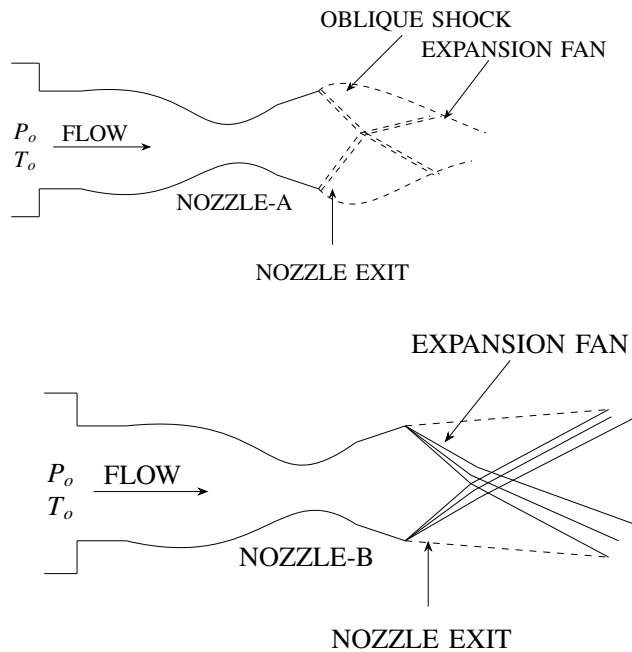


# 2021-AE

EE24BTECH11020 - Ellanti Rohith

- 1) The figure shows schematics of wave patterns at the exit of nozzles A and B operating at different pressure ratios.



Nozzles A and B, respectively, are said to be operating in:

[GATE 2021]

- a) over-expanded mode and under-expanded mode
- b) under-expanded mode and perfectly expanded mode
- c) perfectly expanded mode and under-expanded mode
- d) under-expanded mode and over-expanded mode

- 2) The combustion process in a turbo-shaft engine during ideal operation is:

[GATE 2021]

- a) isentropic
- b) isobaric
- c) isochoric
- d) isothermal

- 3) How does the specific thrust of a turbojet engine change for a given flight speed with an increase in flight altitude?

[GATE 2021]

- a) Increases monotonically
- b) Decreases monotonically
- c) Remains constant
- d) First increases and then decreases

- 4) How does the propulsion efficiency of a turbofan engine, operating at a given Mach number and a given altitude, change with an increase in compressor pressure ratio?

[GATE 2021]

- a) Remains constant
- b) Increases monotonically
- c) Decreases monotonically
- d) First decreases and then increases

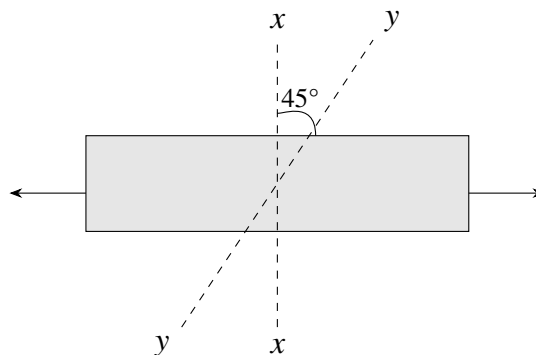
5) A solid propellant rocket producing 25 MN thrust is fired for 150 seconds. The specific impulse of the rocket is 2980 Ns/ Kg. How much propellant is burned during the rocket operation? [GATE 2021]

- a) 8390 Kg
- b) 82300 Kg
- c)  $1.26 \times 10^6$  Kg
- d)  $11.2 \times 10^6$  Kg

6) The shape of a supersonic diffuser that slows down a supersonic flow to subsonic flow is [GATE 2021]

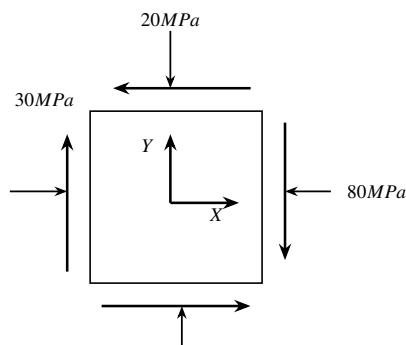
- a) converging
- b) diverging
- c) diverging - converging
- d) converging - diverging

7) Uniaxial tension test (see the figure) is conducted on two different samples prepared with homogeneous, isotropic materials. One of the materials is brittle, whereas the other is ductile.



