AE 2008 40-52

EE24BTECH11005 - Arjun Pavanje

40) In finding a root of the equation: $x^2 - 6x + 5 = 0$ the Newton-Ralphson method achieves an order of convergance equal to,

a) 1.0
b) 1.67
c) 2.0
d) 2.5

41) Consider a $1 - D$ adiabatic, inviscid, compressible Now of air $(R = 287J/Kg - K, c_r = 718J/Kg - K)$ through a duct of constant cross-sectional area $A = 1m$. If the volumetric flow rate is $Q = 680m^3/s$ and stagnation temperature is $T_, = 580.05K$, then the air temperature inside the duct is

a) $300K$
b) $350K$
c) $400K$
d) $450K$

42) A two stage chemical rocket, having the same specific impulse $\left(l_{sp}\right)$ of $300s$ for both the stages is designed in such a way that the payload ratio and the structural ratio are same for both the stages. The second stage of the rocket has following mass distribution:
Propellant Mass = $10208kg$
Structural Mass = $1134kg$
Payload Mass = $1700kg$ $g_e = 9.8m/s2$
If the rocket is fired from rest and it flies in a zero gravity field and a drag free environment, the final velocity attained by the payload is

a) $9729.3m/s$
b) $897.3m/s$
c) $9360.2m/s$
d) $8973.2m/s$

43) A missile with a Ramjet engine is flying in air. The temperature at the inlet and the outlet of the combustor are $1200K$ and $2500K$ respectively. The heating value of the fuel is $43MJ/kg$ and the burner efficiency is 90%. Considering the working fluid to be air $\left(C_p = 1005J/kgK, \gamma = 1.4\right)$, The for this engine is equal to: $\frac{\text{fuel}}{\text{air}}$ ratio $\left(f = \frac{m_f}{m_a}\right)$

a) 0.032
b) 0.036

c) 0.042 d) 0.026

44) The trim curves of an aircraft are of the form $C_m\,(0.05 - 0.2\delta_r) - 0.1C_l$, where the elevator deflection angle, δ_e, is in radians. The change in elevator deflection needed to increase the lift coefficient from 0.4 to 0.9 is:

a) −0.5 radians b) −0.25 radians

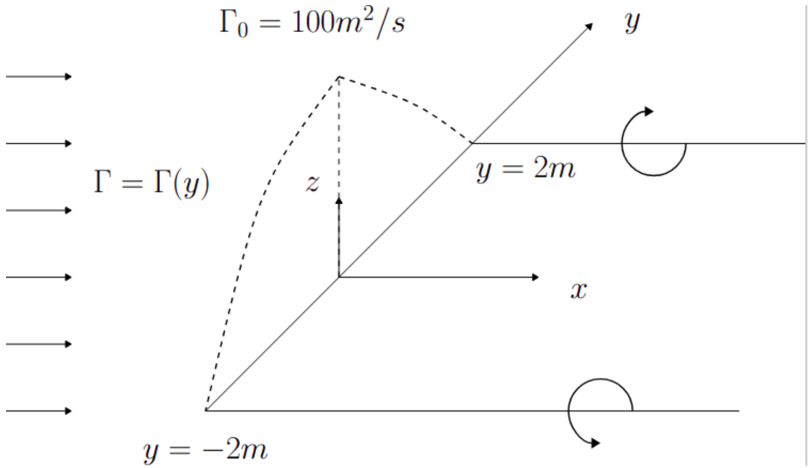
c) 0.25 radians d) 0.5 radians

45) If e is the base of the natural logarithms then the equation of the tangent from the origin to the curve $y = e^x$ is

a) $y = x$ b) $y = \pi x$

c) $y = \frac{x}{e}$ d) $y = ex$

46) Consider a potential flow over a finite wing with the following circulation distribution



$$\Gamma\,(y) = 100\sqrt{1 - \left(\frac{2y}{4}\right)^2}\,m^2/s$$

a) 0.125 radians b) −0.125 radians

c) $0.125\sqrt{1 = \left(\frac{y}{2}\right)^2}$ radians d) $-0.125\sqrt{1 = \left(\frac{y}{2}\right)^2}$ radians

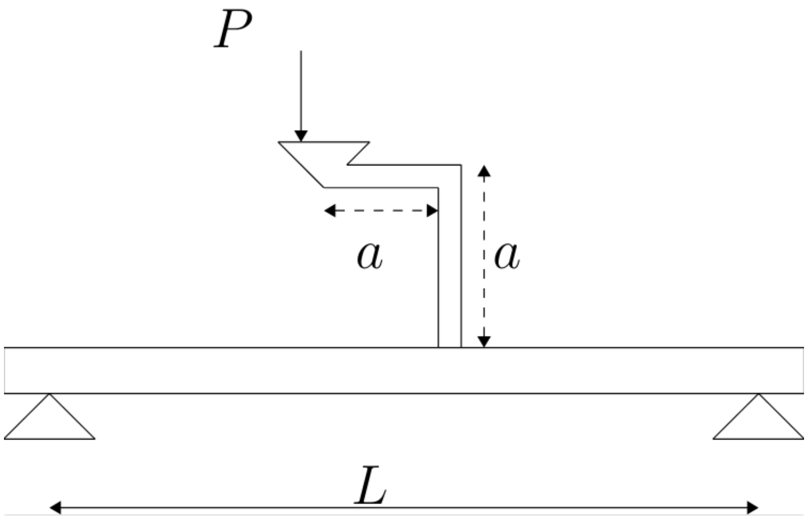
47) The inlet stagnation temperature for a single stage axial compressor is $300K$ and the stage efficiency is 0.80. Following conditions exist at the mean radius of the rotor

