Analysis of stress and strain

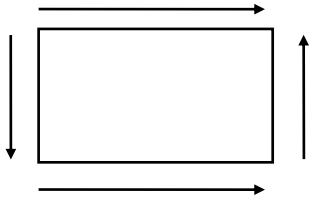
Duration: 45 Minutes **Maximum marks: 30**

Q.1 - Q.10 Carry One Mark each.

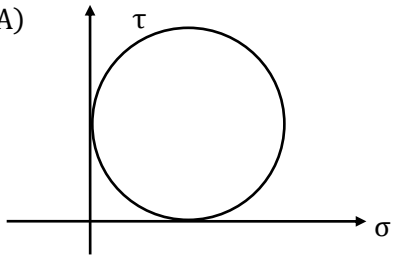
1. The maximum shear stress induced in a rectangular cross section member under tensile loading is 25 MPa, calculate the maximum tensile stress
   (A) 12.5 MPa (B) 16.67 MPa
   (C) 37.5 MPa (D) 50 MPa

2. A point in a strained material is subjected to two mutually perpendicular tensile stresses of 20 MPa and 35 MPa. What will be the intensity of resultant stress (MPa) a plane inclined at 60° to the 20 MPa stress direction

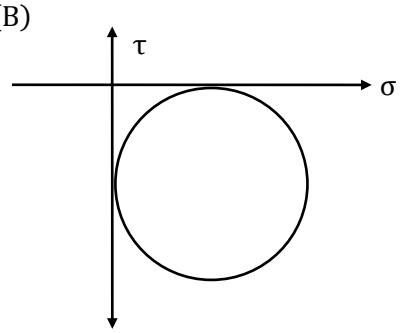
3. State of stress in a plane element is shown in figure . Which one of the following figure is correct sketch of hour's circle



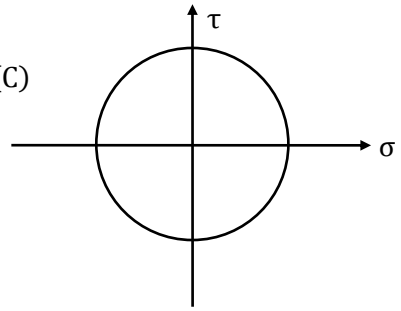
(A)



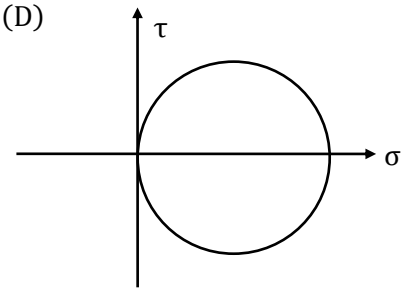
(B)



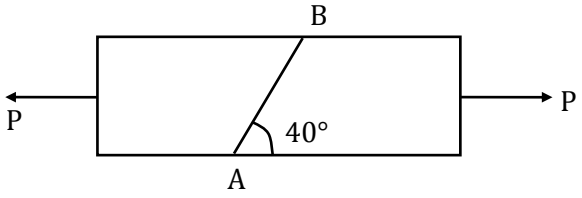
(C)



(D)

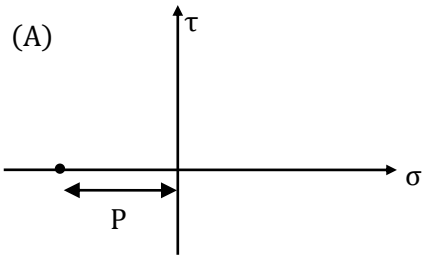


4. Two wooden members 50mm × 100mm cross section are slued together along the joint AB as shown in figure. Determine the normal stress (MPa) in the glue if P=200 kN

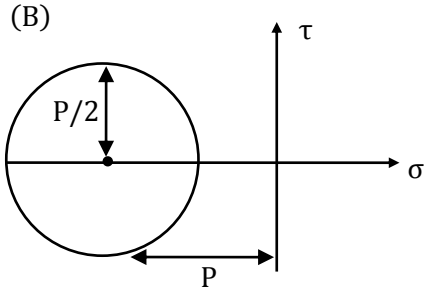


5. A body is in a state of hydrostatic compression due to pressure P. Which one of the following is correct Mohr's circle for this

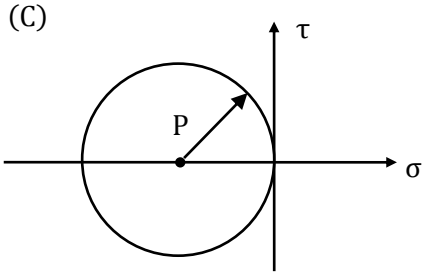
(A)



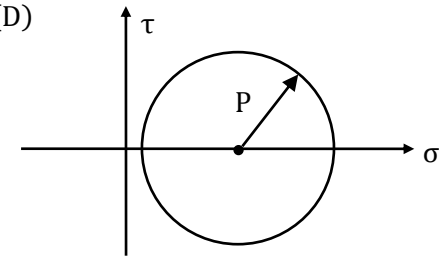
(B)



