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Section	NO # B
paper	MDS II
Date	26/09/2020
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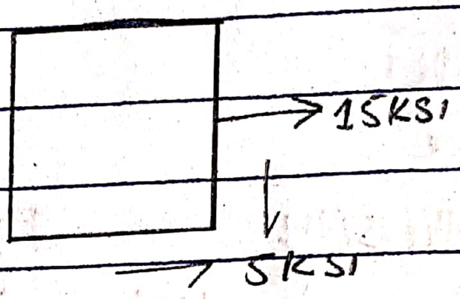
QNO (02):

Given Data:

$\delta_x = 15ksi$



$\delta_y = 0$

$\tau_{xy} = -5ksi$

Required Data:

a- Principal stress

b- Max-plan shear Stress

c- averag Normal Stress

Sollution:

a- principal stress:

$$\delta_{1,2} = \frac{\delta_x + \delta_y}{2} \pm \sqrt{\left(\frac{\delta_x - \delta_y}{2}\right)^2 + \tau_{xy}^2}$$

$$\delta_{1,2} = \frac{15+0}{2} \pm \sqrt{\left(\frac{15-0}{2}\right)^2 + (-5)^2}$$

$$\delta_{1,2} = 7.5 \pm 9.01$$

$$\Rightarrow \delta_1 = 16.51 \text{ ksi}$$

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$\delta_2 = 7.5 - 9.01$

$\delta_2 = -1.51$ KSI.

Now we find orientation
we know that.

$$2\theta_2 = \frac{\tau_{xy}}{(\delta_x - \delta_y)/2}$$

$$2\theta_2 = \frac{-5}{(15-0)/2}$$

$$\theta_2 = -0.33$$

Now we check which angles goes with which principles stress.
we know that:

$$\delta_{x_1} = \frac{\delta_x + \delta_y}{2} + \frac{\delta_x - \delta_y}{2} \cos 2\theta + \tau_{xy} \sin 2\theta$$

$$= \frac{15+0}{2} + \frac{15-0}{2} \cos 2(-\cancel{0.33}\,.33) + (-5) \sin 2(-0.33)$$

$$= \frac{15}{2} + \frac{15}{2}(0.99) + (-5)(-0.12).$$

$$= 14.925 + 0.6$$

$$= 15.525$$

b- Max-plan shear stress:

$$\tau_{max} = \sqrt{\left(\frac{\delta x - \delta y}{2}\right)^2 + \tau_{xy}^2}$$

$$\Rightarrow \tau_{max} = \sqrt{\left(\frac{15-0}{2}\right)^2 + (-5)^2}$$

$$\tau_{max} = 9.01 ksi$$

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Now we find orientation.
we know that.

$$\tan 2\theta_s = \frac{-(\sigma_x - \sigma_y)/2}{\tau_{xy}}$$

$$= \frac{(15-0)/2}{-5}$$

$$\tan 2\theta = +1.5.$$

$$2\theta = \tan^{-1}(+1.5).$$

$$2\theta = 56$$

$$\theta = \frac{56}{2}$$

$$\boxed{\theta = 28.}$$

we know that

$$\tau_{x'y'} = -\frac{\sigma_x - \sigma_y}{2}\sin 2\theta + \tau_{xy}\cos 2\theta.$$

