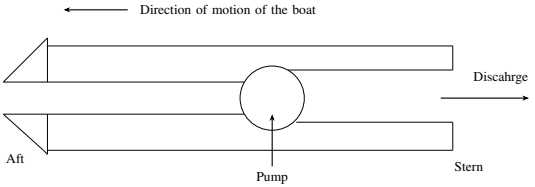
2012-XE-'40-52'

EE24BTECH11009-Mokshith

Common Data for Questions 19 and 20: A boat is propelled in still water at a velocity of $5m/s$ by taking water at the rate of $1m^3/s$ from the aft side and discharging it through the stern using a pump, as shown in the figure below. The velocity of the discharge jet relative to the boat is $9m/s$. The effect of pressure at the intake and discharge can be neglected. The density of water may be taken as $1000kg/m^3$.

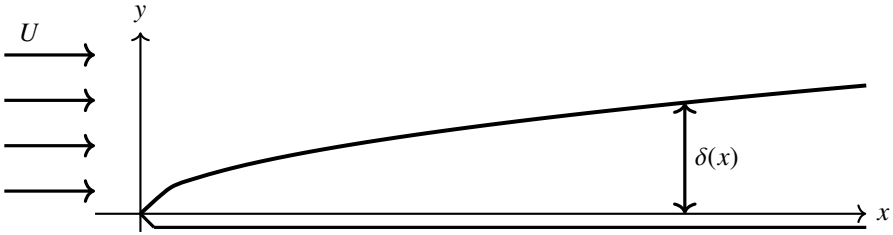


19) The power (inkW) required to propel the boat is
   a) 10
   b) 20
   c) 50
   d) 90

20) The total kinetic energy imparted to the water per second (inkW) by the pump is
   a) 10
   b) 25
   c) 28
   d) 81

Linked Answer Questions

Statement for Linked Answer Questions : The hydrodynamic boundary layer over a flat plate is shown in the figure below. The velocity in the x-direction is approximated as $u = a + by + cy^2$, where a, b and c are constants. U is the free stream velocity and δ is the boundary-layer thickness at any point x on the plate.



21) The dimensionless velocity profile is
   a) $\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$

b) $\frac{u}{U} = 2\left(\frac{y}{\delta}\right) + \left(\frac{y}{\delta}\right)^2$

c) $\frac{u}{U} = 1.5\left(\frac{y}{\delta}\right) - 0.5\left(\frac{y}{\delta}\right)^2$

d) $\frac{u}{U} = 1.5\left(\frac{y}{\delta}\right) + 0.5\left(\frac{y}{\delta}\right)^2$

22) The displacement thickness (inmm) when $\delta = 6mm$, is

a) 2.25
b) 2
c) -2
d) -2.25

C : MATERIALS SCIENCE

1) Which of the following is NOT a Bravais lattice?

a) Simple tetragonal
b) Body centred tetragonal
c) Base centred orthorhombic
d) Face centred tetragonal

2) A Schottky defect in an ionic crystal is a stochiometric defect of

a) Cation vacancy
b) Anion vacancy
c) Cation and anion vacancy
d) Cation and anion interstitial

3) Which of the following techniques is NOT used to grow single crystals of semiconductors?

a) Calendering
b) Czochralski
c) Float zone
d) Bridgman

4) Which of the following signals is produced due to the elastic scattering of electrons by a material?

a) Secondary electron
b) Backscattered electron
c) Auger electron
d) Photoelectron

5) The best magnetostrictive material is

a) $Nd_2Fe_{14}B$
b) Fe_3O_4
c) Cu_2MnAl
d) $ZnFe_2O_4$

6) Of the following materials, which is the most suitable for an LED emitting at around 380nm?

a) Direct bandgap material with a small bandgap
b) Indirect bandgap material with a large bandgap
c) Direct bandgap material with a large bandgap

d) Indirect bandgap material with a small bandgap

7) Which material has the lowest specific heat capacity at room temperature?
   a) Water
   b) Mercury
   c) Copper
   d) Silver

8) Microstrain can be measured by *X*-ray diffraction using peak
   a) Area and intensity
   b) Position and area
   c) Broadening and intensity
   d) Position and broadening

9) The Pilling-Bedworth ratio is defined as the ratio of
   a) Volume of oxide to volume of metal
   b) Weight of oxide to weight of metal
   c) Density of oxide to density of metal
   d) Surface area of oxide to surface area of metal