(C)

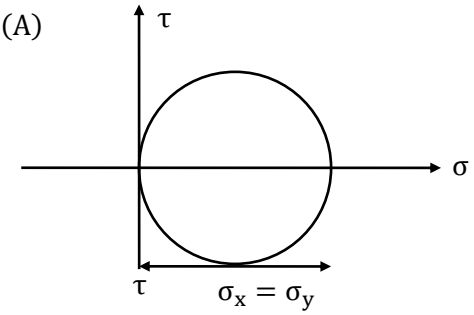


(D)

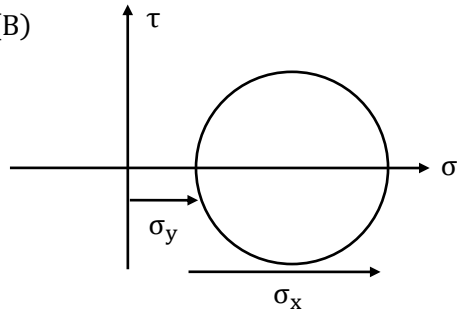


6. The correct representation of the motor circle for a plate stress condition with stress components as $\sigma_x = -\sigma_y$ and $\tau_{xy} = 0$ is

(A)

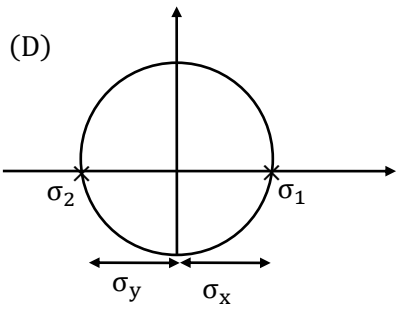


(B)



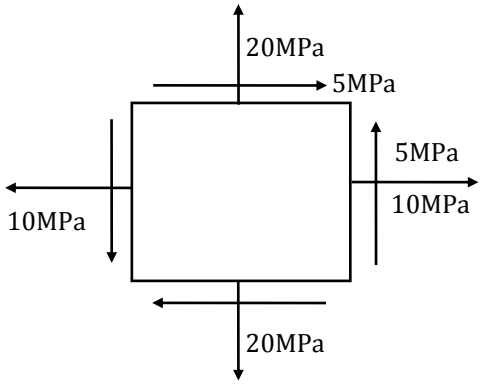
(C) The Mohr's circle reduces to a point

(D)



7. If the state of stress given rise to principle stresses of 100MPa, 50MPa and 0MPa. Calculate maximum shear stress(MPa)

8. In a plane stress condition below,

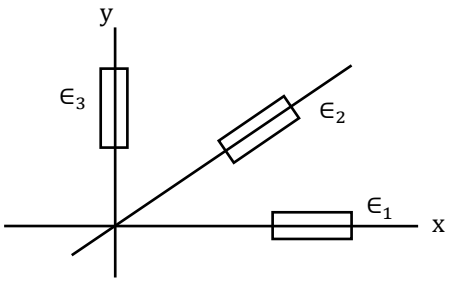


Calculate the normal stress on maximum shear stress plane (MPa)

9. The state of stress is given by $\sigma_x = -6\text{MPa}, \sigma_y = 4$ MPa and $\tau_{xy} = -8$ MPa .The magnitude of maximum compressive stress (MPa) is given by

(A) 8.43 (B) 10.43
(C) 8 (D) 10

10. A rectangular strain rosette, shown below gives following reading in strain measurement



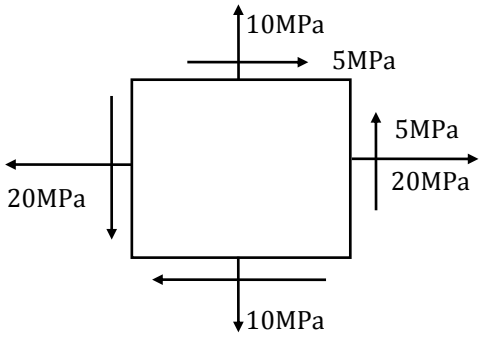
$\epsilon_1 = 1000 \times 10^{-4}$
$\epsilon_2 = 800 \times 10^{-4}$
$\epsilon_3 = 600 \times 10^{-4}$
The magnitude of maximum principle strain is _____

Q.11 - Q.20 Carry Two Mark each.

