

- 1) Which one of the following engines should be used by a subsonic passenger transport airplane for minimum specific fuel consumption ?
 - a) Turbojet engine with afterburner
 - b) Turbofan engine
 - c) Ramjet engine
 - d) Scramjet engine
- 2) A spring-mass-damper system with a mass of 1 kg is found to have a damping ratio of 0.2 and a natural frequency of 5 rad/s . The damping of the system is given by
 - a) 2 Ns/m
 - b) 2 N/s
 - c) 0.2 kg/s
 - d) 0.2 N/s
- 3) if $f(\theta) = \begin{pmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{pmatrix}$, then $f(\alpha)f(\beta) =$
 - a) $f\left(\frac{\alpha}{\beta}\right)$
 - b) $f(\alpha + \beta)$
 - c) $f(\alpha - \beta)$
 - d) 2×2 zero matrix
- 4) An artificial satellite remains in orbit and does not fall to the earth because
 - a) the centrifugal force acting on it balances the gravitational attraction
 - b) the on-board rocket motors provide continuous boost to keep it in orbit
 - c) its transverse velocity keeps it from hitting the earth although it falls continuously
 - d) due to its high speed it derives sufficient lift from the rarefied atmosphere
- 5) The Euler iteration formula for numerically integrating a first order nonlinear differential equation of the form \dot{x} , with a constant step size of Δt is
 - a) $x_{k+1} = x_k - \Delta t \times f(x_k)$
 - b) $x_{k+1} = x_k + \left(\Delta t^2/2\right) \times f(x_k)$
 - c) $x_{k+1} = x_k - (1/\Delta t) \times f(x_k)$
 - d) $x_{k+1} = x_k + \Delta t \times f(x_k)$
- 6) The number of natural frequencies of an elastic beam with cantilever boundary conditions is
 - a) 1

- b) 3
- c) 1000
- d) Infinite

7) For maximum range of a glider, which of the following conditions is true ?

- a) lift to drag ratio is maximum
- b) rate of descent is minimum
- c) descent angle is maximum
- d) lift to weight is maximum

8) An airplane with a larger wing as compared to a smaller wing will necessarily have

- a) more longitudinal static stability
- b) less longitudinal static stability
- c) same longitudinal static stability
- d) more longitudinal static stability for an aft tail airplane if aerodynamic center of the larger wing is behind the center of gravity of the airplane

9) The minimum value of

$$J(x) = x^2 - 7x + 30$$

occurs at

- a) $x = 7/2$
- b) $x = 7/30$
- c) $x = 30/7$
- d) $x = 30$

10) Two airplanes are identical except for the location of the wing. The longitudinal static stability of the airplane with low wing configuration will be

- a) more than the airplane with high wing configuration
- b) less than the airplane with high wing configuration
- c) same as the airplane with high wing configuration
- d) more if elevator is deflected

11) For a fixed center of gravity location of an airplane, when the propeller is mounted on the nose of the fuselage

- a) Longitudinal static stability increases
- b) Longitudinal static stability decreases
- c) Longitudinal static stability remains same
- d) Longitudinal static stability is maximum

12) Let an airplane in a steady level flight be trimmed at a certain speed. A level and steady flight at a higher speed could be achieved by changing

- a) engine throttle only
- b) elevator only
- c) throttle and elevator together
- d) rudder only

13) For a plane strain in the $x - y$ plane, in the general, the non-zero stress terms are

- a) $\sigma_{zz}, \sigma_{xz}, \sigma_{yz}, \sigma_{xy}$
- b) $\sigma_{zz}, \sigma_{xz}, \sigma_{yz}, \sigma_{xy}$
- c) $\sigma_{xx}, \sigma_{xy}, \sigma_{yy}, \sigma_{xz}$
- d) $\sigma_{zz}, \sigma_{yy}, \sigma_{xy}, \sigma_{zz}$

14) For an elastic anisotropic solid, the number of independent elastic constants in its constitutive equations is

- a) 2
- b) 9
- c) 21
- d) 36

15) Total pressure at a point is defined as the pressure when the flow is brought to rest

- a) adiabatically
- b) isentropically
- c) isothermally
- d) isobarically

16) The drag divergence Mach number of an airfoil

- a) is a fixed number for a given airfoil
- b) is always higher than the critical Mach number
- c) is equal to the critical Mach number at zero angle of attack
- d) is the Mach number at which a shock wave first appears on the airfoil

17) On which one of the following thermodynamic cycles does an ideal ramjet operate

- a) The Rankine cycle
- b) The Brayton cycle
- c) Carnot cycle
- d) The Otto cycle