2020-GATE-AE

AI24BTECH11016 - Jakkula Adishesh Balaji

1 14-26

1) Which of the following statements is true about the effect of increase in temperature on dynamic viscosity of water and air, at room temperature?
   a) It increases for both water and air.
   b) It increases for water and decreases for air.
   c) It decreases for water and increases for air.
   d) It decreases for both water and air.
2) Given access to the complete geometry, surface pressure and shear stress distribution over a body placed in a uniform flow, one can estimate
   a) the moment coefficient, and the force on the body.
   b) the force coefficient, and the force on the body.
   c) the moment coefficient, and the moment on the body.
   d) the force and the moment on the body
3) A pair of infinitely long, counter-rotating line vortices of the same circulation strength τ are situated at a distance h apart in a fluid, as shown in the figure. The vortices will

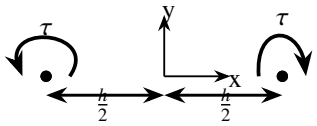

Fig. 3.1

   a) rotate counter-clockwise about the midpoint with the tangential velocity at the line vortex equal to $\frac{\tau}{2\pi h}$
   b) rotate counter-clockwise about the midpoint with the tangential velocity at the line vortex equal to $\frac{\tau}{4\pi h}$
   c) translate along $+y$ direction with velocity at the line vortex equal to $\frac{\tau}{2\pi h}$
   d) translate along $+y$ direction with velocity at the line vortex equal to $\frac{\tau}{4\pi h}$
4) The streamlines of a steady two dimensional flow through a channel of height $0.2m$ are plotted in the figure, where ψ is the stream function in m^2/s. The volumetric flow rate per unit depth is

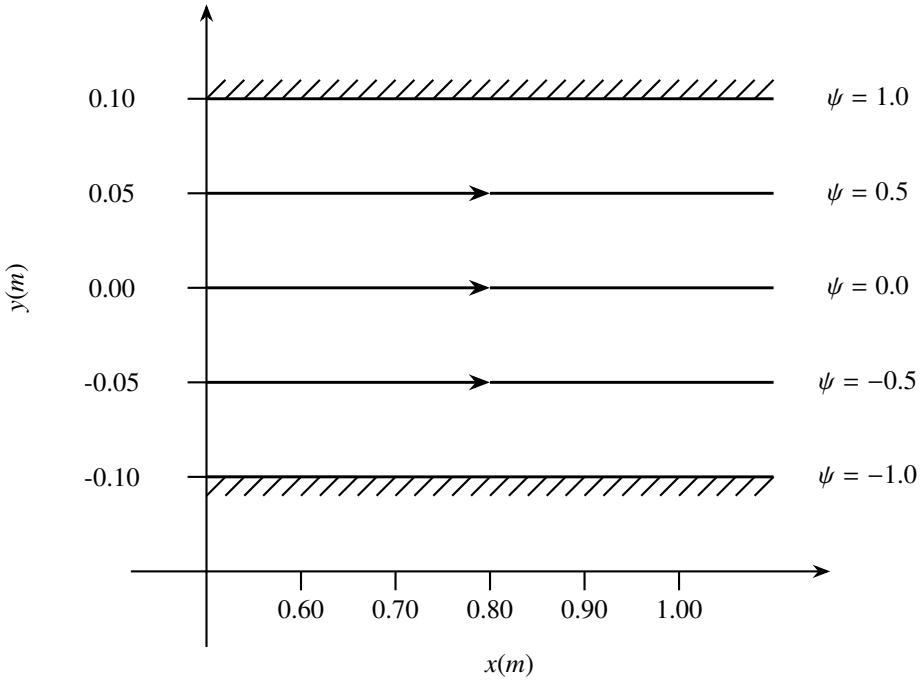

Fig. 4.1

a) $1.0m^2/s$
b) $2.0m^2/s$
c) $0.5m^2/s$
d) $0.1m^2/s$

5) Which of the following options can result in an increase in the Mach number of a supersonic flow in a duct?
   a) Increasing the length of the duct
   b) Adding heat to the flow
   c) Removing heat from the flow
   d) Inserting a convergent-divergent section with the same cross-sectional area at its inlet and exit planes

6) Which one of the following conditions needs to be satisfied from $\phi = Ax^4 + By^4 + Cxy^3$ to be considered as an Airy's stress function?
   a) $A - B = 0$
   b) $A + B = 0$
   c) $A - C = 0$
   d) $A + C = 0$

7) Consider the plane strain field given by $\epsilon_{xx} = Ay^2 + x$, $\epsilon_{yy} = Ax^2 + y$, $\gamma_{xy} = Bxy + y$. The relation between A and B needed for this strain field to satisfy the compatibility condition is

a) $B = A$
b) $B = 2A$
c) $B = 3A$
d) $B = 4A$

8) For hyperbolic trajectory of a satellite of mass m having a velocity V at a distance r from the center of the earth (G: gravitational constant, M: mass of earth), which one of the following relations is true?

a) $\frac{1}{2}mV^2 > \frac{GMm}{r}$
b) $\frac{1}{2}mV^2 < \frac{GMm}{r}$
c) $\frac{1}{2}mV^2 = \frac{GMm}{r}$
d) $\frac{1}{2}mV^2 > \frac{2GMm}{r}$

9) For conventional airplanes, which one of the following is true regarding roll control derivative $C_{l\delta_r} = \frac{\partial C_l}{\partial \delta_r}$ and yaw control derivative $C_{n\delta_r} = \frac{\partial C_n}{\partial \delta_r}$, where δ_r is rudder deflection?

a) $C_{l\delta_r} > 0$ and $C_{n\delta_r} < 0$
b) $C_{l\delta_r} < 0$ and $C_{n\delta_r} > 0$
c) $C_{l\delta_r} < 0$ and $C_{n\delta_r} < 0$
d) $C_{l\delta_r} > 0$ and $C_{n\delta_r} > 0$

10) The ratio of exit stagnation pressure to inlet stagnation pressure across the rotating impeller of a centrifugal compressor, operating with a closed exit, is?

a) 0
b) 1
c) ¿ 1
d) 0.5

11) Which one of the following is a hypergolic propellant combination used in rocket engines?

a) Liquid hydrogen - liquid oxygen
b) Unsymmetrical dimethyl hydrazine - nitrogen tetroxide
c) Rocket fuel RP-1 - liquid oxygen
d) Liquid hydrogen - liquid fluorine

12) In aircraft engine thermodynamic cycle analysis, *perfectly expanded flow* in the nozzle means that the static pressure in the flow at the nozzle exit is equal to

a) the stagnation pressure at the engine inlet.
b) the stagnation pressure at the nozzle exit.
c) the ambient pressure at the nozzle exit.
d) the static pressure at the nozzle inlet.

13) Three long and slender aluminum bars of identical length are subjected to an axial tensile force. These bars have circular, triangular and rectangular cross sections, with same cross sectional area. If they yield at F_{circle}, $F_{triangle}$ and $F_{rectangle}$, respectively, which one of the following is true?

a) F_{circle} ¿ $F_{triangle}$ ¿ $F_{rectangle}$
b) F_{circle} ¡ $F_{triangle}$ ¡ $F_{rectangle}$
c) $F_{triangle}$ ¿ F_{circle} ¿ $F_{rectangle}$

d) $F_{circle} = F_{triangle} = F_{rectangle}$