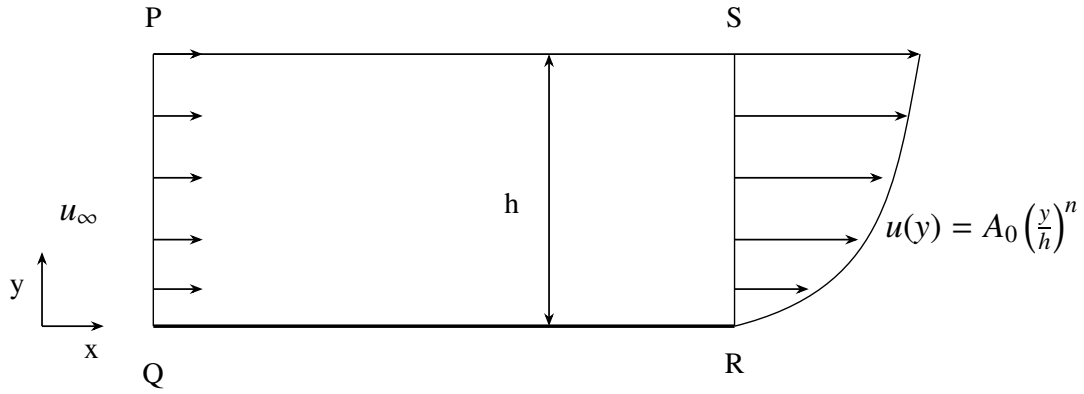
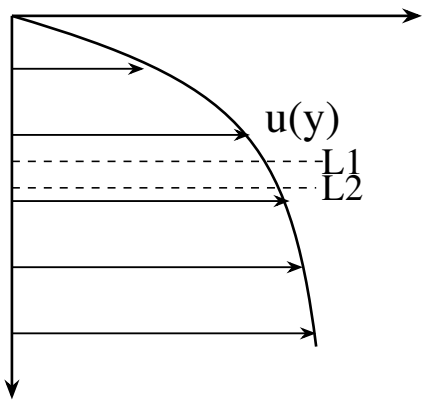
AE-2022

EE24Btech11022 - Eshan Sharma

1) The point of maximum entropy on a Fanno-curve in a Temperature-Entropy (T-s) diagram represents the
   a) maximum flow Mach number
   b) minimum flow Mach number
   c) sonic Mach number
   d) normal shock in the flow
2) Consider a two-dimensional potential flow over a cylinder. If the freestream speed is U_∞, the maximum speed on the cylinder surface is
   a) $\frac{U_\infty}{2}$
   b) $\frac{3U_\infty}{2}$
   c) $2U_\infty$
   d) $\frac{4U_\infty}{3}$
3) Consider steady, two-dimensional, incompressible flow over a non-porous flat plate as shown in the figure. For the control volume PQRS, the speed, U_∞, at section PQ is uniform and the speed at section RS is given by
$$u(y) = A_0 \left(\frac{y}{h}\right)^n,$$
   where n is a positive integer. The value of A_0 for which the flow through section PS will *vanish* is:



   a) $\frac{U_\infty}{n+1}$
   b) $U_\infty(n+1)$
   c) $\frac{U_\infty}{n-1}$
   d) $U_\infty(n-1)$
4) Consider the velocity distribution, $u(y)$ shown in the figure. For two adjacent fluid layers $L1$ and $L2$, the viscous force exerted by $L1$ on $L2$ is

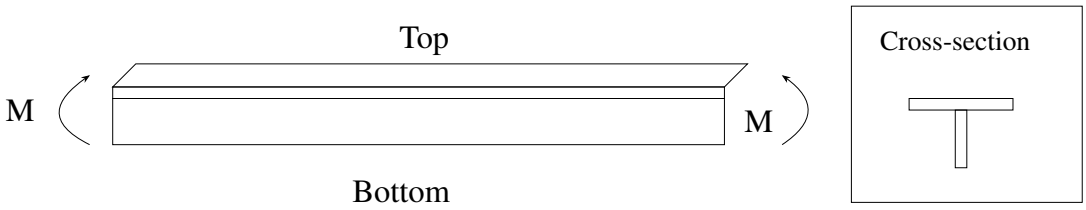


a) to the right
b) to the left
c) vertically upwards
d) vertically downwards

5) The service ceiling of an airplane is the altitude
   a) at which maximum rate of climb is 100 m/min
   b) beyond which theoretically the airplane cannot sustain level flight
   c) at which maximum power is required for flight
   d) at which maximum rate of climb is 100 ft/min

