ASSIGNMENT 5

1. If the minimum principal stress is -7 MPa, find $\sigma_x$ for the case of plane stress illustrated in figure 1.

![Figure 1](image1)

2. Find the angle which the principal stress axes make with the xy axes for the case of plane stress illustrated in figure 1.

3. For the state of stress $\sigma_x = -120$ MPa, $\sigma_y = 50$ MPa, $\tau_{xy} = 100$ MPa, find the stress components (normal stress components) on an element inclined at 30° to the xy axes as shown in figure 2.

![Figure 2](image2)
4. In figure 2 find the shear stress component.

5. A long, cylindrical pressure vessel with closed ends is to be made by rolling a strip of plastic of thickness \( t \) and width \( w \) into a helix and making a continuous fused joint, as illustrated in figure 3. It is desired to subject the fused joint to a tensile stress only 80 percent of the maximum in the parent plastic. What is the maximum allowable width \( w \) of the strip? For cylindrical vessel use the relationships.

\[
\sigma_0 = \frac{pr}{t} \\
\sigma_z = \frac{F}{(2\pi rt)} \text{ and shear stress } \tau_{0} = 0
\]
6. Find the principal stress directions if the stress at a point is the sum of the two states of stress illustrated in figure 4 (case a).

7. Find the principal stress directions if the stress at a point is the sum of the two states of stress illustrated in figure 4 (case b).
8. An open ended, thin walled cylinder, \( r = 25 \text{ cm} \) and \( t = 0.25 \text{ cm} \) is acted on by an internal pressure \( p \) and an axial force \( F \) in figure 5. Find the values of \( p \) and \( F \) acting in the following situation:

\[
\sigma_m = 100 \text{ MPa}, \quad \sigma_n = 30 \text{ MPa}, \quad \tau_{mn} = \? \]

For cylindrical vessel use the relationships.

\[
\sigma_0 = \frac{pr}{t} \\
\sigma_z = \frac{F}{2\pi rt} \text{ and shear stress } \tau_{\theta} = 0
\]

9. In figure 5 find the values of \( p \) and \( F \) acting in the following situation:

\[
\sigma_m = 100 \text{ MN/m}^2, \quad \sigma_n = 100 \text{ MN/m}^2, \quad \tau_{mn} = \?
\]