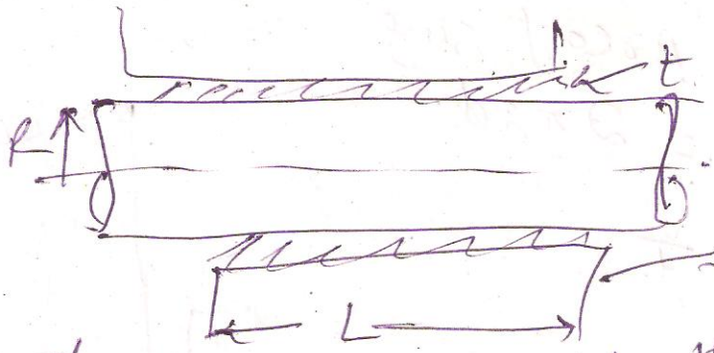
* Power absorbed in journal bearing :—



N = speed, t = thickness of oil film, L = length of bearing.

$\omega = \frac{2\pi N}{60}$, & tangential speed of shaft —

$$v = \omega \times R = \frac{2\pi N}{60} \times \frac{D}{2} = \frac{\pi D N}{60}$$

shear stress $= \tau = \mu \frac{du}{dy}$.

But the thickness is very small the velocity distribution takes place linearly

$$\therefore \frac{du}{dy} = \frac{v-0}{t} = \frac{\pi D N}{60 \times t}$$

$$\text{shear stress } \tau = \frac{\mu \pi D N}{60 \times t}$$

Shear force or viscous resistance offered = $\tau \times$ Area of surface

$$= \frac{\mu \pi D N}{60 \times t} \times \pi D L = \frac{\mu \pi^2 D^2 N L}{60 \times t}$$

Torque required = Viscous resistance $\times \frac{D}{2}$

$$= \frac{\mu \pi^2 D^3 N L}{2 \times 60 \times t}$$

Power required $= \frac{2\pi N T}{60} = \frac{2 \mu \pi^3 D^3 N^2 L}{2 \times 60 \times 60 \times t}$

$$\boxed{P = \frac{\mu \pi^3 D^3 N^2 L}{60 \times 60 \times t}}$$