FORMULA SHEET

1. BELT DRIVES

1.1 $N_1 \times D_1 = N_2 \times D_2$

1.2 Belt speed $= \frac{\pi DN}{60}$ where N is in r/min

1.3 Belt speed $= \frac{\pi(D+t)\times N}{60}$ (t = belt thickness)

1.4 Belt mass = area × length × density (A = thickness × width)

1.5 Speed ratio $= \frac{\text{diameter of driven pulley}}{\text{diameter of driving pulley}}$

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

1.7 Open belt length $= \frac{\pi(D+d)^2}{2} + \frac{(D-d)^2}{4c} + 2c$

1.8 Crossed belt length $= \frac{\pi(D+d)^2}{2} + \frac{(D+d)^2}{4c} + 2c$

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

1.10 Power (P) $= \frac{(T_1 - T_2)\pi DN}{60}$ where N is in r/min

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

1.11 Power (P) = $(T_1 - T_2) \times V$ where V = belt speed in m/s

1.12 Power (P) $= \frac{2\pi NT}{60}$ where N is in r/min

1.13 Width $= \frac{T_1}{\text{permissable tensile force}}$

2. STRESS AND STRAIN

2.1 Stress $= \frac{\text{force}}{\text{area}}$ or $\left(\sigma = \frac{F}{A}\right)$

2.2 Strain (ε) $= \frac{\text{change in length}(\Delta L)}{\text{original length}(L)}$

2.3 Young's modulus (E) = $\frac{\text{stress}}{\text{strain}}$ or $\left(\frac{\sigma}{\varepsilon}\right)$

2.4 Area of a round bar = A = $\frac{\pi d^2}{4}$

2.5 Area of a pipe = A = $\frac{\pi(D^2 - d^2)}{4}$

2.6 Area of a square bar = A = L^2 or A = L × W

3. HYDRAULICS

3.1 Pressure (P) = $\frac{\text{force}(F)}{\text{area (A)}}$

3.2 Volume = (cross-sectional area) × stroke length

3.3 Work done = force × distance

4. KEYS AND KEYWAYS

4.1 Width of key = $\frac{\text{diameter of shaft}}{4}$

4.2 Thickness of key = $\frac{\text{diameter of shaft}}{6}$

4.3 Length of key = 1,5 × diameter of shaft

4.4 Standard taper for taper key = 1 in 100 or 1 : 100

5. LEVERS

5.1 Mechanical advantage (MA) = $\frac{\text{load}(W)}{\text{effort}(F)}$

5.2 Velocity ratio (VR) = $\frac{\text{input movement}}{\text{output movement}}$

5.3 Input movement (IM) = effort × distance moved by effort

5.4 Output movement (OM) = load × distance moved by load

6. GEAR DRIVES

6.1 $N_1 \times D_1 = N_2 \times D_2$

6.2 Power (P) = $\frac{2\pi NT}{60}$

6.3 Gear ratio = $\frac{\text{product of number of teeth on driven gears}}{\text{product of number of teeth on driving gears}}$

6.4 $\frac{N_{input}}{N_{output}} = \frac{\text{product of number of teeth on driven gears}}{\text{product of number of teeth on driving gears}}$

6.5 Torque = force × radius

6.6 Torque transmitted = gear ratio × input torque

6.7 Module (m) = $\frac{\text{pitch} - \text{circle diameter } (\text{PCD})}{\text{number of teeth } (\text{T})}$

6.8 $N_1T_1 = N_2T_2$

6.9 Pitch-circle diameter (PCD) = $\frac{\text{circular pitch}(\text{CP}) \times \text{number of teeth}(\text{T})}{\pi}$

6.10 Pitch-circle diameter (PCD) = m × T

6.11 Outside diameter (OD) = m(T + 2)

6.12 Outside diameter (OD) = Pitch-circle diameter (PCD) + 2 module

6.13 Addendum = module (m)

6.14 Dedendum = 1,157 m or Dedendum = 1,25 m

6.15 Cutting depth = 2,157 m or Cutting depth = 2,25 m

6.16 Clearance = 0,157 m or Clearance = 0,25 m

6.17 Circular pitch (CP) = m × π

6.18 Centre distance between gear A and gear B = $\frac{(PCD)_A}{2} + \frac{(PCD)_B}{2}$

7. SCREW THREADS

7.1 Pitch diameter = outside diameter – $\frac{1}{2}$ pitch

7.2 Pitch circumference = $\pi \times$ pitch diameter

7.3 Lead = pitch × number of starts

7.4 Height of screw thread = 0,866 × pitch

7.5 Depth of screw thread = 0,613 × pitch

8. INDEXING

8.1 Cincinnati dividing head table for milling machine

Cincinnati index plate											
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

8.2 $\text{Indexing} = \frac{40}{n}$ (where n = number of divisions)