**6. BRAKES**

**BRAKES:** It’s machine member used either to reduce the motion of machine or to bring the machine to rest.

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| Mechanical Energy Consumption | KE Consumption | Friction (Brakes) is applied and heat is generated. E.g.…Case of Flat surface and inclined surface. |
| PE Consumption |

**SHOE BRAKES:**

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| P = Applied Load on operating lever,  R = Reaction between friction lining and rotating wheel,  l = Shortest distance between the Line of action of ‘P’ and fulcrum ‘O’,  a = Shortest distance between the Line of action of ‘R’ and fulcrum ‘O’, | b = Shortest distance between the Line of action of ‘F’ and fulcrum ‘O’,  2θ = Angle subtended by shoe at centre,  Applied moment = Pl (Clockwise)  Reaction moment = Ra (Anti-Clockwise) | |
| **Non-Self Energising Shoe Brake:**  Friction Force F = μR (Leftward on lever and Rightward on Wheel)  Additional moment = Fb (Anti-Clockwise)  **If there is no additional moment in the direction of applied moment, the brake is said to be Non-Self Energising Shoe Brake.**  At equilibrium Sum of moments at ‘O’ = 0  Braking Torque = F rd = μR rd , Where rd = Radius of wheel | |  |
| **Self-Energising Shoe Brake:**  Friction Force F = μR (Rightward on lever and Leftward on Wheel)  Additional moment = Fb (Clockwise)  **If there is additional moment in the direction of applied moment, the brake is said to be Self-Energising Shoe Brake.**  At equilibrium Sum of moments at ‘O’ = 0  Braking Torque = F rd = μR rd , Where rd = Radius of wheel | |

**Self-Locking of Shoe Brake:** It’s extreme condition of self-energising brake.

At without Applied Load on operating lever (P = 0), Braking is present.

This effect encounters by extreme wear of brakes. Useful in Cranes.

Hence, limiting Condition for Self-Locking => **a = μb**

**Equivalent Co-efficient of friction (μ’):**

Uniform Pressure condition => 2θ ≤ 45° => Short Shoe => Braking Torque = F rd = μR rd

Uniform wear condition => 2θ > 45° => Long Shoe => Braking Torque = F rd = μ’R rd

Where,

**SIMPLE BAND BRAKES:** One end of band is connected to operating lever and another end to fulcrum.

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| Braking Torque,  **Simple Band Brake is never self-energising brake.** | F = Total Friction Force,  T1= Tension on Tight Side,  T2 = Tension on Slack Side,  θ = Angle of wrap,  Pmax = Maximum radial pressure due to normal reaction force on element  Pmin = Minimum radial pressure due to normal reaction force on element  w = Width of band |  |

**DIFFERENTIAL BAND BRAKES:** No end of band is passing through fulcrum.

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| Both direction of rotation of brake It’s self-energise but only in one direction of rotation it’s self-locking.  **Correct Sequence: b-O-a (b-L)** | Band brake - Wikipedia |

**BAND-BLOCK BRAKES:**

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| Braking Torque, | 2θ = Angle subtended by shoe at centre,  P = Applied Load on operating lever,  T = Reaction Force,  n = No. of shoes, | rd = Radius of wheel,  t = Thickness of shoes, |