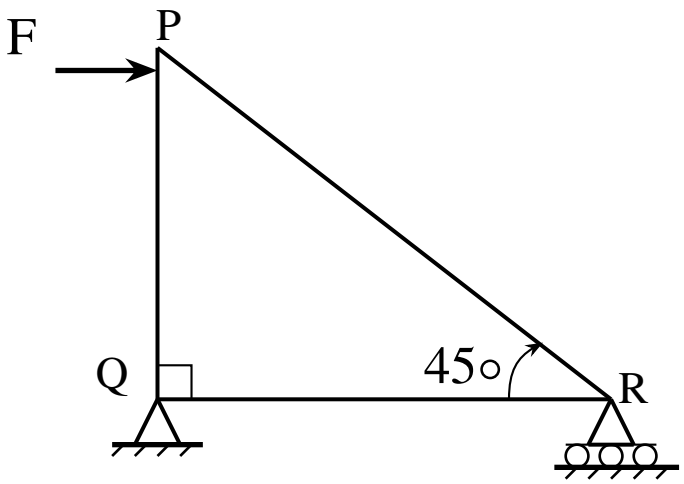
6) Regarding the horizontal tail of a conventional airplane, which one of the following statements is true?
   a) It contributes to $C_{m_\alpha} < 0$
   b) It makes $C_{m_\alpha} = 0$
   c) It makes $C_{m_\alpha} > 0$
   d) It makes $C_{m_0} > 0$ and $C_{m_\alpha} > 0$

7) A beam with symmetrical T-shaped cross-section, as shown in the figure, is subjected to pure bending. The maximum magnitude of the normal stress is realised:



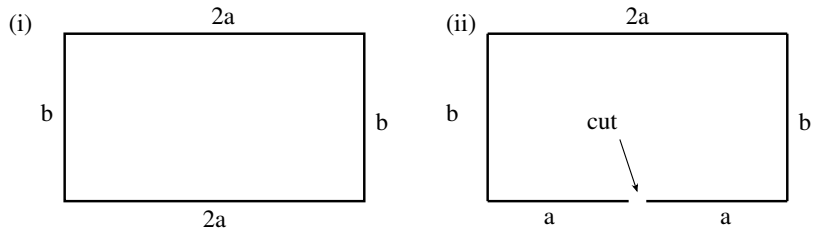
   a) only at the top fibres of the cross-section
   b) only at the bottom fibres of the cross-section
   c) both at the top and bottom fibres of the cross-section
   d) only at the centroidal fibres of the cross-section

8) A three-member truss is simply supported at **Q** and **R**, and loaded at **P** by a horizontal force F as shown. The force in QR is



a) 0
b) $F\,(tensile)$
c) $\frac{F}{\sqrt{2}}\,(compressive)$
d) $\sqrt{2}F\,(tensile)$

9) The closed *thin – walled* rectangular channel shown in figure (*i*) is opened by introducing a sharp cut at the center of the bottom edge, as shown in the figure (*ii*). Which of the following statements is correct?



a) centroids of (*i*) and (*ii*) coincide while shear centers do not
b) shear centers of (*i*) and (*ii*) coincide while centroids do not
c) Both centroids and shear centers of (*i*) and (*ii*) coincide
d) Neither centroids nor shear centers of (*i*) and (*ii*) coincide

10) The region of *highest static temperature* in a rocket engine and the region of *highest heat flux* are _____, respectively.
a) nozzle throat and nozzle entry
b) combustion chamber and nozzle throat
c) nozzle exit and nozzle throat
d) nozzle throat and combustion chamber

11) If $\hat{a}$, $\hat{b}$, $\hat{c}$ are three mutually perpendicular unit vectors, then $\hat{a} \cdot (\hat{b} \times \hat{c})$ can take the value(s):
a) 0
b) 1
c) -1
d) ∞

12) Across an oblique shock wave in a calorifically perfect gas,
a) the stagnation enthalpy changes
b) the stagnation entropy changes
c) the stagnation temperature changes
d) the speed of sound changes

13) NACA 2412 airfoil has
    a) 4% maximum camber with respect to chord
    b) maximum camber at 40% chord
    c) 12% maximum thickness to chord ratio
    d) maximum camber at 20% chord