11. Principle stresses at a point in plane stressed element are $\sigma_1 = \sigma_2 = 500\ \text{kg/cm}^2$ normal stress on the plane inclined at 45° to maximum principle stress plane is

(A) 0 (B) $500\ \text{kg/cm}^2$
(C) $707\ \text{kg/cm}^2$ (D) $1000\ \text{kg/cm}^2$

12. For the plane stress condition shown below, calculate equivalent Von-mises stress (MPa)



13. The corresponding strain tensor matrix for the state of stress below is

$\begin{bmatrix} 20 & 5 \\ 5 & 10 \end{bmatrix}$

Younger modulus of the material is 200GPa and poission's ratio is 0.3

(A) $\begin{bmatrix} 8.5 & 6.5 \\ 6.5 & 2 \end{bmatrix} \times 10^{-5}$

(B) $\begin{bmatrix} 8.5 & 6.5 & 0 \\ 6.5 & 2 & 0 \\ 0 & 0 & -4.5 \end{bmatrix} \times 10^{-5}$

(C) $\begin{bmatrix} 2 & 0 & 6.5 \\ 0 & 8.5 & 0 \\ 6.5 & 0 & -4.5 \end{bmatrix} \times 10^{-5}$

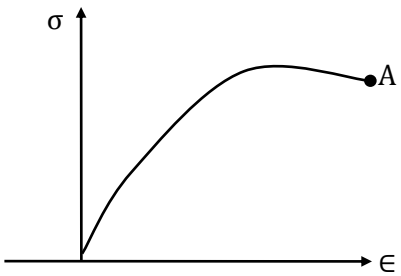
(D) $\begin{bmatrix} 2 & 6.5 \\ 6.5 & 8.5 \end{bmatrix} \times 10^{-5}$

14. If the two principle strain in a plane strain condition are 0.1 and -0.6. The diameter of the corresponding Mohr's circle is equal to ?

15. Design of shafts made up of brittle materials is based on

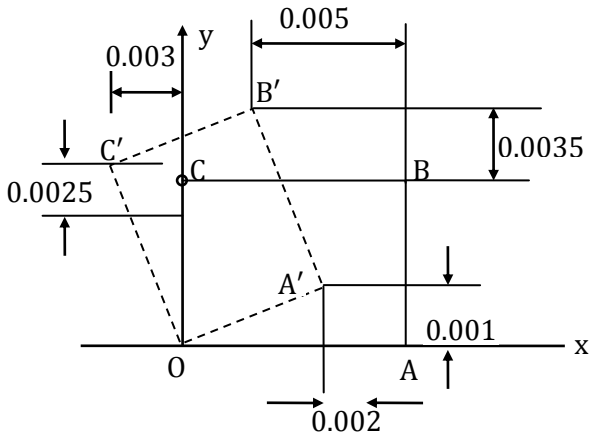
(A) Guests theory
(B) Rankines theory
(C) St venant's theory
(D) Von-mises theory

16. Young's modulus of the material is 200 GPa . It is subjected to stress of magnitude 150 GPa. It is shown in the stress-strain graph at point A strain corresponding to A will be



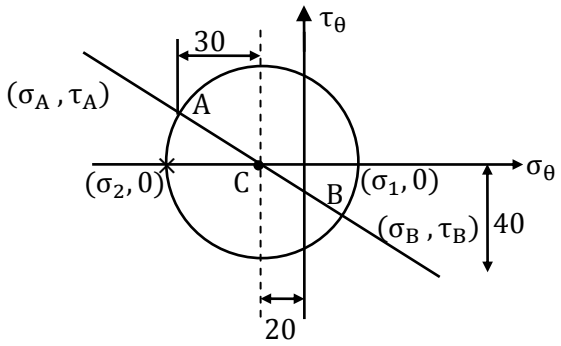
(A) 0.75
(B) 0.5
(C) 0.25
(D) 0.8

17. The element OABC undergoes deformation as shown below. OABC is a square of 1 mm side



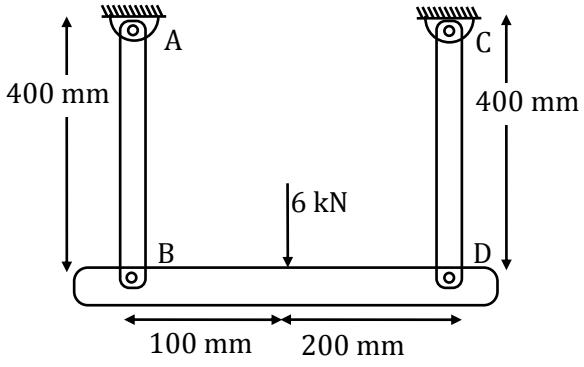
Evaluate, $\epsilon_x+\epsilon_y+\tau_{xy}$.

18. Mohr's circle for the plane state of stress is shown below. Unit of stress is in MPa. Which of the following option is correct



(A) $\sigma_A=-50,\sigma_B=10,\sigma_1=30,\sigma_2=-70$
(B) $\sigma_A=-50,\ \sigma_B=20,\sigma_1=30,\sigma_2=-50$
(C) $\sigma_A=-30,\sigma_B=30,\sigma_1=30,\sigma_2=-10$
(D) $\sigma_A=-20,\sigma_B=10,\sigma_1=50,\sigma_2=-30$

19. In the figure below AB, CD are deformable solids and BD is a rigid member. AB and CD are made up of material of E=100 GPa and cross sectional area of 100 mm^2. Neglecting the weights, the elongation of link AB is (mm)



20. For the plane stress condition shown below. The angle (θ) between the +Ve x plane and the nearest principle plane is _____