R15

Code No: 5221AC

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech I Semester Examinations, February - 2016
ADVANCED FLUID MECHANICS
(Thermal Engineering)

Time: 3hrs **Max.Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

5 × 5 Marks = 25

1.a) Compare streak line and stream tube. [5]
b) Explain Hagen Poisoulle flow. [5]
c) Differentiate local and mean drag coefficients. [5]
d) Explain K – ∈ Model. [5]
e) Describe Fanno and Raleigh's line. [5]

PART - B

5 × 10 Marks = 50

2.a) Distinguish between rotational flow and irrotational flow.
b) For velocity components, u = aysinxy; v = axsinxy. Obtain the expression for the velocity potential. [5+5]

OR

3.a) Explain compressible and incompressible fluids.
b) A closed cylindrical vessel of 15 cm dia. and length 100 cm contains water upto a height of 80 cm. the vessel is rotated at 500 rpm about its vertical axis. Find the height of the parabolaid formed. [5+5]

4.a) What is Hagen Poisoulle's formula and derive it.
b) A pipe of 20 cm dia. and length 10000 m is laid at a slope of 1 in 200. An oil of sp. Gravity 0.9 and viscosity 1.5 poise is pumped up at the rate of 20 liters per second. Find the head lost due to friction. Also calculate the power required to pump the oil. [5+5]

OR

5.a) Derive an expression for the loss of head of a viscous fluid flowing through a circular pipe.
b) The viscosity of oil of sp. Gravity 0.8 is measured by a capillary tube of dia. 40 mm. the difference of pressure head between the points 1.5 m apart is 0.3 m of water. The mass of oil collected in a measuring tank is 40 kg in 120 seconds. Find the viscosity of the oil. [5+5]

6.a) Derive an expression for boundary shear stress in terms of momentum thickness.

b) For the velocity profile for laminar boundary layer $\frac{u}{v}=\frac{3}{2}\left(\frac{y}{\delta}\right)-\frac{1}{2}\left(\frac{y}{\delta}\right)^2$. Calculate the boundary layer thickness, shear stress, drag force and coefficient of drag in terms of Reynold number. [5+5]

OR

7.a) Derive Von Karman momentum integral equation for boundary layer and explain.

b) Find the displacement thickness, the momentum thickness and energy thickness for the velocity distribution in the boundary layer by $\frac{u}{v}=2\left(\frac{y}{\delta}\right)-\left(\frac{y}{\delta}\right)^2$. [5+5]

8.a) Explain the velocity distribution in turbulent flow in pipes.

b) A rough pipe is of 8 cm dia. The velocity at a point 3 cm from wall is 30% more than the velocity at a point 3 cm pipe wall. Determine the average height of roughness. [5+5]

OR

9.a) Explain the resistance of smooth and rough pipes.

b) Water is flowing through a rough pipe of 500 mm dia. and 4000 m length at the rate of 0.5 m^3/s. Find the power required to maintain this flow. Take the average height of roughness as k = 0.40 mm. [5+5]

10.a) Derive the equation for stagnation temperature and stagnation pressure.

b) Calculate the stagnation pressure, temperature and density at the stagnation point on the nose of a plane, which is flying at 800 KMPH through still air having a pressure 8 N/cm^2 (abs.) and at -10^0C. R = 287 J / kgs; K=1.4. [5+5]

OR

11.a) Explain the flow of compressible fluid through orifices and nozzles fitted to a large tank.

b) A projectile travels in air of pressure 9 N/cm^2 at -10^0C at a speed of 1200 kmph. Find the Mach Number and the Mach angle. K = 1.4; R = 287 j/kg K. [5+5]

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