in the main line, if the difference in level of mercury in the limbs of U tube is 10 cm and the free surface of mercury is in level with over the centre of the pipe. If the pressure of water in pipe line is reduced to 9810 N/m^2, calculate the new difference in the level of mercury. Sketch the arrangement in both cases.   (10)

2   a) Differentiate between   (5)
      i.   Absolute and gauge pressure
      ii.   Piezometer and pressure gauges

   b) An open tank contains water up to a depth of 2m and above it an oil of specific gravity 0.9 for a depth of 1m. Find the pressure intensity   (5)
      i.   At the interface of the two liquids
      ii.   At the bottom of the tank

3   Differentiate the following.   (10)
      (a) Lagrangian method and Eulerian method
      (b) Steady and unsteady flow
      (c) Laminar and turbulent flow
      (d) Stream line and streak line flow.

4   An idealized flow is given by $V = 2x^3i – 3x^2yj$. Is the flow steady or unsteady ? Is it 2D or 3D ?Make calculations for the velocity, local acceleration and convective acceleration of a fluid particle in the flow field at the point (2,1,3).   (10)

PART B
Answer any three full questions, each carries 10marks.

5   Derive Darcy -Weisbach equation for head loss due to friction.   (10)

6   A pipe carrying water has a 30 cm x 15 cm venturimeter which is positioned inclined at 30° to the horizontal, the flow being upwards. The converging cone is 45 cm in length and the co-efficient of discharge of the meter is 0.98. A differential U tube manometer with mercury as indicating fluid is connected to the inlet and to the throat and shows a differential column height of 30 cm.
Calculate the discharge in the pipe
If the pressure at inlet section is 50 kPa, determine the pressure at the throat.
And the head loss in the converging section of the venturimeter.   (10)

7   Water is flowing through a taper pipe of length 100 mm having diameters 600 mm at the upper end and 300 mm at the lower end, at the rate of 50 liters/s. The   (10)

         pipe has a slope of 1 in 30. Find the pressure at the lower end if the pressure at the higher level is 19.62 N/cm^2.

8   Obtain the condition for maximum power transmission through pipes and corresponding efficiency of transmission.   (10)

PART C
Answer any four full questions, each carries 10marks.

9   Define displacement thickness. Derive an expression for the displacement thickness.   (10)

10   Find the displacement thickness, the momentum thickness and energy thickness   (10)

         for the velocity distribution in the boundary layer given by

         $(u/U\infty) = 2(y/\delta) - (y/\delta)^2$

11   What is meant by boundary layer separation? What are the different methods of preventing boundary layer separation?   (10)

12   The resisting force R of supersonic plane during flight can be considered as dependent upon the length of the aircraft L, velocity V, air viscosity μ , air density ρ and bulk modulus of air K. Express the functional relationship between these variables and the resisting force by using Buckingham's theorem   (10)

13   Define the following   (10)
             i.   Reynold's Number.
            ii.   Froude's Number.
           iii.   Euler's Number.
           iv.   Weber's Number.
            v.   Mach's Number.

14   The pressure drop in an aeroplane model size 1/40 of its prototype is 80 N/cm^2. The model is tested in water. Find the corresponding pressure drop in the prototype take density of air = 1.24kg/m^3. The viscosity of water is 0.01 poise while the viscosity of air is 0.00018 poise.   (10)

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