4.8-1. (a) $\tau_{max} = 10.45$ ksi, (b) $\phi = 0.01120$ rad
4.8-3. $\mathcal{P}_{max} = 69.0$ kW
4.8-5. $\tau_{max} = 7.31$ ksi
4.8-7. (a) $d_{req} = 65$ mm, (b) $W = 265$ N,
(c) $(d_o)_{req} = 68$ mm, (d) $\dfrac{W_{tube}}{W_{solid}} = 70\%$
4.8-9. $d_{req} = 3/8$ in.
4.8-11. $\omega_{min} = 9.66$ rad/s
4.8-13. $d_{min} = (d_{min})_\phi = \dfrac{13}{16}$ in.
4.8-15. (a) $d_{min} = 18$ mm, (b) $(\tau_{max})_2 = 14.42$ MPa,
(c) $\phi_{C/B} = 0.604°$

4.9-1. (a) $\tau_{max} = 5.00$ ksi, (b) $J = 667$ in^4
4.9-3. (a) $\tau_{max} = 26.2$ MPa, (b) $J = 8.92(10^6)$ mm^4
4.9-5. (a) $\tau_{max} = 17.64$ MPa, (b) $J = 2.92(10^{-5})$ m^4
4.9-7. (a) $\tau_{max} = 24.9$ MPa, (b) $J = 9.40(10^{-7})$ m^4
4.9-9. $\tau = \dfrac{T}{2\pi abt}$
4.9-11. (a) $\dfrac{d\phi}{dx} = 7.41(10^{-4})$ rad/in.,
(b) $\dfrac{d\phi}{dx} = 7.47(10^{-4})$ rad/in.
4.9-13. (a) $\tau_{max}(\alpha) = \dfrac{2T(\alpha+1)^2}{t\alpha L_m^2}$, (b) $\alpha = 1$

4.10-1. (a) $\tau_{max} = 240$ psi, (b) $\phi = 6.45(10^{-4})$ rad,
(c) $A = 0.816$ in^2
4.10-3. (a) $(\tau_{max})_2 = 32.5$ MPa, $(\tau_{max})_4 = 40.1$ MPa,
(b) $\phi_2 = 0.0559$ rad, $\phi_4 = 0.0911$ rad
4.10-5. (a) $\tau_{max} = 7.64$ ksi, (b) $\phi = 0.0208$ rad,
(c) $A = 1.571$ in^2, $\%(\tau_{max})_{decr} = 29.3\,\%$
4.10-7. (a) $\dfrac{(\tau_{max})_{rect}}{(\tau_{max})_{ell}} = 1.147$, (b) $\dfrac{(\phi/L)_{rect}}{(\phi/L)_{ell}} = 1.112$
4.10-9. (a) $\tau_{max} = 19.02$ MPa, (b) $\phi = 0.1189$ rad

4.11-1. (a) ——, (b) $T = 126.1$ kip·in.,
(c) $\phi = 0.1536$ rad
4.11-3. (a) ——, (b) $r_Y = 9.62$ mm, (c) $\phi = 0.332$ rad
4.11-5. (a) $T_Y = 684$ lb · in., $T_P = 821$ lb · in.,
(b) $\%A_{yield} = 34.6\,\%$, (c) $\phi = 0.0667$ rad
4.11-7. $T = \dfrac{\pi\tau_Y}{6}\left(4r_o^3 - \dfrac{3r_i^4}{r_Y} - r_Y^3\right)$
4.11-9. (a) $T = 1.849$ kip · in., $\phi_{PS} = 8.31(10^{-3})$ rad,
(c) ——
4.11-11. (a) $T = 786$ kip · in., $\gamma_o = 8.33(10^{-4})$ rad,
(c) $\phi_{PS} = 4.01(10^{-3})$ rad, (d) ——

CHAPTER 5

5.2-1. (a) $V_{C^-} = 18$ kN, $M_{C^-} = 46$ kN·m,
(b) $V_{D^-} = -2$ kN, $M_{D^-} = 44$ kN·m
5.2-3. (a) $V_{C^-} = P$, $M_{C^-} = -Pa$,
(b) $V_{D^-} = -P$, $M_{D^-} = -3Pa$
5.2-5. $V_C = -2$ kips, $M_C = -4$ kip·ft
5.2-7. (a) $aL = 0.207L$, (b) $|M_B| = |M_C| = |M_E| = 0.0214\,wL^2$
5.2-9. $V_C = 0.5$ kN, $M_C = -2.5$ kN·m
5.2-11. (a) $A_y = 3$ kips, $D_x = 0$ kips, $D_y = 23$ kips,
$M_D = -130$ kip·ft, (b) $V_E = -13$ kips,
$M_E = -40$ kip·ft
5.2-13. (a) $V_1(x) = -\dfrac{25x^2}{2}$ kN, $M_1(x) = -\dfrac{25x^3}{6}$ kN·m,
(b) $V_2(x) = -10$ kN, $M_2(x) = \left(-\dfrac{40}{3} - 10x\right)$ kN·m
(c) $V_C = -10$ kN, $M_C = -\dfrac{190}{3}$ kN·m
5.2-15. (a) $V_1(x) = (20 - 2x)$ kips,
$M_1(x) = (20x - x^2)$ kip·ft, (b) $V_2(x) = (17 - 2x)$ kips,
$M_2(x) = (18 + 17x - x^2)$ kip·ft
5.2-17. (a) $V_1(x) = [130 - (x^2/150)]$ N,
$M_1(x) = [130x - (x^3/450)]$ N·mm,
(b) $V_2(x) = -20$ N, $M_2(x) = [15(10^3) - 20x]$ N·mm
5.2-19. (a) $W_g = 120$ lb, (b) $p_0 = 20$ lb/ft,
(c) $V(x) = (20x - 40)$ lb,
$M(x) = (10x^2 - 40x + 40)$ lb·ft
5.2-21. (a) $V_1(x) = -3.5$ kN, $M_1(x) = -3.5x$ kN·m,
(b) $F_2 = 7.29$ kN
5.2-23. $V(x) = A_y - \dfrac{w_0x^2}{2L}$, $M(x) = A_yx - \dfrac{w_0x^3}{6L}$
5.2-25. $V_1(x) = A_y - \dfrac{w_0x^2}{2L}$, $M_1(x) = A_yx - \dfrac{w_0x^3}{6L}$,
$V_2(x) = \dfrac{w_0L}{2}\left[1 - \left(\dfrac{x}{L}\right)^2\right] - 2A_y$,
$M_2(x) = \dfrac{w_0L^2}{6}\left[-2 + 3\left(\dfrac{x}{L}\right) - \left(\dfrac{x}{L}\right)^3\right] + 2A_y(L - x)$

5.4-1. $V_2(x) = 16$ lb, $M_2(x) = (-800 + 16x)$ lb·in.
5.4-3. Use the "Determinate Beams Module" of MDSolids to check your solution.
5.4-5. Use the "Determinate Beams Module" of MDSolids to check your solution.
5.4-7. Use the "Determinate Beams Module" of MDSolids to check your solution. (Hint: Let $P = 1$ kip, and let $a = 1$ ft.)
5.4-9. Use the "Determinate Beams Module" of MDSolids to check your solution.
5.4-11. Use the "Determinate Beams Module" of MDSolids to check your solution.
5.4-13. Suggestion: Use the 'Beam Deformation' option of the "General Analysis Module" of MDSolids to check your solution. (Hint: Let $p_0 = 1$ kN/m, and let $L = 4$ m.)