

- 35) An aircraft has a level flight stalling speed of 60 m/s EAS (equivalent air speed). As per the $V - n$ diagram, what is the minimum speed at which it should be designed to withstand the maximum vertical load factor of 9?
- 20 m/s
 - 60 m/s
 - 120 m/s
 - 180 m/s
- 36) Match each mode of aircraft motion listed in Group I to its corresponding property from Group II.

Group I: Aircraft mode	Group II: Property
P : Short period mode	1: Coupled roll-yaw oscillations
Q : Wing rock	2: Angle of attack remains constant
R : Phugoid mode	3: Roll oscillations
S : Dutch roll	4: Speed remains constant

TABLE 36: Caption

- $P - 2, Q - 1, R - 4, S - 3$
 - $P - 4, Q - 3, R - 2, S - 1$
 - $P - 4, Q - 1, R - 2, S - 3$
 - $P - 2, Q - 3, R - 4, S - 1$
- 37) An aircraft is cruising at a true air speed (TAS) of 100 m/s under ISA conditions, at an altitude at which the density of free stream is 0.526 kg/m^3 . What will be the equivalent air speed (EAS)?
- 65.5 m/s
 - 72.5 m/s
 - 110.5 m/s
 - 152.7 m/s
- 38) In the definition of the aircraft Euler angles ϕ (roll), θ (pitch), and ψ (yaw), the correct sequence of rotations required to make the inertial frame coincide with the aircraft body frame is
- first ψ about the z axis, second θ about the y axis, third ϕ about the x axis
 - first θ about the y axis, second ϕ about the x axis, third ψ about the z axis
 - first ϕ about the x axis, second θ about the y axis, third ψ about the z axis
 - first ψ about the z axis, second ϕ about the x axis, third θ about the y axis
- 39) To maximize the range of a jet engine aircraft, it should be flown at a velocity that maximizes

- a) $\frac{C_L}{C_{D^{0.5}}}$
- b) $\frac{C_L^2}{C_D}$
- c) $\frac{C_L^3}{C_D}$
- d) $\frac{C_L^2}{C_D}$

- 40) The primary function of the fin in the vertical tail of an aircraft is to provide
- a) yaw control
 - b) yaw stability
 - c) roll damping
 - d) roll stability
- 41) An aircraft requires the trailing edge of the elevator to be deflected upwards from its initial position to lower the trim speed. Which of the following statements about the static stick-fixed stability of this aircraft is true?
- a) The aircraft is unstable.
 - b) The aircraft is neutrally stable.
 - c) The aircraft is stable.
 - d) The stability of the aircraft cannot be determined from the given information.
- 42) Which of the following statements is true for an aircraft flying at a low angle of attack?
- a) Yawing motion generates yawing moment and pitching moment.
 - b) Rolling motion generates rolling moment and pitching moment.
 - c) Yawing motion generates yawing moment and rolling moment.
 - d) Pitching motion generates yawing moment and rolling moment.
- 43) Consider $2-D$ flow with stream function $\psi = \frac{1}{2} \ln(\sqrt{x^2 + y^2})$. The absolute value of circulation is along a unit circle centered at $(x = 0, y = 0)$:
- a) 0
 - b) 1
 - c) $\frac{\pi}{2}$
 - d) π
- 44) Consider a symmetric airfoil at an angle of attack of 4 degrees. Using thin airfoil theory, the magnitude of the moment coefficient about the leading edge is:
- a) 2π
 - b) π
 - c) $\frac{\pi^2}{60}$
 - d) $\frac{\pi}{90}$
- 45) Consider steady, inviscid flow in a convergent-divergent (CD) nozzle, with a normal shock in the divergent portion. The static pressure along the nozzle downstream of the normal shock:
- a) remains constant
 - b) increases isentropically to the static pressure at the nozzle exit
 - c) decreases isentropically to the static pressure at the nozzle exit
 - d) can increase or decrease, depending on the magnitude of the static pressure at the

nozzle exit

- 46) For a free stream Mach number of 0.7, the critical pressure coefficient ($C_{p,cr}$) is -0.78 . If the minimum pressure coefficient for a given airfoil in incompressible flow is -0.6 , then the flow over the airfoil at a free stream Mach number of 0.7 is:
- subsonic and compressible
 - completely supersonic
 - incompressible
 - partly subsonic and partly supersonic
- 47) If the flow Mach number in a turbulent boundary layer over a flat plate is increased keeping the Reynolds number unchanged, the skin friction coefficient C_f :
- decreases
 - increases
 - remains constant
 - initially decreases, followed by a rapid increase
- 48) In supersonic wind-tunnel design, an oblique shock diffuser is preferred over a normal shock diffuser because:
- it reduces total pressure loss
 - the flow is slowed down more rapidly
 - the flow is accelerated more rapidly
 - it increases total pressure loss
- 49) The variation of downwash along the span of an untwisted wing of elliptic planform is:
- sinusoidal
 - parabolic
 - elliptic
 - constant
- 50) Flow past an airfoil is to be modeled using a vortex sheet. The strength of the vortex sheet at the trailing edge will be:
- 0
 - 1
 - 2π
 - ∞
- 51) Consider a 2-D body in supersonic flow with an attached oblique shock as shown below. An increase in free stream Mach number M_∞ , will cause the oblique shock wave to
- move closer to the body
 - move away from the body
 - detach from the body
 - become a normal shock

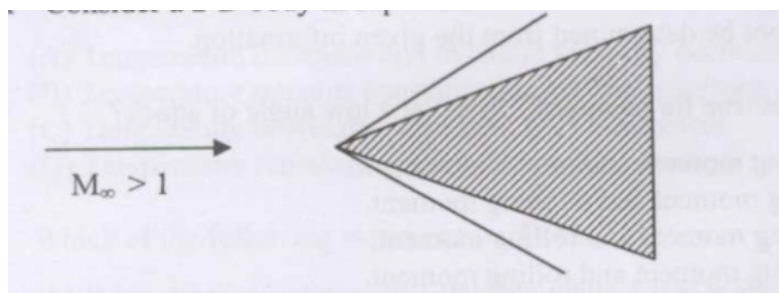


Fig. 51.1