AE 2008 Q52-68

EE24BTECH11002 - Agamjot Singh

1) The geometrical features of a supercritical airfoil are (2008-AE)
   a) rounded leading edge, flat upper surface and high camber at the rear
   b) sharp leading edge, curved upper surface and high camber at the rear
   c) rounded leading edge, curved upper surface and no camber at the rear
   d) sharp leading edge, flat upper surface and no camber at the rear
2) Which one of the following high lift device results in higher stalling angle? (2008-AE)
   a) split flap
   b) Fowler flap
   c) plain flap
   d) leading edge flap
3) A turbofan engine has bypass ratio of 5 and a total mass flow rate of 120 kg/s. The mass flow rate through the bypass duct is (2008-AE)
   a) 20 kg/s
   b) 100 kg/s
   c) 120 kg/s
   d) 600 kg/s
4) A turbojet engine is operating with afterburner off. If the afterburner is switched on, then (2008-AE)
   a) both thrust and sfc decrease
   b) thrust increases and sfc decreases
   c) thrust decreases and sfc increases
   d) both thrust and sfc increase
5) A centrifugal compressor operates with a tip blade speed of 340 m/s. The air leaves the impeller with a radial velocity of 88 m/s. If the slip factor is 0.85, the relative velocity of the blade tip is (2008-AE)
   a) 101.7 m/s
   b) 120.3 m/s
   c) 132.6 m/s
   d) 135.8 m/s
6) An ideal ramjet engine is flying at a Mach number M. The exhaust gas static temperature at the outlet of the nozzle is T_e. The ambient static temperature is T_α. Gas constant R and specific heat ratio γ do not vary through the ramjet. Assuming that nozzle exhaust static pressure is equal to the ambient pressure and fuel air ratio $f << 1$, the thrust per unit mass flow rate is (2008-AE)
   a) $\sqrt{\gamma R T_\alpha}\left(\sqrt{\frac{T_e}{T_\alpha}}\right)$
   b) $\sqrt{\gamma R T_\alpha}\left(\sqrt{\frac{T_e}{T_\alpha}}-1\right)$
   c) $M\sqrt{\gamma R T_\alpha}\left(\sqrt{\frac{T_e}{T_\alpha}}-1\right)$
   d) $M\sqrt{\gamma R T_\alpha}\left(\sqrt{\frac{T_e}{T_\alpha}}\right)$
7) A 50 percent degree of reaction axial flow turbine operates with a mean blade speed of 180 m/s. The flow leaves the stator and enters the rotor at an angle of 60 degrees to the axial direction. The axial velocity is 150 m/s, and remains constant throughout the stage. THe turbine power per unit mass flow is (2008-AE)
   a) 29.76 kJ/kg
   b) 41.12 kJ/kg
   c) 58.33 kJ/kg
   d) 61.13 kJ/kg
8) The chamber stagnation temperature inside a rocket motor is T_e. Only a convergent nozzle is used, and the flow at the exit of the nozzle is choked. Assume that the nozzle exhaust static pressure is equal to the ambient static pressure. Gas constant for exhaust gases is R and ratio of specific heats is γ. The specific impulse of the rocket motor is (2008-AE)
   a) $\sqrt{\frac{2\gamma R T_e}{\gamma-1}}$

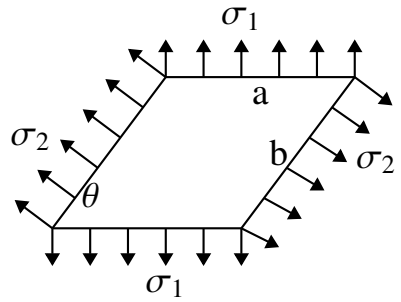
b) $\sqrt{\frac{\gamma RT_e}{\gamma-1}}$
c) $\sqrt{\frac{\gamma RT_e}{\gamma+1}}$
d) $\sqrt{\frac{2\gamma RT_e}{\gamma+1}}$

9) Air enters the combustor of a gas turbine engine at total temperature of 500 K and leaves the combustor at total temperature of 1800 K. If c_p remains constant at 1.005 kJ/kgK and heating value of the fuel used is 44 MJ/kg, the fuel to air ratio is (2008-AE)
a) 0.003
b) 0.012
c) 0.031
d) 0.074

10) The inital temperature sensitivity of burn rate of a solid rocket motor propellant is positive. If the inital temperature increases then (2008-AE)
a) thrust increases but burn time decreases
b) thrust decreases and burn time decreases too
c) thrust remains same but burn time increases
d) thrust increases but burn time remains same

