1. Air at 3 kg/s and a stagnation temperature of 290 K, enters a 10 stage axial flow compressor when operating with a mean blade speed of 180 m/s. The compressor operates with a pressure ratio of 6.5 and has an isentropic efficiency of 90%. The axial velocity is 150 m/s and is constant across the stages. If the compressor stages have symmetrical velocity triangles, determine the power required to drive the compressor and the blade angles at the entry and exit of the rotor.

\[
\theta_{2s} = 290 \times \frac{6.5}{1.4-1} = 495.23 \text{ K}
\]

\[
\eta_c = 0.90 = \frac{\theta_{2s} - \theta_1}{\theta_2 - \theta_1}
\]

\[
\theta_2 = 518.14 \text{ K}
\]

1. Power required to drive the compressor

\[
\dot{m}C_p \Delta \theta = 3 \times 1005 (518.14 - 290)
\]

\[
= 687.84 \text{ kW}
\]

2. Temperature rise per stage, \( \Delta \theta_{\text{stage}} = \frac{518.14 - 290}{10} = 22.81 \text{ K} \)

\[
\text{Work done per unit mass} = U \Delta C_w
\]

\[
= 180 \Delta C_w = C_p \Delta \theta_{\text{stage}}
\]

\[
\Delta C_w = \frac{1005 \times 22.81}{180} = 127.36 \text{ m/s}
\]

For symmetrical stages, \( \Delta C_w = \frac{C_1 \tan \beta_1 - \tan \beta_2}{2} \)

\[
127.36 = 150 (\tan \beta_1 - \tan \beta_2)
\]

\[
0 = \tan \beta_1 - \tan \beta_2 = 0.843
\]

Also, \( R_x = \frac{C_1 (\tan \beta_1 + \tan \beta_2)}{2u} \), \( \tan \beta_1 + \tan \beta_2 = 1.2 \)

\[
\beta_1 = 45.69^\circ
\]

\[
\beta_2 = 9.95^\circ
\]