Design a flywheel for a Punching machine to Punch 30 holes of 20mm dia Per minute in a steel Plate of 18mm thickness. The ultimate shear strength for plate material is 300 MPa. The actual Punching machine o/p is to be $\frac{1}{5}$th angular rotation of Crank shaft. Crank shaft is Powered by flywheel having a ratio (1:10). The flywheel made of Cast iom. (Density = 7250 kg/m3) and having a working stress of 6MPa. hub and spoke Provide 5% of rotational moment of inertia of the wheel. The dia of flywheel is not to exceed by 1m. estimate the Power required for driving the motors. $\eta = 70\%$.

Gn:

$d = 20mm$

No of holes = 30 /min.

$t = 18mm$

$\tau = 300$ MPa.

$\rho = 7250$ kg/m3

$\eta = 0.70$, $i = 10$. $D = 1.0m$.

$F_s = \tau \times A$, $\Rightarrow \tau \times \pi \times d \times t$

$= 300 \times \pi \times 80 \times 18$

$= 340 kN$

$E_1 = \frac{1}{2} F_s \times t$

$= \frac{1}{2} \times 340 \times 10^3 \times 18 = 3.05 \times 10^6 N\text{-}mm.$

$E = 30 \times 3.05 \times 10^6 = 91.8 \times 10^6 N\text{-}mm.$

$P = E / \eta_{mec} \times 60 = 2.8 kW.$

Punching m/c takes $\frac{1}{6}$ rev of crank then $\frac{4}{5}$ rev of crank shaft energy stored in flywheel. ∴

$\Delta E = \frac{4}{5} \times E_1$

$= 2.4 \times 10^6 N\text{-}mm$

$\Delta E = 0.95 \times \Delta E = 2.3 \times 10^6 N\text{-}mm.$

$N = 30 \times 10 = 300 rpm.$

$\omega = 2\pi N / 60$

$= 2 \times \pi \times 300 / 60$

$= 31.41 rad/sec$

$(C_s = 0.02).$

$$\Delta E = m R^2 \omega^2 C_s$$

$$2.3 \times 10^6 = m \times (500)^2 \times (31.42)^2 \times 0.02$$

$$\boxed{m = 465 \text{ kg}}$$

$$m = \pi D e A$$

$$h = 101 \text{ mm}$$

$$b = 202 \text{ mm} \quad \text{"}$$