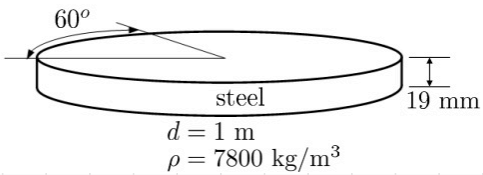
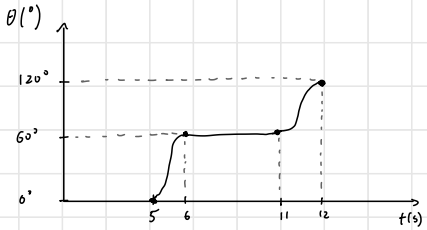
Ex 2) Rotary Indexing

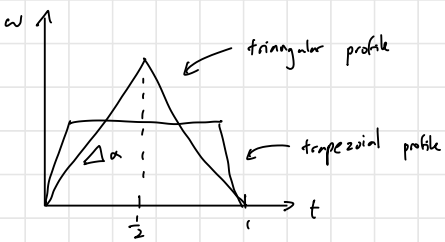
- **A machine is based on circular indexed table that rotates 60° for each step. 5 sec process time with 1 sec rotation time is required. Determine the required motor power and torque.**





- Start velocity = 0°/s
- end velocity = 0°/s
- rotation angle = 50°
- rotation time = 1s

Within 1 sec, the plate must accelerate and decelerate



- Inertia of table: $m = \pi r^2 t \rho = \pi \times 0.5^2 \times 0.019 \times 7800 = 116.4\ kg$

$J = \frac{1}{2} mr^2 = 14.6\ kg \cdot m^2$

- Rotating 60° in 1 sec $\Rightarrow$ max velocity after 30°

$\omega = \alpha t \Rightarrow \theta = \frac{\alpha}{2} t^2 \Rightarrow 30° = \frac{1}{2} \alpha (\frac{1}{2})^2 \Rightarrow \alpha = 240°/s^2 = 4.2\ rad/s^2$

- Required torque $T = J\alpha = 14.6 \times 4.2 = \boxed{61.32\ Nm}$

Average power: $KE = \frac{1}{2} J \omega_{max}^2 = 32.19J$

$P_{av} = \frac{KE}{t} = \frac{32.19\ J}{1/2} = 64.39\ kW$

Max power: $P_{max} = T \cdot \omega_{max} = 61.32 \times 2.1 = \boxed{128.77\ W}$