Gate-ASSIGNMENT-2

EE24BTECH11043 - Murra Rajesh Kumar Reddy

1) A single-stage gas turbine operates with an axial absolute flow at the entry and exit from the stage. The absolute flow angle at the nozzle exit is 70°. The turbine stage generates a specific work of $288kJ/kg$ when operating with a mean blade speed of $440m/s$. The absolute velocity at the rotor entry is
   a) $275.5m/s$
   b) $551.5m/s$
   c) $1103.0m/s$
   d) $1654.5m/s$

2) An axial compressor operates such that is has an inlet and an exit total temparature of $300K$ and $430K$, respectiely. The isentropic efficency of the compressor is 85%. If the ratio of specific heats is 1.4,then the total pressure ratio across the compressor is _____.

3) The maximum value of coefficent of lift (C_1) for a 2D circular cylinder, provided at least one stagnation point lies on the cylinder surface, is predicted by the potential flow theory to be
   a) $\pi/2$
   b) π
   c) 2π
   d) 4π

4) The nozzle **AB**, as shown below, leading to the test section of a low seed subsonic wind tunnel, has a contraction ratio of 10 : 1. The pressure difference across the nozzle is maintained at $1000N/m^2$ and the density of air is $1.23kg/m^3$. Assuming one-dimensional, steady, inviscid flow, the velocity in the test section as measured at point **B** is _____m/s.
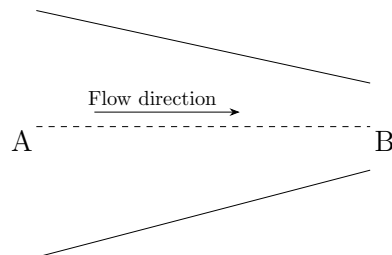
5) The rate of change of moment coefficient with respect to the angle of attack, $\frac{dC_m}{d\alpha}$, at half chord point of a thin airfoil, as per approximations from the thin airfoil theory is
   a) $\pi^2/16$
   b) $\pi^2/12$
   c) $\pi^2/8$
   d) $\pi/2$

6) A gaseous mixture of air and fuel enters a constant area combustion chamber at a velocity of $100m/s$ and at a static temparature of $300K$. The heat release due to combustion is $100J/kgK$. The total temparature of air-fuel mixture after combustion is _____K.

7) Consider 1-D, steady, inviscid, compressible flow through a convergent nozzle. The total temparature and total pressure are T_o, P_o respectively. The flow through the nozzle is choked with a mass flow

rate of m_o. If the total temparature is increased to $4T_o$, with total pressure remaining unchanged, then the mass flow rate through the nozzle

a) remains unchanged.
b) becomes half of $\dot{m}_o$.
c) becomes twice of $\dot{m}_o$.
d) becomes four times of $\dot{m}_o$.

8) Consider a second order linear ordinary differential equation $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = 0$, with the boundary conditions $y(0); \frac{dy}{dx}\Big|_{x=0} = 1$. The value of y at $x = 1$ is

a) 0
b) 1
c) e
d) e^2

9) Consider the following system of lineal equatins:

$2x - y + z = 1$
$3x - 3y + 4z = 6$
$x - 2y + 3z = 4$

This system of linear equation has

a) no solution.
b) one solution.
c) two solutions.
d) three solutions.

10) A bar made of linear elastic isotropic material is fixed at one end and subjected to an axial force of $1kN$ at the other end. The cross-sectional area of the bar is $100mm^2$, length is $100mm$ and the Young's Modulus is $1 \times 10^5 N/mm^2$. The strain energy stored in the bar is _____Nmm.

11) A cantilever beam-spring system is shown in the figure, The beam is made with a material of Young's modulus $1 \times 10^5 N/mm^2$ and geometry such that its moment of inertia is $100mm^4$ and length l=100 mm. It is supported by a spring of stiffness $K = 30N/mm$ and subjected to a load of $P = 100N$ at the point 'B'. The deflection at the point 'B' due to the load P is _____mm.

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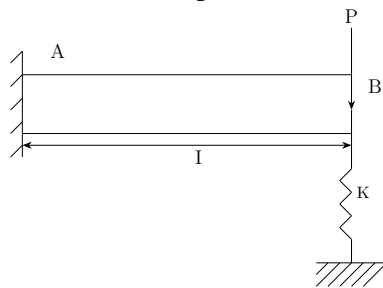
12) Determne the correctness or otherwise of the following statements, [a] and [r],

[a]: Ribs, used in airplane wings, increase the column buckling strength of the longitudinal stiffners.

[r]: Ribs distribute concentrated loads into the structure and redistribute stresses around discontinuities.

a) Both [a] and (r) are true and [r] is the correct reason for [a]
b) Both [a] and [r] are ture but [r] is not the correct reason for [a]
c) Both [a] and [r] are false
d) [a] is true but [r] is false