Torsion: state of a phat under the action re a torque
Torque: moment that in paroled to the axis of a sheet


$$
\begin{aligned}
& L \gamma_{\text {max }}=c \phi \\
& \gamma_{\text {max }}=\frac{c \phi}{L}
\end{aligned}
$$

$\phi$ : angle of twist
$\gamma=$ shearing strain
$\gamma_{\text {max }}=$ maximamen cohering strain
$L \gamma=\rho \phi$

$$
\phi=\frac{\gamma_{\max } L}{c} \quad \gamma=\frac{\rho}{\Delta} \cdot \frac{\gamma_{\max } \Delta}{c}
$$

$$
\frac{\gamma=\frac{\rho \phi}{L}}{\gamma=\frac{\rho}{c} \gamma_{\text {max }}}
$$

$\tau=$ shearingetress Hooke's law: $\tau=G \gamma$
$G=$ modulus of rigidity

$$
\tau=\frac{e}{c}\left(G \gamma_{\text {max }}\right)=\frac{e}{c} \tau_{\max }
$$

$\tau_{\text {max }}=G \gamma_{\text {max }} \quad \tau=\frac{\rho}{c}\left(G \gamma_{\text {max }}\right)=\frac{\rho}{c} \tau_{\text {max }}$
$\tau=\frac{\rho}{c} \tau_{\text {max }}$$\quad$ cresesesection of the shaft

$$
\begin{aligned}
T & =\int \rho \tau d A \\
& =\int \rho \cdot \frac{\rho}{c} \tau_{\text {max }} d A
\end{aligned}
$$

$$
\begin{aligned}
& =\int \rho \cdot \frac{c}{c} c_{\text {mex }} \\
& =\tau_{\max }\left(\int^{2} d A\right) \text { poler moment }
\end{aligned}
$$



$$
=\frac{\tau_{\max }}{c} \int e^{2} d A \text { of inertia }
$$

$$
J=\int \rho^{2} d A
$$

$$
T=\frac{\tau_{\text {max }}}{c} J \quad \tau_{\text {max }}=\frac{T c}{J} \text { v., v.... } .
$$

$$
\tau=\frac{P}{c}\left(\frac{T k}{\sigma}\right)=\frac{T P}{J} \quad \tau=\frac{T P}{J} \quad 0, V, \cdots I .
$$

$$
\phi=\frac{\gamma_{\max } L}{C}=\frac{G \gamma_{\max } L}{G C}=\frac{\tau_{\max } L}{G C}
$$

3.24

$$
=\frac{T E}{J} \cdot \frac{L}{G Q}=\frac{T L}{J Q} \quad \phi=\frac{T L}{J G}
$$

$$
\begin{align*}
& v_{-} l_{-} \cdot \cdot I, \\
& \tau_{\text {are }}=60 \mathrm{MPa} \quad T=? \tag{N}
\end{align*}
$$

Shat $A B ; \quad \tau_{\max }=\frac{T C}{J}$
$T^{48} \mathrm{~mm}$

$$
60 \times 10^{6}=-
$$

$J=\frac{\pi}{2} r^{4}$
$F=$ tangatiol force between the gears

$$
T=0.08 \mathrm{~F} \quad F=\frac{T}{0.08} \quad T_{C D}=F(0.24)=\frac{0.47 T}{0.08}
$$

Shaft $C D: \quad T_{\text {max }}=\frac{T C}{T}$

$$
60 \times 10^{6}=\frac{3 T(0.033)}{(T / 2)(0.033)^{4}} \quad T=\square \mathrm{N} . \mathrm{m}
$$

Chore the smaller of the ter $T^{\prime} / 2$ as the answer.