Assuming that there is no stress concentration at loading points, the failure would initiate: [GATE 2021]

- a) along x-x in both materials
  - b) along x-x in brittle material and along y-y in ductile material
  - c) along y-y in brittle material and along x-x in ductile material
  - d) along y-y in both materials
- 8) For the state of stress as shown in the figure, what is the orientation of the plane with maximum shear stress with respect to the x-axis?



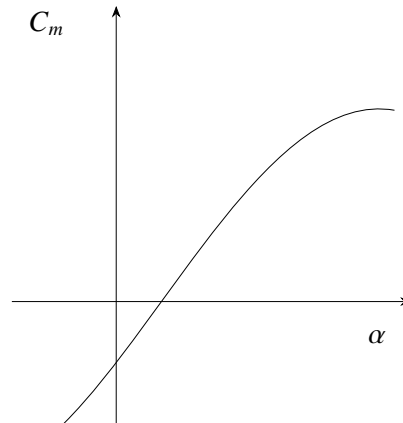
[GATE 2021]

- a)  $45^\circ$                       b)  $-45^\circ$                       c)  $22.5^\circ$                       d)  $-22.5^\circ$

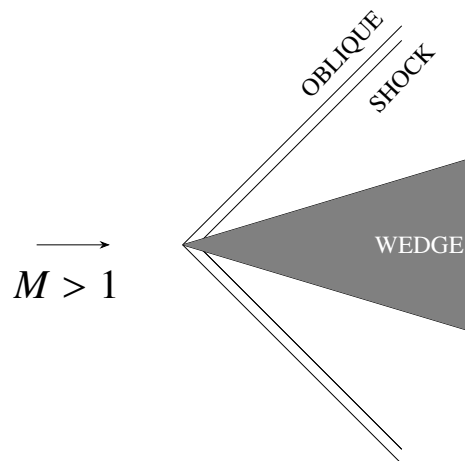
9) Let  $V_{TAS}$  be the true airspeed of an aircraft flying at a certain altitude where the density of air is  $\rho$ , and  $V_{EAS}$  be the equivalent airspeed. If  $\rho_0$  is the density of air at sea level, what is the ratio  $\frac{V_{TAS}}{V_{EAS}}$  equal to? [GATE 2021]

- a)  $\frac{\rho}{\rho_0}$                       b)  $\frac{\rho_0}{\rho}$                       c)  $\sqrt{\frac{\rho_0}{\rho}}$                       d)  $\sqrt{\frac{\rho}{\rho_0}}$

10)  $C_m - \alpha$  variation for a certain aircraft is shown in the figure. Which one of the following statements is true for this aircraft? [GATE 2021]



- a) The aircraft can trim at a positive  $\alpha$  and it is stable.  
 b) The aircraft can trim at a positive  $\alpha$ , but it is unstable.  
 c) The aircraft can trim at a negative  $\alpha$  and it is stable.  
 d) The aircraft can trim at a negative  $\alpha$ , but it is unstable.
- 11) Which of the following statement(s) is/are true across an oblique shock (in adiabatic conditions) over a wedge as shown below?



[GATE 2021]

- a) Total pressure decreases  
 b) Mach number based on velocity tangential to the shock decreases  
 c) Total temperature remains constant  
 d) Mach number based on velocity tangential to the shock remains the same and that based on velocity normal to the shock decreases

- 12) Which of the following statement(s) is/are true with regards to Kutta condition for flow past airfoils?  
[GATE 2021]
- a) It is utilized to determine the circulation on an airfoil.
  - b) It is applicable only to airfoils with sharp trailing edges.
  - c) The trailing edge of an airfoil is a stagnation point.
  - d) The flow leaves the trailing edge smoothly.
- 13) According to the airfoil theory, which of the following statement(s) is are true for a cambered airfoil?  
[GATE 2021]
- a) The lift coefficient for an airfoil is directly proportional to the absolute angle of attack.
  - b) The aerodynamic centre lies at quarter chord point.
  - c) The centre of pressure lies at quarter chord point.
  - d) Drag coefficient is proportional to the square of lift coefficient.