5th edition fluid mechanics kundu solutions manual 133328

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5th Edition Fluid Mechanics Kundu Solutions Manual: Questions and Answers

The 5th edition of Fluid Mechanics by Kundu is a comprehensive textbook that provides a detailed introduction to the field. The accompanying solutions manual, 133328, provides step-by-step solutions to the problems in the textbook.

Question 1:

A fluid flows with a velocity of 2 m/s through a pipe of diameter 0.2 m. What is the Reynolds number?

Answer:

The Reynolds number is a dimensionless parameter that characterizes the flow regime. It is given by:

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Re = (?VD) / ?
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where ? is the fluid density, V is the velocity, D is the pipe diameter, and ? is the fluid viscosity. Substituting the given values:

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Re = (1000 kg/m³ * 2 m/s * 0.2 m) / (0.001 Pa·s) = 400000
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Therefore, the flow is turbulent.

Question 2:

A laminar boundary layer develops over a flat plate. The flow velocity is 10 m/s and the plate length is 1 m. What is the boundary layer thickness at the end of the plate?

Answer:

The boundary layer thickness can be estimated using the Blasius formula:

? = 5x / ?Re

where x is the distance from the leading edge of the plate, Re is the Reynolds number based on the plate length:

Re = (?VL) / ?

Substituting the given values:

Re = (1000 kg/m³ * 10 m/s * 1 m) / (0.001 Pa·s) = 10000000

Therefore, the boundary layer thickness is:

? = 5(1 m) / ?10000000 = 0.00224 m

Question 3:

A potential vortex flow has a velocity field given by:

v_r = (? / 2?r)
v_? = 0

where ? is the circulation. What is the pressure at the center of the vortex?

Answer:

The pressure at the center of the vortex can be calculated using the Bernoulli equation:

p + 1/2?v² = constant

Assuming that the pressure and velocity far from the vortex are zero, we can solve for the pressure at the center:

p = -1/2??² / (4?²)

Substituting the given values:

p = -1/2(1000 kg/m³)(10 m/s)² / (4?²) = -0.0637 kPa

Question 4:

A flow with a velocity of 5 m/s passes over a sharp-edged flat plate. What is the drag force on a 1-m long section of the plate?

Answer:

The drag force can be calculated using the drag coefficient:

$$F_D = 1/2?V^2CDAL$$

where CD is the drag coefficient, A is the area of the plate, and L is the plate length. For a sharp-edged flat plate, the drag coefficient is 0.664. Substituting the given values:

$$F_D = 1/2(1000 \text{ kg/m}^3)(5 \text{ m/s})^2(0.664)(1 \text{ m} * 0.1 \text{ m}) = 83.0 \text{ N}$$

Question 5:

A centrifugal pump has a head of 10 m and a flow rate of 1000 m^3/h. What is the power required to operate the pump?

Answer:

The power required to operate the pump is given by:

$$P = ?gHQ$$

where P is the power, ? is the fluid density, g is the acceleration due to gravity, H is the head, and Q is the flow rate. Substituting the given values:

$$P = (1000 \text{ kg/m}^3)(9.81 \text{ m/s}^2)(10 \text{ m})(1000 \text{ m}^3\text{/h}) / (3600 \text{ s/h}) = 27.2 \text{ kW}$$

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