Code No: 5421AC

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech I Semester Examinations, June/July - 2018
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 streak line and stream tube. [5]
b) Explain about Hagen Poisoulle flow. [5]
c) Explain about Boundary layer thickness for flow over a flat plate. [5]
d) Write short notes on k-epsilon model. [5]
e) Explain sonic velocity and mach number. [5]

PART - B

5 × 10 Marks = 50

2.a) What is a stream tube? What are its characteristics? Derive three dimensional continuity equation and its significance.
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 80 m^3/s at t=4 sec, find the total acceleration when t=0 at a section where the diameter of the diffuser is 1.75m. [5+5]

OR

3. Write down the Euler's equation of motion in the three coordinate directions and hence derive the Bernoulli's equation. [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.a) Derive the expression for discharge and mean velocity in plane poisueille flow.
b) Find the average Velocity, the energy correction factor, and the momentum correction factor, for the following velocity profile in a circular pipe. $V = V_m [1- (r/R)^2]$ where V is the velocity at any radius r. V_m is the velocity at the pipe axis. And R is the radius of the pipe. [5+5]

6.a) Derive the Von karman's momentum integral equation as applied to boundary layer flows.

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

OR

7.a) Explain the phenomenon of boundary layer separation and its influence on the drag of an immersed body.

b) The velocity distribution in the turbulent boundary layer over a flat plate is given as $u/U = (y/\delta)^{1/5}$. Obtain the expression for the displacement thickness and momentum thickness. [5+5]

8.a) What do you mean by prandtl mixing length theory? Find an expression for shear stress due to prandtl.

b) A rough pipe of 10cm diameter carries water at the rate of 5800 lpm. The average height of roughness is 0.19 mm. find the shear velocity and maximum velocity. [5+5]

OR

9. Write short notes on:
a) Moody's diagram b) Approximate solutions for drag coefficients. [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 Rankine – Hugoniot equations for oblique shock wave.

b) Air approaches a symmetrical wedge ($\delta=20^0$) at a mach number of 1.8. Determine for the strong and weak waves i) wave angle ii) pressure ratio, iii) density ratio, iv) temperature ratio and v) downstream Mach number. Verify these values using Gas tables for normal shocks. [5+5]

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