11) An aircraft is cruising at a Mach number of 0.8 at an altitude where the ambient static pressure is 95 kPa. The diffuser exit total pressure is 140 kPa. Assuming there is no change in the specific heat at constant pressure across the diffuser, and the ratio of specific heats is 1.4, the adiabatic efficiency of the intake is (2008-AE)
a) 0.988
b) 0.915
c) 0.722
d) 0.684

12) A parallelogram shaped plate of dimensions $'a'$ and $'b'$ as shown in the figure, is subjected to a uniform loading of normal stresses σ_1 and σ_2. The plate is in equilibrium for (2008-AE)



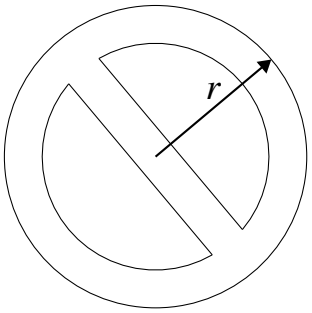
a) any value of σ_1 and σ_2
b) $\sigma_1 = \sigma_2 \cos\theta$
c) $\sigma_2 = \sigma_1 \cos\theta$
d) $\sigma_2 = \sigma_1$

13) A column of solid circular cross-section and length L can have various end conditions. Choose correct set that matches the end conditions (listed in Group I) with the corresponding effective length for buckling (listed in Group II). (2008-AE)

Group I (end conditions)	Group II (effective length)
(P) one end built-in and other end free	(1) 1.0 L
(Q) both ends pinned	(2) 0.7 L
(R) both ends built-in	(3) 2.0 L
(S) one end built-in and other end pinned	(4) 0.5 L

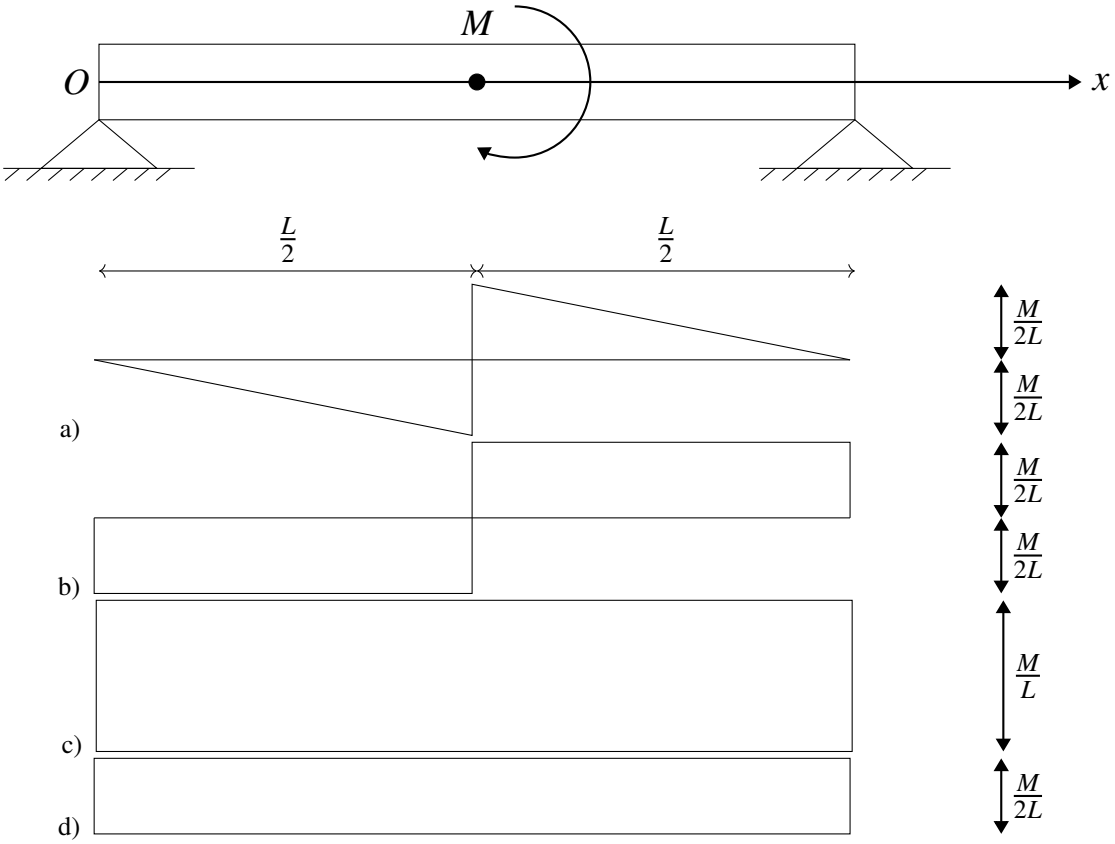
a) $P-3, Q-1, R-4, S-2$
b) $P-4, Q-1, R-2, S-3$
c) $P-2, Q-1, R-3, S-4$
d) $P-3, Q-1, R-2, S-4$

