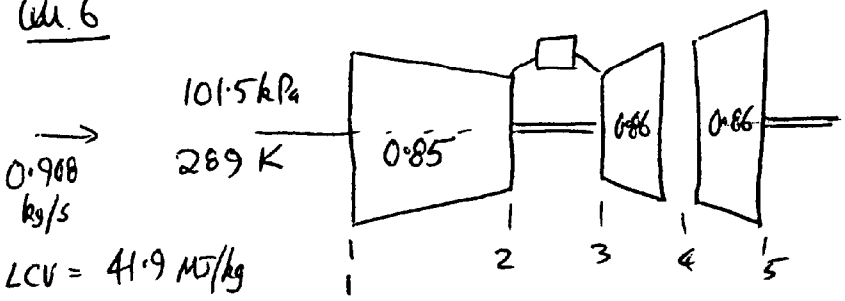
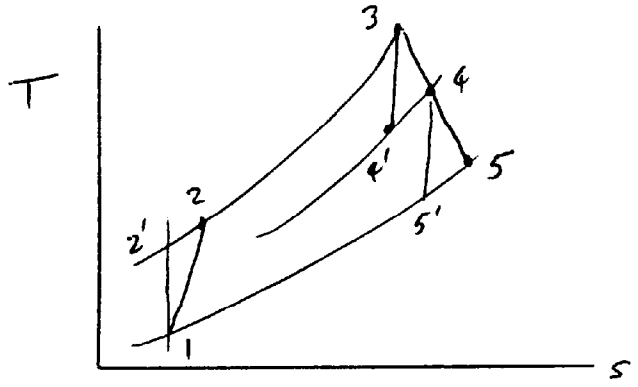
Qu. 6



$\frac{p_2}{p_1} = 4$



(Assume $\gamma = \gamma_g$ & $C_{pa} = C_{pg}$

$T_3 = 1090\ K$

$\frac{T_{2'}}{T_1} = r_{p_c}^{\frac{\gamma-1}{\gamma}}$ $\quad T_{2'} = 289 \times 4^{\frac{1.4-1}{1.4}} = 429.5\ K$

$\frac{T_{2'} - T_1}{T_2 - T_1} = 0.85 \quad \therefore \frac{429.5 - 289}{T_2 - 289} = 0.85$ whence $\underline{T_2 = 454.2\ K}$

Assume ~~$\dot{m} C_p (T_2 - T_1)$~~ = ~~$\dot{m} C_p (T_3 - T_4)$~~

$454.2 - 289 = 1090 - T_4$ whence $\underline{T_4 = 924.8 K}$

$\frac{T_3 - T_4}{T_3 - T_{4'}} = 0.86 \quad \therefore \frac{1090 - 924.8}{1090 - T_{4'}} = 0.86$ whence $\underline{T_{4'} = 897.9\ K}$

$\frac{T_3}{T_{4'}} = r_{p_T}^{\frac{\gamma-1}{\gamma}} \quad \therefore \frac{1090}{897.9} = r_{p_T}^{\frac{1.4-1}{1.4}}$ whence $r_{p_T} = 1.971$

$\therefore \frac{p_3}{p_4} = 1.971 \quad \therefore p_4 = \frac{4 \times 101.5}{1.971} = \underline{\underline{205.95\ kPa}}$

$\frac{T_4}{T_{5'}} = \left(\frac{205.95}{101.5}\right)^{\frac{1.4-1}{1.4}} \quad \therefore T_{5'} = \frac{924.8}{\left(\frac{205.95}{101.5}\right)^{\frac{1.4-1}{1.4}}} = \underline{755.5\ K}$

$\frac{T_4 - T_5}{T_4 - T_{5'}} = 0.86 \quad \therefore \frac{924.8 - T_5}{924.8 - T_{5'}} = 0.86$ whence $\underline{T_5 = 779.2\ K}$

$\dot{W} = \dot{m} C_p (T_4 - T_5) = 0.908 \times 1.01 (924.8 - 779.2) = \underline{\underline{133.5\ kW}}$