

# Assignment2

EE24BTECH11007 - Arnav Makarand Yadnopavit

- 1) For a flow through a Prandtl-Meyer expansion wave:
  - a) Mach number stays constant.
  - b) Entropy stays constant.
  - c) Temperature stays constant.
  - d) Density stays constant.
- 2) For two-dimensional irrotational and incompressible flows:
  - a) Both potential and stream functions satisfy the Laplace equation.
  - b) Potential function must satisfy the Laplace equation but the stream function need not.
  - c) Stream function must satisfy the Laplace equation but the potential function need not.
  - d) Neither the stream function nor the potential function need to satisfy the Laplace equation.
- 3) A trailing edge plain flap deflected downward increases the lift coefficient of an airfoil by
  - a) Increasing the effective camber of the airfoil.
  - b) Delaying the separation of the flow from the airfoil surface.
  - c) Increasing the local airspeed near the trailing edge.
  - d) Controlling the growth of the boundary layer thickness along the airfoil surface.
- 4) Thin airfoil theory predicts that the lift slope is  $\frac{dc_l}{d\alpha} = 2\pi$  for:
  - a) Symmetric airfoils only.
  - b) Cambered airfoils only.
  - c) Any airfoil shape.
  - d) Joukowski airfoils only.
- 5) The ordinary differential equation  $\frac{d^2y}{dx^2} + ky = 0$ , where  $k$  is real and positive:
  - a) is non-linear.
  - b) has a characteristic equation with one real and one complex root.
  - c) has a characteristic equation with two real roots.
  - d) has a complementary function that is simple harmonic.
- 6) A non-trivial solution to the  $(n \times n)$  system of equations  $[A]\{x\} = \{0\}$ , where  $\{0\}$  is the null vector:
  - a) can never be found.
  - b) may be found only if  $[A]$  is not singular.
  - c) may be found only if  $[A]$  is an orthogonal matrix.
  - d) may be found only if  $[A]$  has at least one eigenvalue equal to zero.
- 7) For a plane strain problem, the stresses satisfy the condition:
  - a)  $\tau_{xz} = \tau_{yz} = \sigma_z = 0$
  - b)  $\tau_{xz} = \tau_{yz} = 0, \sigma_z = \nu(\sigma_x + \sigma_y)$
  - c)  $\tau_{xz} = \tau_{yz} = 0, \sigma_z = \nu\tau_{xy}$
  - d)  $\tau_{xz} = \tau_{yz} = 0, \sigma_z = \nu(\sigma_x + \sigma_y) + (1 - \nu)\tau_{xy}$
- 8) The propulsive efficiency of a turbo-jet engine moving at velocity  $U_\infty$  and having exhaust velocity  $U_e$  with respect to the engine is given by:
  - a)  $\frac{2}{U_\infty/U_e + 1}$
  - b)  $1 - \frac{U_\infty}{U_e}$
  - c)  $\frac{2U_\infty U_e}{U_e^2 + U_\infty^2}$
  - d)  $\frac{2U_\infty}{U_e + U_\infty}$
- 9) An aircraft is flying at  $M = 2$  where the ambient temperature around the aircraft is  $250K$ . If the specific heat ratio for air  $\gamma = 1.4$ , the stagnation temperature on the surface of the aircraft is:

- a) 200K                      b) 450K                      c) 350K                      d) 1450K

10) The division of feed air to an aircraft gas-turbine combustor into primary and secondary streams serves which of the following purposes?

- P. A flammable mixture can be formed  
Q. Cooling of combustor liner and flame tube can be accomplished  
R. Specific fuel consumption can be reduced

- a) P and R                      b) Q and R                      c) P and Q                      d) P, Q and R

11) Classify the following propellants as: cryogenic (C), semi-cryogenic (SC), compressed gas (CG), and earth storable (ES).

$\text{N}_2\text{O}_4$ -UDMH (*nitrogen tetroxide and unsymmetrical dimethylhydrazine*)

LOX-RP1 (*liquid oxygen and kerosene*)

LOX-LH<sub>2</sub> (*liquid oxygen and liquid hydrogen*)

$\text{N}_2$  (*nitrogen gas*)

- a)  $\text{N}_2\text{O}_4$ -UDMH (ES), LOX-RP1 (C), LOX-LH<sub>2</sub> (C),  $\text{N}_2$  (C)  
b)  $\text{N}_2\text{O}_4$ -UDMH (SC), LOX-RP1 (SC), LOX-LH<sub>2</sub> (C),  $\text{N}_2$  (C)  
c)  $\text{N}_2\text{O}_4$ -UDMH (ES), LOX-RP1 (SC), LOX-LH<sub>2</sub> (C),  $\text{N}_2$  (CG)  
d)  $\text{N}_2\text{O}_4$ -UDMH (ES), LOX-RP1 (C), LOX-LH<sub>2</sub> (C),  $\text{N}_2$  (CG)

12) A conventional altimeter is a:

- a) Pressure transducer                      c) Density transducer  
b) Temperature transducer                      d) Velocity transducer