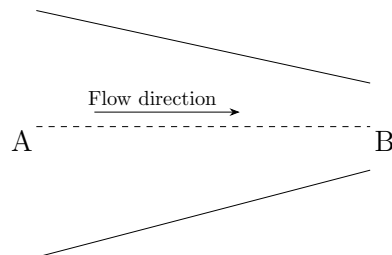


Gate-ASSIGNMENT-2

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 288 kJ/kg when operating with a mean blade speed of 440 m/s . The absolute velocity at the rotor entry is
 - a) 275.5 m/s
 - b) 551.5 m/s
 - c) 1103.0 m/s
 - d) 1654.5 m/s
- 2) An axial compressor operates such that it has an inlet and an exit total temperature of 300 K and 430 K , respectively. The isentropic efficiency 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 coefficient of lift (C_L) 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 speed subsonic wind tunnel, has a contraction ratio of $10 : 1$. The pressure difference across the nozzle is maintained at 1000 N/m^2 and the density of air is 1.23 kg/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 100 m/s and at a static temperature of 300 K . The heat release due to combustion is 100 J/kgK . The total temperature of air-fuel mixture after combustion is _____ K .
- 7) Consider 1-D, steady, inviscid, compressible flow through a convergent nozzle. The total temperature and total pressure are T_o , P_o respectively. The flow through the nozzle is choked with a mass flow

rate of \dot{m}_o . If the total temperature 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 $y(0); \frac{dy}{dx}\bigg|_{x=0} = 1$. The value of y at $x = 1$ is

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

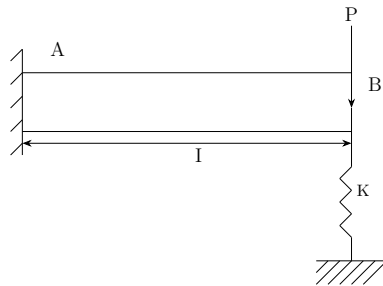
9) Consider the following system of linear equations:

$$\begin{aligned} 2x - y + z &= 1 \\ 3x - 3y + 4z &= 6 \\ x - 2y + 3z &= 4 \end{aligned}$$

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 .



- 12) Determine 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 stiffeners.
 $[r]$: 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 true but $[r]$ is not the correct reason for $[a]$
 - c) Both $[a]$ and $[r]$ are false
 - d) $[a]$ is true but $[r]$ is false