Printed Pages : 4

TCE301

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 4070 Roll No.

B.Tech

(SEM III) ODD SEMESTER THEORY EXAMINATION 2009-10

FLUID MECHANICS

Time : 3 Hours] *[Total Marks : 100*

Note : (1) *Attempt **all five** questions.*

(2) *The figures on the right hand side indicate marks.*

(3) *Missing data if any, may suitably be assumed.*

(4) *Be precise in your answers.*

1 Attempt any **two** parts : $10\times2=20$

(a) Differentiate between :

(i) Stability conditions for immersed and floating bodies.

(ii) Absolute, Gauge, Atmospheric and Vacuum pressure using sketch also give the relation between them.

(b) What is the difference between Eulerian and Langrangian approach ? Define Manometers.

(c) A pipe tapers from 250 mm to 125 mm when the rate of flow of the liquid in the pipe is 2400 lit/min. Calculate the average velocity of flow at the two sections.

2 Attempt any **four** parts : 5×4=20

(a) What is continuum ? Some insects walk on water ? Why ?

(b) Define centre of Buoyancy and Metacentre.

(c) An oil of specific gravity 0.9 and viscosity 10 poise is flowing through a pipe of diameter 110 mm. The velocity at the centre is 2 mtr. Find the pressure gradient in the direction flow and shear stress at the pipe wall.

(d) Prove stream function (ψ) and potential function (ϕ) are orthogonal to each other.

(e) What are the similarity laws ? What is their importance in model testing ?

(f) One litre crude oil weighs 9.6 N. Calculate its specific gravity, density and specific weight.

3 Attempt any **two** parts : 10×2=20

(a) A two dimensional flow is described by the velocity components $\mu = 5x^3$ and $V = -15x^2y$. Evaluate the stream function velocity and acceleration at point $p(x = 1 \text{ mtr}, y = 2 \text{ m})$.

(b) State the momentum equation and what is the difference between pitot tube and pitot static tube ?

(c) (i) Derive the expression for the path travelled by a free jet out of a nozzle.

(ii) A 1 : 75 model of a submarine is tested in water. What is the speed of the model to simulate a speed of 3 m/sec of the submarine ?

4 Attempt any **two** parts : 10×2=20

(a) A pipe bend of 400 mm at the inlet and 200 mm at the outlet turns the flow of water through 120° in a vertical plane. The flow through the bend is 200 lit/sec. and the pressure at the inlet is horizontal and the exit is 1.2 mtr below the entrance section. If the volume of the bend is 0.18 m^3 determine the force exerted on the bend.

(b) (i) Prove that laminar flow through a circular pipe, momentum correction factor $\beta = 4/3$.

(ii) Differentiate between stream lines body and bluffy body.

(c) State Buckingham's π – theorem. What are repeating variables ? Why this theorem is considered superior over Rayleigh's method for dimensionless analysis ?

5 Attempt any **two** parts : **10×2=20**

(a) A metallic sphere of sp. gr. 7.0 falls an oil of density 800 kg/m^3. the diameter of the sphere is 8 mm and it attains a terminal velocity of 40 m/s. Find the viscosity in poise.

(b) (i) Define and discuss hydraulic gradient and total energy lines with figure.

(ii) Water flows through a pipe of diameter 120 mm. The velocities at the pipe axis and 40 mm from the pipe axis are 4 m/s and 3 m/s respectively. Determine the wall shear stress.

(c) Define displacement thickness. Derive an expression for momentum thickness for boundary layer flow.