GANPAT UNIVERSITY

B.Tech.Semester IV (CIVIL), Regular Examination(CBCS) --May /June : 2013

2CI-405 FLUID MECHANICS -II

Max.Time: 3 Hours | Max. Marks: 70

Exam. No. of the candidate: _____ | Supervisor's dated initial: _____

Instructions: - (1) Answer to the two sections must be written in **separate** answer books.

(2) Figures to the **right** indicate **full** marks.

(3) Assume suitable data if required.

Section - I

Q.1 (A) What is dimensional analysis? Explain Buckingham's π theorem (6)

(B) The resistance R to the completely submerged body depends on the length of the body L, velocity of flow V, mass density of fluid ρ , and kinematic viscosity v. By dimensional analysis prove that (6)

$$R = \rho v^2 L^2 \varphi[\frac{VL}{v}]$$

OR

Q.1 (A) Define:1) Laminar boundary layer 2) Turbulent boundary layer and derive an expression for Energy Thickness. (6)

(B) A thin plate is moving in still atmospheric air at a velocity of 4 m/s .The length of the plate is 0.5m and width 0.4 m. Calculate the 1) thickness of the boundary layer at the end of plate and 2) drag force on one side of the plate. Take density of air as 1.25 Kg/m^3 and kinematic viscosity 0.15 stokes. (6)

Q.2 (A) What do you mean by separation of boundary layer? What is the effect of pressure gradient on boundary layer separation? (5)

(B) For the velocity profile in laminar boundary layer given as

$$\frac{u}{U} = \frac{3}{2}(y/\delta) - \frac{1}{2}(y/\delta)^3,$$

Find the thickness of the boundary layer and shear stress 1.8 m from the leading edge of a plate. The plate is 2.5 m long and 1.5 m wide is placed in water which is moving with a velocity of 15 cm/s. Find the drag on one side of the plate if the viscosity of water = 0.01 poise.

OR

Q.2 (A) Explain the term :(1) Slope of the bed,(2)Hydraulic mean depth and (3) Wetted perimeter. (6)

(B) Find the discharge through a rectangular channel 3m wide, having depth of water 2m and bed slope as 1 in 1500. Take the value of K=2.36 in Bazin's formula. (5)

Q.3 (A) Derive "Von Karman momentum integral" equation. (4)

(B) Explain Rayleigh's theorem for dimensional analysis. (4)

(C) Derive equation for dimensionless number (1) Reynolds (2) Froude (4)

Section - II

Q.4 (A) Define: 1) Isothermal Process 2) Adiabatic Process 3) Universal Gas Constant. (6)

(B) The following cases represents the two velocity components, determined the third component of velocity such that they satisfy the continuity equation. (6)
(1) $U = 4x^2, V = 5xyz$ (2) $U = 5x^3 + 4xy, W = z^2 - 4xy - 3yz$

OR

Q.4 (A) Derive an expression for Shear stress distribution velocity distribution, Maximum velocity, Ratio of Maximum and Average Velocity, and Drop of pressure head for viscous flow passing through two stationary parallel plates. (8)

(B) A capillary tube of dia. 4mm & length 150mm is used for measuring viscosity of liquid. The difference of pressure between the two ends of the tube is 0.4878N/cm^2 & the viscosity of the liquid is 0.2 poise. Find the rate of flow of liquid through the tube. (4)

Q.5 (A) What do you mean by Prandtl mixing length theory? Derive an expression for shear stress due to Prandtl? (6)

(B) A smooth pipe 100mm in diameter and 1000m long carries water at rate of 0.075 m^3/sec .If the Kinematic viscosity of water is 0.02 stokes. Calculate,(1) Head lost, (2)Wall shearing stress, (3)Centre line velocity, (4) Shear stress and velocity at 40mm from the centre line and (5) Thickness of the Laminar sub layer. (5)

OR

Q.5 (A) Derive continuity equation in cylindrical polar co-ordinates. (6)

(B) The velocity vector in a fluid flow is given by V= $2x^4i - 5x^3yj + 4tk$. Find the velocity & acceleration of a fluid particle at (1,1,3) at time, t=2 (5)

Q.6 (A) Write short note on : " Hydro dynamically Rough Pipes" (4)

(B) Obtain an expression for the co efficient of friction in terms of shear stress. (4)

(C) Write short note on "Capillary Tube Viscometer" (4)

"END OF PAPER"