GIET MAIN CAMPUS AUTONOMOUS,
GUNUPUR - 765022

Registration No: | | | | | | | | | | | **M.TECH**

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M.TECH 1ST SEMESTER SUPPLE EXAMINATIONS, DECEMBER 2018

ADVANCED FLUID MECHANICS

Branch: TE, Subject Code:MTEPC1010

(Regulations 2017)

Time: 3 Hours **Max Marks : 70** **Question Code: SD18002012**

PART-A (10 X 2=20 Marks)

1. Answer the following questions.
   a. What is uniform flow?
   b. Define vorticity and circulation with diagram.
   c. Write an equation of continuity for incompressible flow in two dimensions.
   d. Write down the differential form of Euler equation with neat diagram.
   e. Define momentum thickness.
   f. Write the formula for head loss by fluid friction on solid surface and show that thermodynamic pressure is equal to hydrostatic pressure.
   g. Differentiate between wall turbulence and free turbulence.
   h. What is friction factor in a laminar flow.
   i. What do you mean by Heimenz flow.
   j. Differentiate between Poiseuille flow and couetee flow

PART-B (5 X 10=50 Marks)

Answer any five questions from the following.

2.a) A flow field is given by $V = x^2yi + y^2zj - (2xyz+yz^2)k$. Prove that it is a case of possible steady incompressible fluid flow. Calculate the velocity and acceleration at the point (2,1,3) [5]

b) Prove that the continuity equation in a three dimensional Cartesian coordinate is given by [5]

$$\frac{\partial}{\partial t}(\rho) + \frac{\partial}{\partial x}(\rho u) + \frac{\partial}{\partial x}(\rho v) + \frac{\partial}{\partial x}(\rho w) = 0$$

3 a)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. [7]

b) What do you mean by closure of turbulence? [3]

4.a) Derive the expression for fully developed laminar flow between two infinite parallel plate. [5]

b) What is the basic difference between Eulers equation of motion and Navier Stokes equation. [5]

5 a) Write short notes of the following. (i) homogeneous turbulence, (ii) isotropic turbulence, and (iii) intensity of turbulence. [5]

b) Write Reynolds stress matrix for turbulent flow and write the expressions for individual components in a three dimensional flow field. [5]

6 a) 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. [5]

b) Explain stress tensor and rate of deformation tensor. [5]

7 a) Air moves over a flat plate with a uniform free stream velocity 10 m/s. At position 15 cm front edge of the plate calculate the boundary layer thickness. Use a parabolic profile $\frac{u}{U\infty}$ = $a+by+cy^2$ [5]

Having boundary condition y = 0 u =0

Y= δ u = U_∞

Y= δ $\frac{\partial u}{\partial y} = 0$

For air $\nu = 1.5 X10^{-5}$ m^2/s and $\rho = 1.23$ kg/m^3

b) Derive a relation for universal velocity distribution law and friction factor in ducts flow for very large Reynolds number. [5]

8. Write short notes on the following
   a) stationary turbulence [5]
   b) translation of flow [5]

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