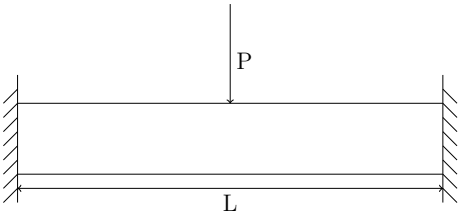
AE 2008 40-52

EE24BTECH11005 - Arjun Pavanje

40) A clamped-clamped beam, subjected to a point load P at the midspan, is shown in the figure below. The magnitude of the moment reaction at the two fixed ends of the beam is



a) $\frac{PL}{2}$

b) $\frac{PL}{4}$

c) $\frac{PL}{8}$

d) $\frac{PL}{16}$

41) Which of the following statement(s) is/are true about the state of a body in plane strain condition?
P : All the points in the body undergo displacements in one plane only, for example the $x-y$ plane, leading to $\varepsilon_{zz} = \gamma_{xz} = \gamma_{yz} = 0$.
Q : All the components of stress perpendicular to the plane of deformation, for example the $x-y$ plane, of the body are equal to zero, i.e. $\sigma_{zz} = \tau xz = \tau yz = 0$
R : Except the normal component, all the other components of stress perpendicular to the plane of deformation of the body, for example the $x-y$ plane, are equal to zero, i.e. $\sigma_{zz} \neq 0, \tau_{sz} = \tau_{yz} = 0$.

a) P only

b) Q only

c) P and Q

d) P and R

42) An aircraft with a turbojet engine flies at a velocity of $100m/s$. If the jet exhaust velocity is $300m/s$, the propulsive efficiency of the engine, assuming a negligible fuel-air ratio, is

a) 0.33

b) 0.50

c) 0.67 d) 0.80

43) An axial compressor that generates a stagnation pressure ratio of 4.0, operates with inlet and exit stagnation temperatures of $300K$ and $480K$, respectively. If the ratio of specific heats γ is 1.4, the isentropic effeciency of the compressor is,

a) 0.94 b) 0.81

c) 0.72 d) 0.63

44) An aircraft with a turboprop engine produces a thrust of $500N$ and flies at $100m/s$. If the propeller efficiency is 0.5, the shaft power produced by the engine is

a) $50kW$ b) $100kW$

c) $125kW$ d) $500kW$

45) A rocket has an initial mass of $150kg$. After operating for a duration of $10s$, its final mass is $50kg$. If the acceleration due to gravity is $9.81m/s^2$ and the thrust produced by the rocket is $19.62kN$, the specific impulse of the rocket is

a) $400s$ b) $300s$

c) $200s$ d) $100s$

46) Consider the vecotr field $\mathbf{v} = \begin{pmatrix} -\frac{y}{r^2} \\ \frac{x}{r^2} \end{pmatrix}$ where $r = \sqrt{x^2 + y^2}$. The contour integral $\oint \mathbf{v} \cdot \mathbf{ds}$ where **ds** is tangent to the contour that encloses the origin is, _____ (accurate to two decimal places)

47) The magnitude of the x-component of the unit vector at the point $\begin{pmatrix} 1 \\ 1 \end{pmatrix}$ that is normal to equipotential lines of the potential function $\phi(r) = \frac{1}{r^2+4}$, where $r = \sqrt{x^2 + y^2}$ is,(accurate to two decimal places)

48) Assuming ISA standard sea level conditions , the density of air $\left(\text{in } kg/m^3\right)$ at Leh, which has an altitude of $3500m$ above mean sea level is _____ (_____accurate to two decimal places)

49) Consider a cubical tank of side $2m$ with its top open. It is filled with water up to a height of $1m$. Assuming the density of water to be $1000kg/m^3, g = 9.81m/s^2$ and the atmospheric pressure to be $100kPa$, the net hydrostatic force (in kN) on the side face of the tank due to the air and water is _____ (accurate to two decimal places)

50) An aircraft with mass of $400,000kg$ cruises at $240m/s$ at an altitude of $10km$. Its lift to drag ratio at cruise is 15. Assuming g as $9.81m/s^2$, the power (in MW) needed for it to cruise is_____ (accurate to two decimal places)

51) A statically-stable aircraft has a $C_{L_\alpha} = 5$ (where the angle of attack,α, is measured in radians). The coefficient of moment

of the aircraft about the center of gravity is given as $C_{M,C,g} = 0.05 - 4\alpha$. The mean aerodynamic chord of the aircraft wing is $1m$. The location (positive towards the nose) of the neutral point of the aircraft from the center of gravity is _____ (accurate to two decimal places)

52) An aircraft with a gross weight of $2000kg$ has a speed of $130m/s$ at sea level, where the conditions are: 1 atmosphere (*pressure*), $288K$ (*temperature*), and $1.23kg/m^3$ (*density*). The speed (in m/s) required by the aircraft at an altitude of $9000m$, where the conditions are: 0.31 atmosphere, $230K$, and $0.47kg/m^3$, to maintain a steady, level flight is _____ (accurate to two decimal places)