GATE-2011-AE

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14) In an un-powered glide of an aircraft having weight W, lift L and drag D, the equilibrium glide angle is defined as

a) $\tan^{-1}\left(\frac{L}{D}\right)$
b) $\tan^{-1}\left(\frac{D}{L}\right)$
c) $\tan^{-1}\left(\frac{L}{W}\right)$
d) $\tan^{-1}\left(\frac{W}{L}\right)$

15) Lift on an aircraft climbing vertically up is

a) equal to its weight
b) zero
c) equal to the drag
d) equal to the thrust

16) If an aircraft is performing a positive yawing manoeuvre, the side slip angle

a) is always zero
b) is never zero
c) is always negative
d) could be any value

17) For an airplane to be statically stable, its centre of gravity must always be

a) ahead of wing aerodynamic centre
b) aft of the wing aerodynamic centre
c) ahead of neutral point
d) aft of neutral point

18) It is seen that the drag polar of a certain aerofoil is symmetric about the C_d axis. This drag polar could refer to

a) NACA 0012
b) NACA 4415
c) NACA 23012
d) None of the above

19) The aerodynamic centre of a supersonic aerofoil, with chord c, is located at

a) the leading edge
b) 0.25c
c) 0.5c
d) 0.75c

20) Winglets are used on wings to minimize

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

21) Consider a potential flow with free stream velocity V_∞, over a spinning circular cylinder of radius R and circulation Γ . The stream function, ψ , where $\psi = 0$ on the cylinder surface, in cylindrical coordinates (r, θ), is given by

a) $V_\infty r\cos\theta\left(1-\frac{R^2}{r^2}\right)+\frac{\Gamma}{2\pi}\ln\frac{r}{R}$
b) $V_\infty r\cos\theta\left(1+\frac{R^2}{r^2}\right)+\frac{\Gamma}{2\pi}\ln\frac{r}{R}$
c) $V_\infty r\sin\theta\left(1-\frac{R^2}{r^2}\right)+\frac{\Gamma}{2\pi}\ln\frac{r}{R}$
d) $V_\infty r\sin\theta\left(1+\frac{R^2}{r^2}\right)+\frac{\Gamma}{2\pi}\ln\frac{r}{R}$

22) A main objective of by-pass in a turbo-fan engine is to increase

a) mass flow rate through engine inlet
b) turbine inlet temperature
c) mass flow rate through exhaust nozzle
d) compressor pressure ratio

23) The pressure ratio in any one stage of a jet engine compressor is limited by
a) entry stagnation temperature in that stage
b) entry Mach number in that stage
c) pressure gradient induced separation in that stage
d) mass flow rate in that stage

24) Thermodynamic cycle on which the jet engine operates can be

a) open Rankine cycle only
b) either open or closed Rankine cycle
c) open Brayton cycle only
d) either open or closed Brayton cycle

25) Propulsion efficiency of a jet engine is
a) directly proportional to both the thrust power and the air mass flow rate
b) inversely proportional to both the thrust power and the air mass flow rate
c) directly proportional to thrust power and inversely proportional to the air mass flow rate
d) inversely proportional to thrust power and directly proportional to the air mass flow rate

26) Consider a cantilever beam having length $L = 1m$, square cross-section (width = depth = 0.01 m) and Young's modulus 50 GPa. The beam is subjected to a transverse load $P = 1N$ at the mid-span $(L/2)$ at the center of the cross-section. Under the small deformation theory, the transverse deflection of the beam (in mm) at its free-end is _____