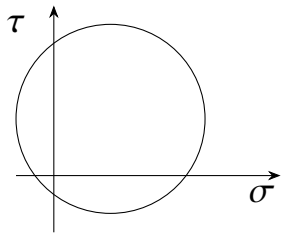
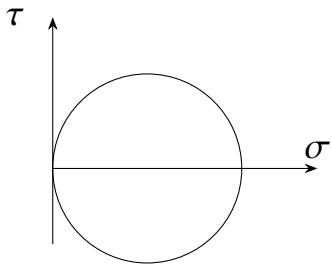
GATE Questions 19

EE24BTECH11012 - Bhavanisankar G S

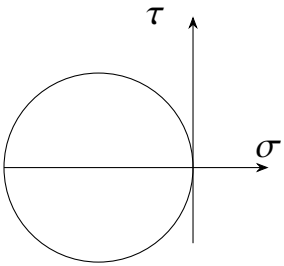
1) For INnternational Standard Atmosphere (ISA) upto 11 km, which of the following statement(s) is(are) true ?
   a) The hydrostatic / aerostatic equation is used.
   b) The temperature lapse rate is taken as $-10^{-2}K/m$
   c) The sea level conditions are taken as $P_s = 1.01325 \times 10^5 Pa, T_s = 300K, \rho_s = 1.225kg/m^3$
   d) Air is treated as a perfect gas
2) Let σ and ρ represent the normal stress and shear stress on a plane, respectively. The Mohr circle(s) that may possibly represent the state of stress at points in a beam of rectangular cross-section under **pure blending** is/are :



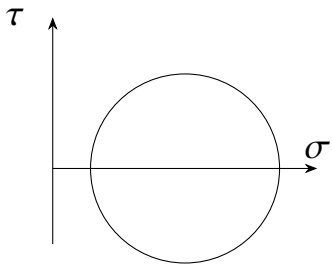
a)



c)



b)



d)

3) An isotropic linear elastic material point under plane srain condition in the x-y plane always obeys :
   a) out-of-plane normal strain $\epsilon_{zz} = 0$
   b) out-of-plane normal stress $\sigma_{zz} = 0$

c) out-of-plane shear stress $\tau_{xz} = 0$
d) out-of-plane shear strain $\gamma_{xz} = 0$

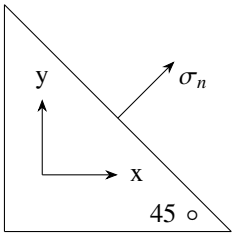
4) A high-pressure-ratio multistage axial compressor encounters an extreme loading mismatch during starting. Which of the following technique(s) can be used to alleviate this problem ?

a) Blade cooling
b) Variable angle stator vanes
c) Blow-off valves
d) Multi-spool shaft

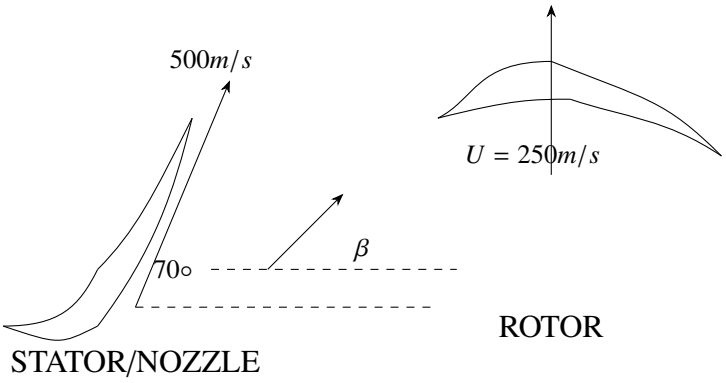
5) The arc length of the parametric curve: $x = \cos\theta, y = \sin\theta, z = \theta$ from $\theta = 0 \text{to} \theta = 2\pi$ is equal to
6) An unpowered glider is flying at a glide angle of 10°. Its lift-to-drag ratio is _
7) The two-dimensional plane-stress state at a point is

$$\sigma_{xx} = 110MPa, \sigma_{yy} = 30MPa, \tau_{xy} = 40MPa$$

The normal stress, σ_n on a plane inclined at 45° as shown in the figure is _ MPa .



8) In a **static** test, a turbofam engine with **by-pass ratio** of 9 has core hot exhaust speed 1.5 times that of fan exhaust speed. The engine is operated at a fuel to air ratio of f = 0.03 . Both the fan and the core streams have no pressure thrust. The ratio of fan thrust to thrust from the core engine is _
9) In a single stage turbine, the hot gases come out of stator/nozzle at a speed of 500 m/s and at angle of 70° with the turbine axis as shown. The design speed of the rotor blade is 250 m/s at the mean blade radius. The rotor blade angle, β, at the leading edge is _ degrees.



10) The height of a right circular cone of maximum volume that can be enclosed within a hollow sphere of radius R is

a) R b) $\frac{5}{4}$ R c) $\frac{4}{3}$ R d) $\frac{3}{2}$ R

11) Consider the differential equation $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = 0$. The boundary conditions are $y = 0$ and $\frac{dy}{dx} = 1 \text{at} x = 0$. Then the value of y at $x = \frac{1}{2}$ is

a) 0 b) $\sqrt{e}$ c) $\frac{\sqrt{e}}{2}$ d) $\sqrt{\frac{e}{2}}$

12) Consider the partial differential equation $\frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2} = 0$ where x, y are real. If $f(x, y) = a(x)b(y)$, where $a(x)$ and $b(y)$ are real functions, which one of the folowing statements can be true ?

a) $a(x)$ is a periodic function and $b(y)$ is a linear function.
b) both $a(x)$ and $b(y)$ are exponential functions
c) $a(x)$ is a periodic function and $b(y)$ is an exponential function
d) both $a(x)$ and $b(y)$ are periodic functions

13) A cyindrical object of diameter 900 mm is designed to move **axially** in air at 60 m/s. Its drag is estimated on a geometrically half-scaled model in water, assuming flow similarity.
Co-efficients of dynamic viscosity and densities for air and water are $1.86 \times 10^{-5} Pa - s, 1.2 kg/m^3 \text{and} 1.01 \times 10^{-3} Pa - s, 1000 kg/m^3$ respectively.
Drag measured for the model is 2280 N. Drag experienced by the full-scale object is _ N

a) 322 b) 644 c) 1288 d) 2576