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 \( = \frac{\pi(D + t) \times N}{60} \) \( (t = \text{belt thickness}) \)

1.4 Belt mass = area \( \times \) length \( \times \) density \( \ (A = \text{thickness} \times \text{width}) \)

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

1.6 Belt length (flat belt) = \( [(D + d) \times 1.57] + 2 \times \text{centre distance} \)

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

\( T_1 = \text{force in tight side} \)

\( T_2 = \text{force in slack side} \)

\( T_1 - T_2 = \text{effective force (} T_e \text{)} \)

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

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

1.13 Width = \( \frac{T_1}{\text{permissible tensile force}} \)

2. **STRESS AND STRAIN**

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

2.2 Strain \( (\varepsilon) = \frac{\text{change in length}(\Delta L)}{\text{original length}(L)} \)
2.3 Young's modulus (E) = \frac{\text{stress}}{\text{strain}} \quad \text{or} \quad \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 \text{ or } A = L \times W

3. HYDRAULICS

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

3.2 Volume = (cross-sectional area) \times \text{stroke length}

3.3 Work done = \text{force} \times \text{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 \times \text{diameter of shaft}

4.4 Standard taper for taper key = 1 \text{ in 100} \text{ 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) = \text{effort} \times \text{distance moved by effort}

5.4 Output movement (OM) = \text{load} \times \text{distance moved by load}

6. GEAR DRIVES

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

6.2 \quad \text{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 \( \frac{N_{\text{input}}}{N_{\text{output}}} = \frac{\text{product of number of teeth on driven gears}}{\text{product of number of teeth on driving gears}} \)

6.5 Torque = force \times radius

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

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

6.8 \( N_1T_1 = N_2T_2 \)

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

6.10 Pitch-circle diameter (PCD) = \( m \times T \)

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) = \( m \times \pi \)

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 = \( \pi \times \text{pitch diameter} \)

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

7.4 Height of screw thread = 0,866 \times \text{pitch}

7.5 Depth of screw thread = 0,613 \times \text{pitch}
8. INDEXING

8.1 Cincinnati dividing head table for milling machine

<table>
<thead>
<tr>
<th>Cincinnati index plate</th>
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<tbody>
<tr>
<td>Side 1</td>
</tr>
<tr>
<td>24 25 28 30 34 37 38</td>
</tr>
<tr>
<td>39 41 42 43</td>
</tr>
<tr>
<td>Side 2</td>
</tr>
<tr>
<td>46 47 49 51 53 54 57</td>
</tr>
<tr>
<td>58 59 62 66</td>
</tr>
</tbody>
</table>

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