blade:
Blade speed = $200m/s$
Axial flow velocity = $160m/s$
Intet blade angle $\beta_1 = 44°$
Outlet blade angle $\beta_2 = 14°$
$C_p 1005 J/kgK$and$y = 1.4$
What is the stagnation pressure ratio (PRS) for this compressor?

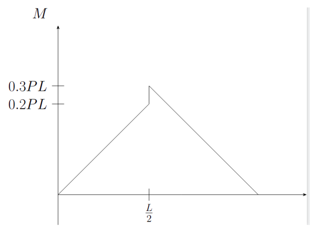
a) 1.41
b) 1.37
c) 1.51
d) 1.23

Common Data for Questions 48 and 49:
Consider a simply supported beam of length L, carrying a bracket welded at its center. The bracket carries a vertical load, P, as shown in the figure. Dimensions of bracket are $a = 0.1L$. The beam has a square cross-section of dimension $h \times h$.

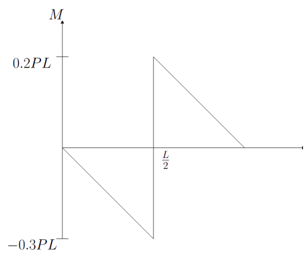
48) Bending moment diagram is given by,



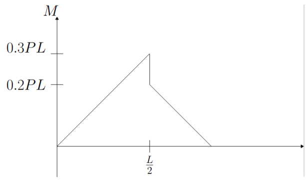
a) .



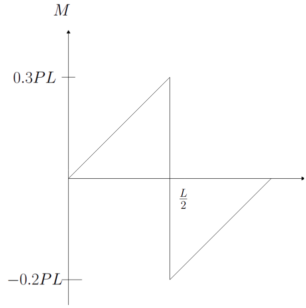
b) .



c) .



d) .



49) Maximum value of shear stress is,

a) $0.67P/h^2$

b) $1.33P/h^2$

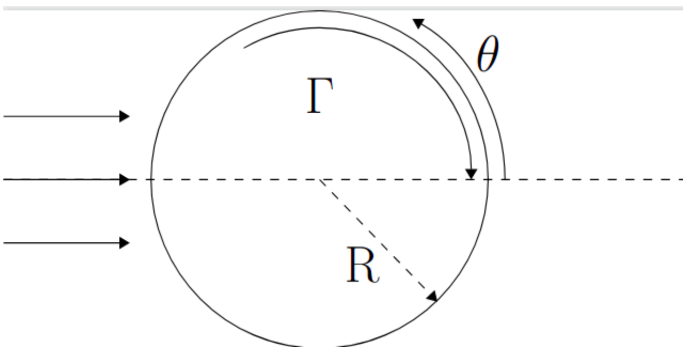
c) $1.5P/h^2$

d) $0.9P/h^2$

Statement for Linked Answer Questions 50 and 51:
Consider a potential flow over a spinning cylinder. The stream function is given as,

$$\psi = (V_\infty r \sin\theta)\left(1 = \frac{R^2}{r^2}\right) + \frac{\Gamma}{2\pi}\ln\frac{r}{R}$$

where
Free stream velocity, $V_\infty = 25m/s$
Cylinder radius, $R = 1m$
Circulation, $\Gamma = 50\pi m^2/s$



50) The radial and azimuthal velocities on the cylinder surface at $\theta = \frac{\pi}{2}$ are,

a) $V_r = 0m/s, V_0 = -75m/s$
b) $V_r = 0m/s, V_0 = 75m/s$
c) $V_r = 0m/s, V_0 = -25m/s$
d) $V_r = 0m/s, V_0 = 25m/s$

51) The stagnantation points are located at

a) 210° and 330°
b) 240° and 300°
c) 30° and 150°
d) 60° and 120°

Statement for Linked Answer Questions 52 and 53:
An aircraft with an IDEAL Turbojet engine is flying at $200m/s$ at an altitude where the ambient pressure is equal to $0.8bar$. The stagnation pressure and temperature at the inlet of the turbine are $6bar$ and $1400K$ respectively. The change in specific enthalpy across the compressor is $335kJ/kg$. Assume the fuel flow rate to be very small in comparison to the air flow rate and consider $C_p = 1117J/kgK$ and $\gamma = 1.3$.

52) What is the stagnantation pressure at the inlet of the nozzle,

a) $2.8bar$
b) $5.7bar$
c) $2.1bar$
d) $6.3bar$