



Printed Pages : 4

TCE301

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

PAPER ID : 4070

Roll No.

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## 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 : 10×2=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 ( $\psi$ ) and potential function ( $\phi$ ) 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  $u = 5x^3$  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  $120^\circ$  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  $0.18 \text{ m}^3$  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 bluff body.
- (c) State Buckingham's  $\pi$ -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 in an oil of density  $800 \text{ kg/m}^3$ . 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.
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