$$= -\frac{15-0}{2}\sin 2(28) + (-5)\cos 2(28).$$

$$= -7.5(0.82) - 2.8$$

$$= -8.95$$

{Q:NO: 1 Part b}

$\delta x = 15\ ksi$

$\tau_{xy} = -5\ ksi$

$\delta y = 0$

$$c = \frac{\delta x + \delta y}{2} = \frac{15+0}{2}$$

$c = 7.5\ ksi$

$$R = \sqrt{\left(\frac{\delta x - \delta y}{2}\right)^2 + \tau_{xy}^2}$$

$$R = \sqrt{\left(\frac{15-0}{2}\right)^2 + (-5)^2}$$

$R = 9.01$

Scale =>

1 smal box = 0.5 ksi

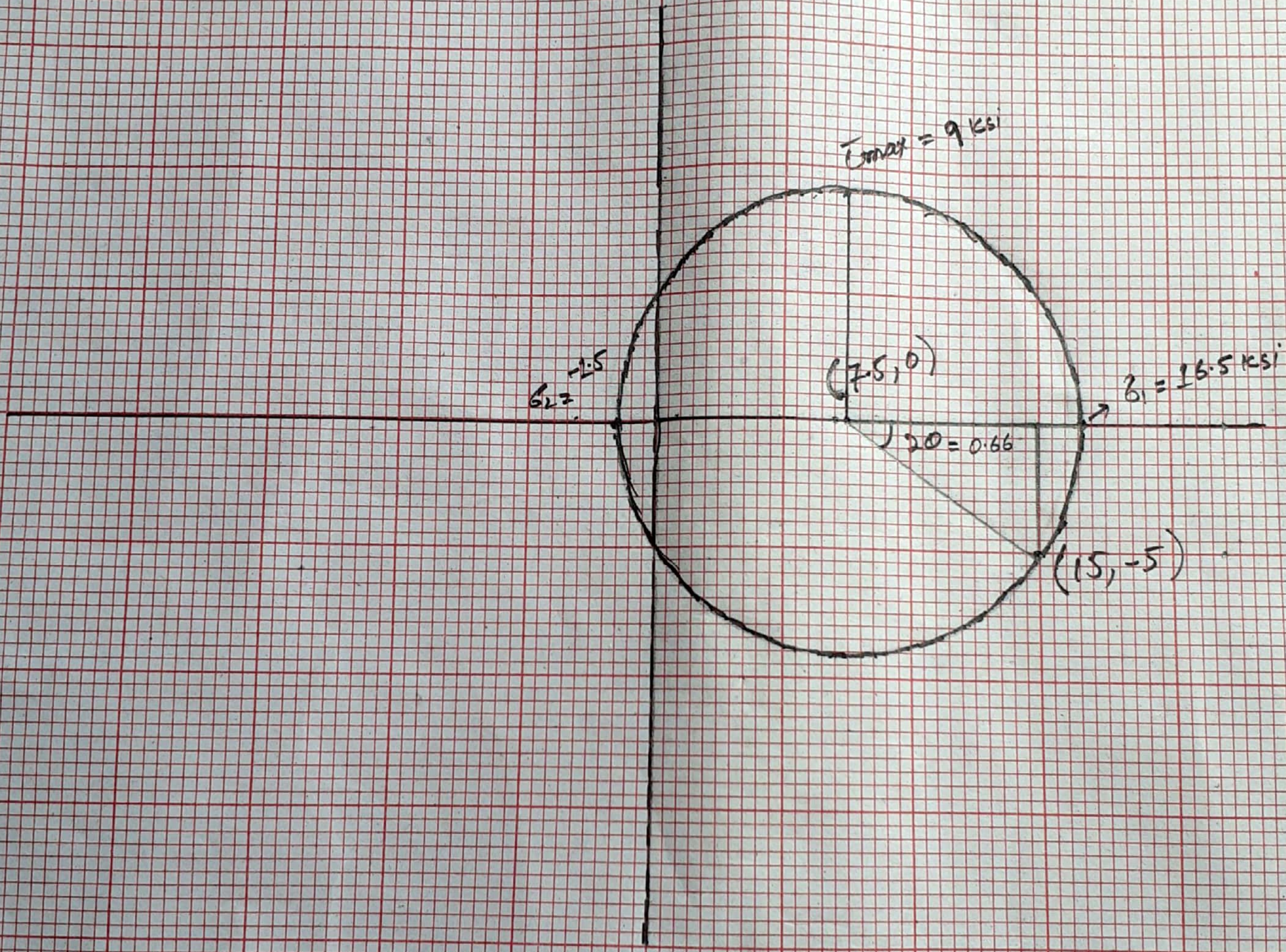
$\delta_x = 15$ ksi

$\tau_{xy} = -5$ ksi

$\delta_y = 0$

$c = \frac{\delta_x + \delta_y}{2}$

$c =$



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Q: NO: 02:→

Given Data:→

$\sigma_1 = 32 \, MPa$
$\sigma_2 = 16 \, MPa$

Required Data:→

Absolute Maximum Shear Stress:.

Sollution:→

The principal stresses are
$\sigma_1 = 32 \, MPa$
$\sigma_2 = 16 \, MPa$

If σ_1 & σ_2 are plotted along σ axis, the Mohar circles are obtained.

The large circle has Radius of 16 MPa. & have center of 16 MPa. The small circle has both have Radious of 8 ~~Map~~ MPa &
1st small has center of 8 & 2nd one have center of 24 on σ axis.

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An orientation of 45°, in Plane, show that as shown in graph.

$\tau_{abs-max} = 16$ MPa

$\sigma_{ave} = 16$ MPa.

{CHECK :-}

$$\tau_{abs-max} = \frac{\sigma_1}{2}$$

$$\tau_{abs-max} = \frac{32}{2} = 16 \text{ MPa.}$$

$$\sigma_{ave} = \frac{\sigma_x + \sigma_y}{2}$$

$$\sigma_{ave} = \frac{32+0}{2} = 16 \text{ MPa.}$$

By comperison, the maximum in plan shear stress can be determined from the Mohr's circle shown in graph.

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τ_{max} - in plan = 8mpa

B δ_{ave} = 24mpa.

