FORMULA SHEET FOR MECHANICAL TECHNOLOGY: FITTING AND MACHINING

1. BELT DRIVES

1.1 *Belt speed* $= \dfrac{\pi DN}{60}$

1.2 *Belt speed* $= \dfrac{\pi(D+t)\times N}{60}$ *(t = belt thickness)*

1.3 *Belt mass = Area × Length × Density* *(A = thickness × width)*

1.4 *Speed ratio* $= \dfrac{\text{Diameter of driven pulley}}{\text{Diameter of driver pulley}}$

1.5 *Belt length (flat) = [(D + d) × 1,57] + (2 × centre distance)*

1.6 *Open-belt length* $= \dfrac{\pi(D+d)}{2} + \dfrac{(D+d)^2}{4c} + 2c$

1.7 *Crossed-belt length* $= \dfrac{\pi(D+d)}{2} + \dfrac{(D+d)^2}{4c} + 2c$

1.8 *Power (P)* $= \dfrac{(T_1 - T_2)\pi\, D\, N}{60}$

Where:

T_1 *= force in the tight side*
T_2 *= force in the slack side*
$T_1 - T_2$ *= effective tensile force* (T_e)

1.9 *Ratio between tight side and slack side* $= \dfrac{T_1}{T_2}$

1.10 *Width* $= \dfrac{T_1}{\text{Permissible tensile force}}$

1.11 $N_{DR} \times D_{DR} = N_{DN} \times D_{DN}$

1.12 *Torque = Force × Radius*

1.13 *Power (P)* $= \dfrac{2\pi\, NT}{60}$

2. STRESS AND STRAIN

2.1 $A_{shaft} = \dfrac{\pi d^2}{4}$

2.2 $A_{pipe} = \dfrac{\pi \left(D^2 - d^2\right)}{4}$

2.3 $Safety\ factor = \dfrac{Maximum\ stress/Break\ stress}{Safe\ working\ stress}$

2.4 $Stress = \dfrac{Force}{Area}$ OR $\sigma = \dfrac{F}{A}$

2.5 $Strain = \dfrac{Change\ in\ length}{Original\ length}$ OR $\varepsilon = \dfrac{\Delta L}{oL}$

2.6 $Young's\ modulus = \dfrac{Stress}{Strain}$ OR $E = \dfrac{\sigma}{\varepsilon}$

3. HYDRAULICS

3.1 $Pressure = \dfrac{Force}{Area}$ OR $P = \dfrac{F}{A}$

3.2 $Volume = Area \times Stroke\ length \quad (l\ or\ s)$

3.3 $Work\ done = Force \times distance$

3.4 $P_A = P_B$

3.5 $\dfrac{F_A}{A_A} = \dfrac{F_B}{A_B}$

4. GEAR DRIVES

4.1 $Power\ (P) = \dfrac{2\pi\ NT}{60}$

4.2 $Gear\ Ratio = \dfrac{Product\ of\ teeth\ on\ driven\ gear}{Product\ of\ teeth\ on\ driver\ gear}$ OR $Speed\ ratio = \dfrac{N_{input}}{N_{output}}$

4.3 $$\frac{N_{input}}{N_{output}} = \frac{\text{Product of teeth on driven gear}}{\text{Product of teeth on driver gear}}$$

4.4 $N_A \times T_A = N_B \times T_B$

4.5 *Torque = Force × Radius*

4.6 *Torque transmitted = Gear ratio × Input torque*

4.7 $$\text{Module} = \frac{\text{Pitch-circle diameter}}{\text{Number of teeth}} \quad \text{OR} \quad m = \frac{PCD}{T}$$

4.8 $$\text{Pitch-circle diameter} = \frac{\text{Circular pitch} \times \text{Number of teeth}}{\pi}$$

