Code No: 5621AB

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech I Semester Examinations, January - 2020

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) Explain the terms stream line, path line and streak line. [5]
b) Write a note on Plane Poisoulle flow. [5]
c) Define displacement thickness and energy thickness. [5]
d) Explain briefly about boundary layer control. [5]
e) Explain about Fenno and Releigh lines. [5]

PART - B **5 × 10 Marks = 50**

2.a) Distinguish between lagrangian and Eularian method of describing fluid motion.
b) The diffuser a wind tunnel linearly increases the diameter of the tunnel section from 1m to 2m in a length of 3m. if the rate of flow of air through the tunnel uniformly increases from 20 m^3/s at t=0 to 100 m^3/s at t=5 sec, find the total acceleration when t=0 at a section where the diameter of the diffuser is 1.75m. [5+5]

OR

3. Derive three dimensional continuity equation and its significance. [10]

4. The fixed parallel plates kept at 80mm apart have laminar flow of oil between them with a maximum velocity 1.5 m/s. Taking dynamic viscosity of oil to be μ = 19.62 poise, calculate:
a) The discharge per metre width
b) The shear stress at the plates
c) The pressure difference between two points 25m apart
d) The velocity at 20mm from the plate and
e) The velocity gradients at the plates end. [10]

OR

5. Derive the velocity distribution for Hagen- poisenelli flow and show that for Laminar flow in a circular pipe, the friction factor F = 16/R where R is the Reynolds number. [10]

6. A plate of length 500 mm and width 200 mm has been placed longitudinally in a stream of crude oil which flows with a velocity of 6 m/sec. if the oil has a specific gravity of 0.9 and kinematic viscosity of 1 stoke. Calculate the boundary layer thickness at the middle of the plate, shear stress at the middle of the plate and friction drag on one side of the plate. [10]

OR

7.a) How will you determine whether a boundary layer flow is attached flow, detached flow or on the verge of separation?

b) Write short note on "Boundary layer in transition". [5+5]

8.a) Explain the concept of prandtl's mixing length theory.

b) Water is flowing through a pipe of diameter 40 cm. the flow is turbulent. If the velocities at the pipe centre and 50 mm from the centre are 5m/s and 4 m/s respectively, find the wall shear stress. [5+5]

OR

9.a) Derive expression for thickness of boundary layer shear stress and friction drag for turbulent boundary layer.

b) Explain the phenomenon of Karman Vortex Trail. [5+5]

10.a) What is stagnation state? Derive the expression for pressure, density and temperature at stagnation point.

b) Derive Bernoulli's equation for compressible fluid flow both for isothermal and adiabatic processes. [5+5]

OR

11.a) Derive area velocity relationship for compressible flow.

b) Air flows through enlarging taper the temperature, pressure and velocity at upstream section are -3^0c, 75 kpa (abs) and 80 m/s respectively. The area of cross section is 120 cm^2. What would be the area at the downstream section to give a pressure of 150 kpa(abs). What is the temperature at this section? Calculate the Mach numbers at the two sections. Take R = 287 J/Kg.K. and $\gamma = 1.4$ for air. [5+5]

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