QP Code: RO20MTECH187 Reg. No | | | | | | | | | | | AR 19

GIET UNIVERSITY, GUNUPUR – 765022

M. Tech (Second Semester Examinations) – October' 2021

MPCTE2020 – Advanced Fluid Mechanics

(Heat Power and Thermal Engineering)

Time: 2 hrs Maximum: 50 Marks

(The figures in the right hand margin indicate marks)

PART – A

Q.1. Answer ***ALL*** questions (2 x 10 = 20)

a. Why dynamic viscosity of gas increases with increase of temperature.

b. Differentiate between wall turbulence and free turbulence.

c. Explain the concept of boundary layer of a flowing of fluid.

d. What is body force and surface force?

e. Define momentum thickness.

f. What are the different form of energy in a flowing fluid?

g. Differentiate between Poiseuille flow and Couetee flow.

h. Define vorticity and circulation.

i. For a hydrostatic fluid, show that the thermodynamic pressure is equal to hydrostatic pressure.

j. If the symmetric and anti-symmetric tensor are given as A_{ij} and S_{ij} , show that $A_{ij}\, S_{ij} = 0$.

PART – B **(6 x 5 = 30 Marks)**

Answer ***ANY FIVE*** questions Marks

2. Derive Prandtl boundary layer equation for steady two dimensional incompressible flow. Explain the significance of Prandtl boundary layer equation in comparison with Navier-Stokes equation. (6)

3. For two dimensional flow $\phi = 3xy \; and \; \psi = (3/2)(y^2\text{-}x^2)$. Determine the velocity component at the points (1,3) and (3.3) . Also find the discharge passing between the streamlines passing through the points given above. (6)

4. In a hydro dynamically rough pipe of diameter 30 cm having turbulent flow, the center line velocity is 5 m/s and the local velocity at 15 cm from the pipe center is 2.5 m/s. Find the discharge and the height of the roughness projection. (6)

5. Derive the expression for fully developed laminar flow between two infinite parallel plate. (6)

6. Water at 80^0C flow between two large flat plates. The lower plate moves at a speed of 0.9 m/s. The plate spacing is 7 mm and flow is laminar. Determine the pressure gradient required to produce zero net flow at the cross- section. $(\mu)_{wat} = 4.9 \text{ X } 10^{-4}$ Ns/m^2 (6)

7. A fully developed laminar flow is taking place in the annulus between two concentric pipes. The inner pipe is stationary, and the outer pipe is moving in the axial direction with velocity Vo. Assume the axial pressure gradient to be zero. Find out the general expression for shear stress as a function of radial coordinate. Also find out the general expression for the velocity profile (6)

8. Write short notes on the following: (6)

   i. Oseens approximation for slow viscous flow
   ii. Theory of hydro dynamic lubrication

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