FORMULA SHEET FOR MECHANICAL TECHNOLOGY (FITTING AND MACHINING)

1. BELT DRIVES

$$\text{Belt speed} = \frac{\pi D N}{60} \qquad \text{or} \qquad v = \frac{\pi D N}{60}$$

$$\text{Speed ratio} = \frac{\text{Diameter of driven pulley}}{\text{Diameter of driver pulley}}$$

$$N_1 D_1 = N_2 D_2$$

$$\text{Power } (P) = \frac{2 \pi N T}{60}$$

$$\text{Ratio of tight side to slack side} = \frac{T_1}{T_2}$$

$$\text{Power} = \frac{(T_1 - T_2)\, \pi D N}{60}$$

where T_1 = force in the tight side

T_2 = force in slack side

$T_1 - T_2$ = effective force (T_e)

2. STRESS AND STRAIN

$$\text{Stress} = \frac{\text{Force}}{\text{Area}} \quad \text{or} \quad (\sigma = \frac{F}{A})$$

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

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

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

$$A_{pipe} = \frac{\pi (D^2 - d^2)}{4}$$

$$\text{Safety factor} = \frac{\text{Break stress}}{\text{Safe working stress}}$$

3. HYDRAULICS

$$\text{Pressure (P)} = \frac{\text{Force (F)}}{\text{Area (A)}}$$

$$\text{Volume} = \text{Cross-sectional area} \times \text{stroke length}$$

4. KEYS AND KEYWAYS

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

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

$$\text{Length of key} = 1{,}5 \times \text{Diameter of shaft}$$

$$\text{Standard taper for taper key} : 1 \text{ in } 100 \text{ or } 1:100$$

5. GEAR DRIVES

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

$$N_1T_1 = N_2T_2$$

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

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

$$\text{Torque} = \text{force} \times \text{radius}$$

$$\text{Torque transmitted} = \text{gear ratio} \times \text{input torque}$$

$$\text{Module (m)} = \frac{\text{Pitch-circle diameter (PCD)}}{\text{Number of teeth (T)}}$$

Pitch-circle diameter (PCD) = module (m) x number of teeth (T)

Outside diameter (OD) = PCD + (2 x module)

Addendum (a) = module (m)

Dedendum (b) = 1,157 m or Dedendum (b) = 1,25 m

Cutting depth (h) = 2,157 m or Cutting depth (h) = 2,25 m

Clearance (c) = 0,157 m or Clearance (c) = 0,25 m

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

$$Add_c = m + \frac{Tm}{2}\left(1 - \cos\frac{90°}{T}\right)$$

$$t_c = Tm\sin\frac{90°}{T} \quad \text{or} \quad t_c = PCD\sin\frac{90°}{T}$$

6. SCREW THREADS

$$\text{Pitch diameter} = \text{Outside diameter} - \tfrac{1}{2}\text{pitch}$$

$$\text{Pitch circumference} = \pi \times \text{pitch diameter}$$

$$\text{Lead} = \text{pitch} \times \text{number of starts}$$

$$\text{Height of screw thread} = 0{,}866 \times p \quad \text{where } p = \text{pitch of the screw thread}$$

$$\text{Depth of screw thread} = 0{,}613 \times p \quad \text{where } p = \text{pitch of the screw thread}$$

$$\text{Number of turns} = \frac{\text{length}}{\text{lead}}$$

$$\text{Helix angle}: \tan\theta = \frac{\text{lead}}{\text{pitch diameter}}$$

$$\text{Leading tool angle} = 90° - (\text{helix} + \text{clearance angle})$$

$$\text{Following tool angle} = 90° + (\text{helix} - \text{clearance angle})$$

7. CINCINNATI DIVIDING HEAD TABLE FOR THE 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										
24 x 2	28	32	40	44	48	56	64	72	86	100

$$\text{Simple indexing} = \frac{40}{n} \quad (\text{where } n = \text{number of divisions})$$

$$\text{Angular Indexing} = \frac{n}{9°}$$

$$\text{Change gears: } \frac{Dr}{Dn} = (A - n) \times \frac{40}{A} \quad \text{or} \quad \frac{Dr}{Dn} = \frac{(A - n)}{A} \times \frac{40}{1}$$

$(\text{where } A = \text{chosen divisions})$ $(\text{where } n = \text{given divisions})$