A torque of 40ft-lb is applied through gear A to the left end of the gear train shown. The diameters of gears B and C are 5in and 2in respectively. If the maximum shear stress in aluminum (G=3800ksi) is limited to 15ksi, determine (a) minimum permissible diameter for shaft AB, (b) minimum permissible diameter in shaft CD and (c) maximum length for shaft CD if the rotation of D with respect to C must not exceed 0.5rad.

A torque of magnitude $T=4\text{kN-m}$ is applied at end A of the composite shaft shown. Knowing that the $G_{\text{Al}}=27\text{GPa}$ and $G_{\text{Steel}}=77\text{GPa}$, determine The maximum sharing stress in the steel core and in the aluminum jacket and the angle of twist at A.
For the compound shaft shown, determine the magnitude of the rotation angle of pulley $D$ with respect to pulley $B$.

The design of the gear-and-shaft system shown requires that steel shafts of the same diameter be used for both $AB$ and $CD$. It is further required that $\tau_{\text{Max}} \leq 60\text{MPa}$ and that the angle through which end $D$ of shaft $CD$ rotates not exceed $1.5^\circ$. Knowing that $G=77\text{GPa}$, determine the required diameter of the shafts.
A composite torsion member consists of two solid shafts joined at flange \( B \). Shafts (1) and (2) are attached to rigid supports at \( A \) and \( C \), respectively. A concentrated torque \( T \) is applied to flange \( B \) in the direction shown. Determine the internal torque in shaft (1).

\[
J_1 = I_{p1} = 1.27 \times 10^6 \text{ mm}^4 \\
G_1 = 25 \text{ GPa} \\
J_2 = I_{p2} = 2.36 \times 10^6 \text{ mm}^4 \\
G_2 = 70 \text{ GPa}
\]

A solid circular aluminum alloy (\( G = 4000 \text{ ksi} \)) shaft with diameters of 2.5 in. and 1.75 in. is subjected to a torque \( T \). The allowable shearing stress is \( \tau = 9000 \text{ psi} \), and the maximum allowable angle of twist in the 7-ft length is \( \varphi_{AC} = 0.04 \text{ rad} \). Determine the maximum allowable value of \( T \).
A compound shaft with applied torques and dimensions is shown below. Section AB is made of steel. Section BC is made of brass. Section CD is made of steel. For this shaft: determine the maximum shear stress, the section in which it takes place and the angle of twist of D with respect to A. The modulus of rigidity for steel = 12 x 10^6 lb/in^2. The modulus of rigidity for brass = 6 x 10^6 lb/in^2.