2008 Aerospace Engineering

AI24BTECH11003 - Badde Vijaya Sreyas

1) The function defined by $f(x) = \begin{cases} \sin x, & x < 0 \\ 0, & x = 0 \\ 3x^3, & x > 0 \end{cases}$

   a) Is neither continuous nor differentiable at $x = 0$
   b) Is continuous and differentiable at $x = 0$
   c) Is differentiable but not continuous at $x = 0$
   d) Is continuous but not differentiable at $x = 0$

2) The product of the eigenvalues of the matrix $\begin{pmatrix} 1 & 0 & 1 \\ 0 & 2 & 1 \\ 1 & 1 & -3 \end{pmatrix}$ is

   a) 4 b) 0 c) -6 d) -9

3) Which of the following equations is a LINEAR ordinary differential equation?

   a) $\frac{d^2y}{dx^2} + \frac{dy}{dx} + 2y^2 = 0$
   b) $\frac{d^2y}{dx^2} + y\frac{dy}{dx} + 2y = 0$
   c) $\frac{d^2y}{dx^2} + x\frac{dy}{dx} + 2y = 0$
   d) $\left(\frac{dy}{dx}\right)^2 + \frac{dy}{dx} + 2y = 0$

4) To transfer a satellite from an elliptical orbit to a circular orbit having radius equal to the apogee distance of the elliptical orbit, the speed of the satellite should be

   a) increased at the apogee
   b) decreased at the apogee
   c) increased at the perigee
   d) decreased at the perigee

5) The service ceiling of a transport aircraft is defined as the altitude
   a) That is halfway between sea level and absolute ceiling
   b) at which it can cruise at one engine operational
   c) at which it's maximum rate of climb is zero
   d) at which it's maximum rate of climb is $0.508\frac{m}{s}$

6) The drag of an aircraft in steady climbing flight at a given forward speed is
   a) inversely proportional to climb angle
   b) higher than drag in steady level flight at the same forward speed
   c) lower than drag in steady level flight at the same forward speed
   d) independent of climb angle

7) In steady, level turning flight of an aircraft at a load factor $'n'$, the ratio of horizontal component of lift and aircraft weight is

a) $\sqrt{n-1}$ b) $\sqrt{n+1}$ c) $\sqrt{n^2-1}$ d) $\sqrt{n^2+1}$

8) The parameters that remain constant in a cruise climb of an aircraft are

a) equivalent airspeed and lift coefficient
b) altitude and lift coefficient
c) equivalent airspeed and altitude
d) lift coefficient and aircraft mass

9) The maximum thickness to chord ratio for the NACA 24012 airfoil is

a) 0.01 b) 0.12 c) 0.24 d) 0.40

10) The maximum possible value of pressure coefficient C_p in incompressible flow is

a) 0.5 b) 1 c) π d) ∞

11) An irrotational and inviscid flow can become rotational on passing through a

a) normal shock wave
b) oblique shock wave
c) curved shock wave
d) Mach wave

12) Laminar flow airfoils are used to reduce

a) trim drag b) skin friction drag c) induced drag d) wave drag

13) The degree of reaction of an impulse turbine is

a) 2 b) 0.75 c) 0.5 d) 0

14) In a convergent-divergent (CD) nozzle of a rocket motor, the wall heat flux is maximum at

a) the exit of the divergent portion of the CD nozzle
b) the entry to the convergent portion of the CD nozzle
c) the throat of the CD nozzle
d) the mid-length of the divergent portion of the CD nozzle

15) In a scramjet engine, the Mach number at the entry to the combustion chamber is around

a) 0 b) 0.3 c) 2 d) 6

16) DB denotes double base solid propellant.
LOX-RPI denotes liquid oxygen - kerosene combination.
LOX-LH_2 denotes liquid oxygen - hydrogen combination.

The correct order of increasing specific impulse is

a) DB<LOX-RPI<LOX-LH_2
b) LOX-RPI<DB<LOX-LH_2
c) LOX-LH_2 <DB<LOX-RPI
d) DB<LOX-LH_2 <LOX-RPI

17) In the absence of body movements, the symmetry of the stress tensor is derived from
a) force equilibrium conditions
b) movement equilibrium conditions
c) linear relations between stresses and strains
d) compatibility conditions