OR

$$PCD = \frac{CP \times T}{\pi}$$

4.9 *Outside diameter (OD) = PCD + 2(m)*

4.10 *Addendum = Module* *OR* $a = m$

4.11 *Dedendum (b) = 1,157 × m* *OR* *Dedendum (b) = 1,25 × m*

4.12 *Cutting depth (h) = 2,157 × m* *OR* *Cutting depth (h) = 2,25 × m*

4.13 *Clearance (c) = 0,157 × m* *OR* *Clearance (c) = 0,25 × m*

4.14 *Circular pitch (CP) =* $m \times \pi$

4.15 *Working depth (WD) = 2 × m* *OR* *Working depth (WD) = 2 × a*

5. KEYWAYS

5.1 *Width (W)* = $\frac{D}{4}$

5.2 *Thickness (T)* = $\frac{D}{6}$

5.3 *Length (L) = 1,5 × D*
Where:
D = Diameter of shaft

5.4 *Standard taper for taper key: 1 in 100 or 1 : 100*

6. CINCINNATI DIVIDING HEAD TABLE FOR MILLING MACHINE

Hole circles											
Side 1	*24*	*25*	*28*	*30*	*34*	*37*	*38*	*39*	*41*	*42*	*43*
Side 2	*46*	*47*	*49*	*51*	*53*	*54*	*57*	*58*	*59*	*62*	*66*
Change gears											
Gears	*24 x 2*	*28*	*32*	*40*	*44*	*48*	*56*	*64*	*72*	*86*	*100*

6.1 *Indexing* = $\frac{40}{n}$ *(n = number of divisions)*

6.2 $\frac{Dr}{Dn} = \frac{A-n}{A} \times \frac{40}{1}$ *OR* $\frac{Dr}{Dn} = (A-n) \times \frac{40}{A}$

Where:
A = chosen number of divisions
n = real number of divisions

7. DOVETAILS

Where:
R = Radius of precision roller
y = Distance from top edge of dovetail in relation to bottom corner of dovetail
x = Distance from middle of precision roller to bottom corner of dovetail
θ = Dovetail included angle (normally 60°)
h = height of dovetail
w = Minimum width of dovetail
W = maximum width of dovetail
m = Distance between rollers
M = Distance over rollers

8. TAPERS

8.1 $\tan\frac{\theta}{2} = \frac{D - d}{2 \times l}$ *(l = Taper length)*

8.2 $Tail\ stock\ set\text{-}over = \frac{L(D - d)}{2 \times l}$ *(L = Distance between centres)*

9. SCREW THREADS

9.1 *Mean diameter = Outside diameter – (½ × Pitch)* OR $D_m = OD - \frac{P}{2}$

9.2 *Effective diameter* (D_{eff}) *= Pitch diameter* (D_p) *= Mean diameter* (D_m)

9.3 *Lead = Pitch × Number of starts*

9.4 *Height of screw thread = 0,866 × Pitch (P)*

9.5 *Depth of screw thread = 0,613 × Pitch (P)*

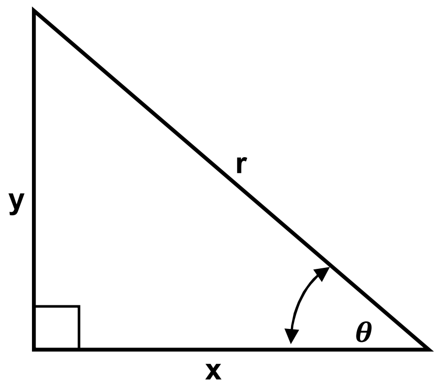
9.6 *Helix angle:* $Tan\ \theta = \frac{Lead}{\pi \times D_m}$

9.7 *Leading angle = 90° – (Helix angle + Clearance angle)*

9.8 *Following angle = 90° + (Helix angle – Clearance angle)*

9.9 $D_P = D_N - (0{,}866 \times P)$

10. PYTHAGORAS' THEOREM AND TRIGONOMETRY



10.1 $Sin\ \theta = \frac{y}{r}$

10.2 $Cos\ \theta = \frac{x}{r}$

10.3 $Tan\ \theta = \frac{y}{x}$

10.4 $r^2 = x^2 + y^2$