Tut 1 Design II

- Transmission ratio $= i = \frac{w_1}{w_2} = \frac{n_1}{n_2} = \frac{N_2}{N_1} = \frac{d_2}{d_1}$
- $D_{Pitch} = m * N$
- circular pitch $= \pi m = P_c$
- $H = Tw$ $\rightarrow$ $T = Fr \longrightarrow r = \frac{mN}{2}$
  $\rightarrow$ $w = \frac{2\pi n}{60}$

Tut 2

$$Z = \sqrt{(r_p + a_p)^2 - (r_p \cos\varphi)^2} + \sqrt{(r_g + a_g)^2 - (r_g \cos\varphi)^2} - C \sin\varphi$$

r_g: gear / r_p: pinion / a_g, a_p: modules / C: center to center dist.
$C = r_g + r_p$

Contact ratio $= m_c = \frac{Z}{P_c \cos\varphi}$

Tut 3

$n = \frac{\sigma_{FP}}{\sigma}$

Bending Stress

$\sigma = \frac{w_t}{bmJ} K_v K_o K_s K_H K_B$

* J: From graph
* $K_v = \left(\frac{A + \sqrt{200V}}{A}\right)^B$
  - $A = 50 + 56(1-B)$
  - $B = 0.25(12 - Q_v)^{2/3}$
  - $V = wr = \frac{2\pi n}{60} * \frac{mN}{2}$
* $K_s = 1/K_B \longrightarrow$ Table
* K_H = table
* $K_B = \begin{cases} 1.6 \ln(2.242/m_b) & m < 1.2 \\ 1 & m > 1.2 \end{cases}$
  - $m_b = t_R/h_t$
    - t_r: rim thick.
    - h_t: tooth height

$\sigma_{FP} = \sigma'_{FP} \frac{Y_N}{Y_0 Y_Z}$

* $\sigma'_{FP} = 0.703 H_B + 113$
* Y_N: graph
* Y_0: 1
* Y_Z: table or equations

$\boxed{\text{Tut4}}$ Design $\quad n'_c = \frac{\sigma_{HP}}{\sigma_c} \longrightarrow n_c = (n'_c)^2$

Contact Stress:

$$\sigma_c = C_p \sqrt{\frac{W_t}{b d_p I} K_v K_o K_s K_H C_f}$$

$$* I = \frac{\cos\varphi \sin\varphi}{2} \frac{m_G}{m_G+1} \quad \text{external gears}$$

$$= \frac{\cos\varphi \sin\varphi}{2} \frac{m_G}{m_G-1} \quad \text{internal gears}$$

$$m_g = \frac{N_G}{N_P}$$

* C_p : table
* b : face width

Helical Gears:

ψ : helix angle

φ_n : normal pressure angle

φ_n : tranoveral pressure angle

m or m_t : tranoverse module

m_n : normal module

- $m_t = \frac{m_n}{\cos\psi}$
- $p_t = \frac{p_n}{\cos\psi}$
- $d = m_t N$
- $p_x = \frac{p_t}{\tan\psi}$
- $W_r = W \sin\varphi_n$

$W_t = W \cos\varphi_n \cos\psi$

$W_a = W \cos\varphi_n \sin\psi$

$$\left.\begin{aligned} W_r &= W \sin\varphi_n \\ W_t &= W\cos\varphi_n\cos\psi \\ W_a &= W\cos\varphi_n\sin\psi \end{aligned}\right\} \quad \begin{aligned} W_r &= W_t \tan\varphi_t \\ W_a &= W_t \tan\psi \end{aligned}$$