



SE-6571

B. E. - II (Sem. IV) (Mech.) Examination

May / June - 2011

Fluid Mechanics

Time : Hours]

[Total Marks : 70

Instructions : (1)

नीचे दशांशों के निशानों वाली विगतो उत्तरवही पर अवश्य लिखनी।  
Fillup strictly the details of signs on your answer book.

Name of the Examination :  
B. E. - 2 (SEM. 4) (MECH.)

Name of the Subject :  
Fluid Mechanics

Subject Code No. : 6 5 7 1 Section No. (1, 2.....) : NIL

Seat No. :

Student's Signature

(2) Attempt all questions.

(3) Make suitable assumptions wherever necessary.

(4) Figure to the right indicate full marks.

1 (A) Attempt multiple choice questions. (20)

1. For turbulent flow in smooth pipes, the entrance length is taken as -

- 20
- 50
- 80
- 115.

2. Measurement of velocity without any obstruction to the flow in a pipe may be made by -

- Pitot static probe
- Hot wire anemometer
- Hot film anemometer
- Laser Doppler anemometer.

3. Loss of head at exit of a pipe is given as -

- $\frac{v^2}{2g}$
- $\frac{v^2}{g}$
- $\frac{g}{v^3}$
- $\frac{g}{v^3 \cdot 2g}$

4. A boundary layer –
  - a. May exist near a solid boundary only
  - b. May exist near any boundary or wall
  - c. May not exist for some fluids
  - d. May or may not grow along the direction of flow.
5. In which of the following measuring devices Bernoulli's equation is used:
  - a. Venturimeter
  - b. Orifice meter
  - c. Pitot tube
  - d. All of the above.
6. A control volume implies –
  - a. An isolated system
  - b. A closed system
  - c. A specified mass in a fluid flow
  - d. A fixed region in space
7. The flow of a fluid is sure to be laminar when –
  - a. The fluid is ideal
  - b. The fluid is viscous
  - c. The Reynolds number is less than a critical value
  - d. The velocity of fluid is more than a critical value
8. A pipe is said to be siphon if –
  - a. It can operate without external power
  - b. It can discharge a liquid at a fast rate
  - c. It has sub atmospheric pressure in it
  - d. The exit is at a lower level than the inlet.
9. In case of a closed cylindrical vessel sealed at the top and the bottom the volume of air before rotation is ..... the volume air after:
  - a. More than
  - b. Less than
  - c. Equal to
  - d. None of above.
10. The maximum velocity in a circular pipe when flow is laminar occurs at
  - a. The top of the pipe
  - b. The bottom of the pipe
  - c. The centre of the pipe
  - d. Not necessarily at the centre.

**2 Attempt any Two**

- (A) Define – 1. Boundary Layer Thickness  
2. Displacement Thickness  
3. Momentum Thicknes.
- (B) Derive Euler's equation of motion.
- (C) Expain – Laminar flow through an annulus.
- (D) Explain:
  1. Co-efficient of velocity ( $C_v$ )
  2. Co-efficient of contraction ( $C_c$ )
  3. Co-efficient of discharge ( $C_d$ )

**(15)**

**3 Attempt any Two****(15)**

- (A) Pipeline carrying water has surface protrusions of average height of 0.10 mm. If the shear stress developed is  $8.2 \text{ N/m}^2$ . Determine whether the pipe surface acts as smooth, rough or in transition. For water take  $\rho=1000 \text{ Kg/m}^3$  and kinematic viscosity  $\nu=0.0093$  stokes.
- (B) Water is flowing through a pipe having diameters 600 mm and 400 mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is  $350 \text{ kN/m}^2$  and the pressure at the upper end is  $100 \text{ kN/m}^2$ . Determine the difference in datum head if the rate of flow through the pipe is 60 litres/s. (Sp. gravity,  $\gamma = 9.81 \text{ kN/m}^3$ )
- (C) A submarine can be assumed to have cylindrical shape with rounded nose. Assuming its length to be 50 m and diameter 5.0 m, determine the total power required to overcome boundary friction if it cruises at 8 m/s velocity in sea water at  $20^\circ \text{ C}$ , For sea water take  $\rho=1030 \text{ Kg/m}^3$  and kinematic viscosity  $\nu=1 \times 10^{-6} \text{ m}^2/\text{s}$
- (D) A rough plastic pipe 500 mm in dia meter and 300 m in length carrying water with a velocity of 3 m/s, has an absolute roughness of 0.25 mm and a kinematic viscosity of 0.9 centistokes,
- Is the flow turbulent or laminar?
  - What is the head lost in friction?

$$\text{For turbulent flow } \frac{1}{\sqrt{f}} = 2 \log_{10} \frac{R}{k} + 1.74$$

**4: Attempt any Three .****(15)**

1. The drag force on a smooth sphere is found to be affected by the velocity of flow  $u$ , the diameter  $D$  of the sphere and the fluid properties density  $\rho$  and viscosity  $\mu$  using dimensional analysis. Obtain the dimension groups to correlate the parameters used M,L,T Dimension set.
2. An isoscaler triangular plate of the base 3 meter and altitude 3 meter is immersed vertically on an oil of specific gravity of 0.8. the base of plate coincide with free surface of oil, determine. (1) total pressure on plate (2) center of pressure.
3. In a three dimensional incompressible flow, the velocity components in y and z directions are  $V=3x^3-9y^2+2z^2x$ . find the velocity component in x direction such that the continuity equation is satisfied.
4. The dynamic viscosity of an oil used for lubrication between a shaft and sleeve is 6poise. the shaft is of diameter of 0.4 meter and rotates at 190 rpm. Calculate the power lost in the bearing for a sleeve length of 90 mm. the thickness of film is 1.5 meter.

**5(A) Explain the terms. (any five) (10)**

1. Pascal's law 2. Metacentric height 3. Ideal fluid 4. Capillarity 5. Specific gravity 6. Flow net 7. Viscosity

**5 (B) Derive an expression for continuity for two dimensional flow & deduce steady incompressible two dimensional flow. (5)**

**OR**

**5(B). Explain capillarity. Derive the equation for the capillary rise. (5)**

**6: Attempt any Four. (20)**

1. Write various methods of determination of coefficient of viscosity & explain any one of it.
  2. Explain stability of floating body.
  3. Explain surface tension. derive the equation for surface tension on a liquid jet and liquid droplet.
  4. Derive Eulers equation of motion along a stream line.
  5. Write note on Dimensional Analysis.
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