14) A thin walled tube of circular cross-section with mean radius r has a central web which divides it into two symmetric cells as shown. A torque M is acting on the section. The shear flow q in the central web is (2008-AE)

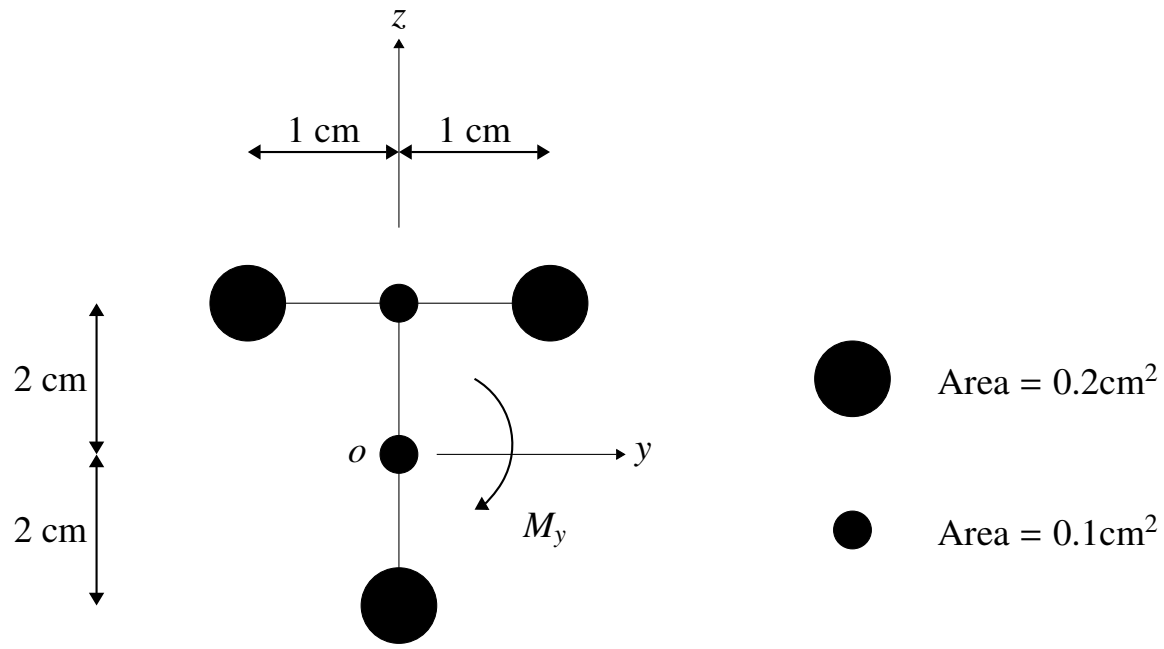


a) $q = \frac{M}{2\pi r^2}$
b) $q = 0$
c) $q = \frac{M}{4\pi r^2}$
d) $q = \frac{M}{\pi r^2}$

15) A concentrated bending moment M is acting at mid-span of a beam as shown. The shear force diagram for the beam is: (2008-AE)



16) An idealized thin-walled cross-section of a beam and the respective areas of the booms are shown. A bending moment M_y is acting on the cross-section. The ratio of the magnitude of normal stress in the top booms to that of the bottom boom is (2008-AE)



a) $\frac{5}{11}$
b) $\frac{2}{5}$
c) 1
d) $\frac{5}{2}$

17) An engineer is asked to test a system which can be idealized as SDOF (single degree of freedom) with viscous damping. A frequency response test was conducted and it is found that the quality factor Q is equal to 10. What will be the logarithmic decrement if a free vibration test is performed? (2008-AE)

a) $\frac{\pi}{40}$
b) $\frac{\pi}{20}$
c) $\frac{\pi}{10}$
d) $\frac{\pi}{5}$