Check :-

τ_{max} - inplan = $\frac{\delta_1 - \delta_2}{2}$

$= \frac{32 - 16}{2}$

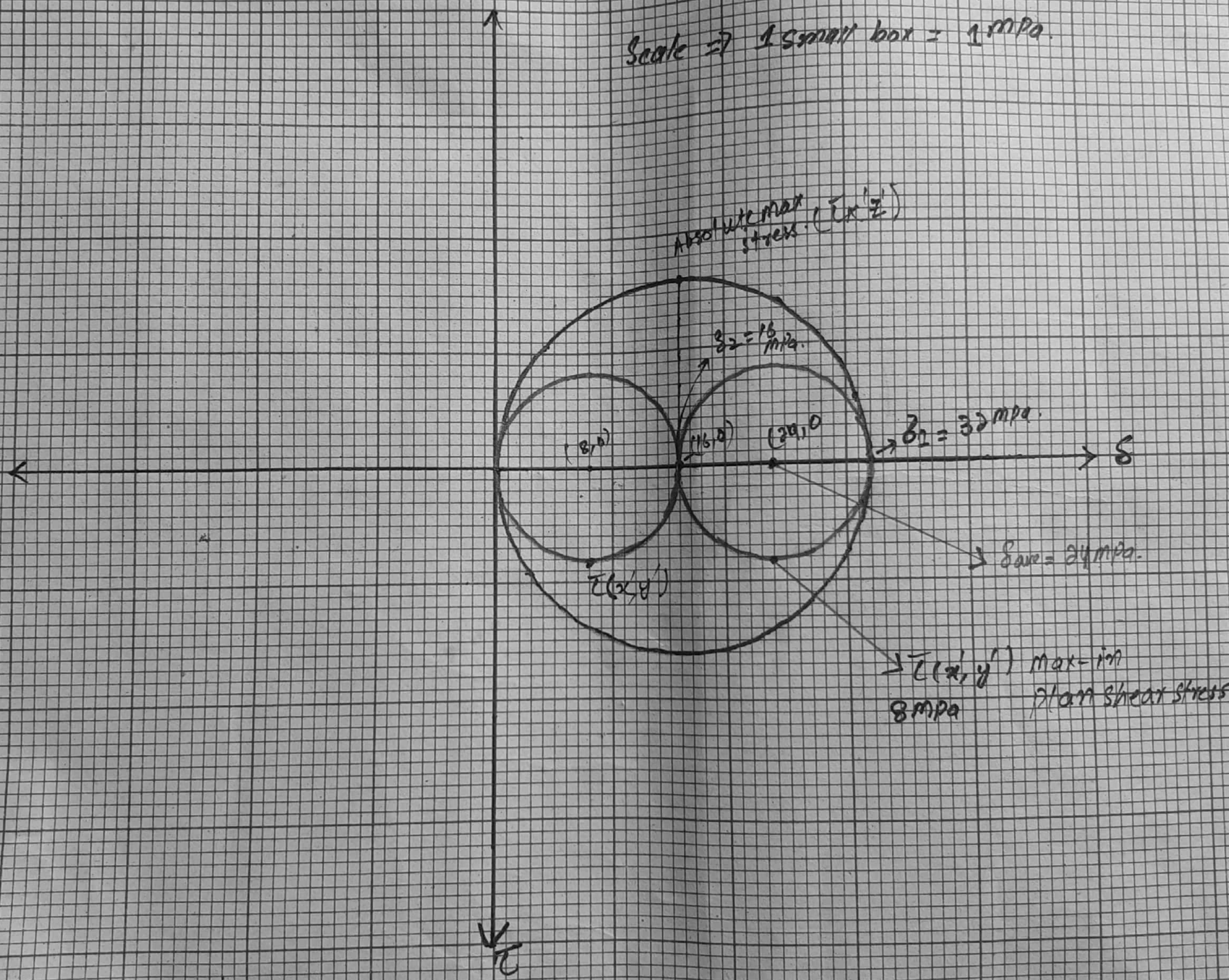
$\Rightarrow$ 8 mpa

$\delta_{avg} = \frac{\delta_1 + \delta_2}{2}$

$\delta_{avg} = \frac{32 + 16}{2}$

δ_{avg} = 24 mpa.

Scall ⇒ 1 small box ⇒ 1 MPa



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QNO (03) :- (03)

Stresses Responsible For ~~Fails~~ Failure of Ductile and Brittle Materials.

There are two main stresses

(1) Tensile stresses

(2) Shear stresses.

Ductile Materials → failures occurs due to shear stresses. When shear stresses exceed the shear strength of ductile Materials.

Brittle Material failure occurs due to tensile strength. When tensile stresses exceed the strength of Brittle materials.

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Two Failure theories For Ductile Material.

(1). Maximum Shear Stress Theory.

(2) Maximum Distortion Energy Theory.

Two Failure theories For Brittle Materials.

(1) Maximum Normal Stress Theory.

(2) Mohr's Failure Criterion.

Failure Theory for concrete.

As a concrete ~~as~~ is a brittle material, the fracture of brittle material is due to the maximum tensile stresses. if a brittle

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material has a stress-strain diagram that is different in tension and compression than Mohr's failure criterion may be used to predict failure.

if the stress-strain diagram is similar in tension and compression then we used maximum normal stress theory.

Due to material property tensile fracture of brittle material is difficult to predict, so theory of failure for brittle material should be used with lot of care.

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(b). steel is ductile material and due to maximum shear stress the steel bend which may cause the breaking of steel. Therefore maximum Distortion theory are applicable to ductile material such as steel.