CHAPTER 11

11.3-1. (b) $\mathcal{U} = 4$ kip · in.

11.3-3. (a) $\mathcal{U}_{1a} = \dfrac{P^2L}{AE}$, $\mathcal{U}_{2a} = \dfrac{P^2L}{2AE}$, $\mathcal{U}_a = \dfrac{3P^2L}{2AE}$,
(b) $\mathcal{U}_b = \dfrac{5P^2L}{2AE}$

11.3-7. $\dfrac{\mathcal{U}_b}{\mathcal{U}_a} = \dfrac{\alpha + \lambda - \alpha\lambda}{\alpha}$ **11.3-9.** $\mathcal{U} = \dfrac{2P^2L}{\pi E d_A d_B}$

11.3-11. $\mathcal{U} = \dfrac{21P^2L}{8AE}$ **11.3-13.** $\mathcal{U} = 0.701$ J

11.3-17. (a) $\mathcal{U}_1 = \dfrac{1024T_0^2L}{81\pi d^4G}$, $\mathcal{U}_2 = \dfrac{16T_0^2L}{\pi d^4G}$, $\mathcal{U} = \dfrac{2320T_0^2L}{81\pi d^4G}$,
(b) No, more would be stored.

11.3-25. $\mathcal{U} = \dfrac{GI_p}{L}(\phi_B^2 - \phi_B\phi_C + \phi_C^2)$

11.3-27. (a) $d_1 = 1.366$ in., $d_2 = 1.193$ in., $d_3 = 0.947$ in.,
(b) $\mathcal{U} = 0.412$ kip · in.

11.3-31. (a) $\mathcal{U}_{\sigma a} = \dfrac{2P^2L^3}{Ebh^3}$, $\mathcal{U}_{\sigma b} = \dfrac{83P^2L^3}{108Ebh^3}$

11.3-39. $\mathcal{U}_\sigma = \dfrac{17w_0^2L^5}{15360EI}$

11.4-1. $\Delta_B = 0.0367$ in., $\Delta_E = 0.0301$ in.

11.4-3. $\Delta_B = 5.74(10^{-4})$ in. **11.4-7.** $\phi_B = \dfrac{28}{3\pi}\dfrac{T_0L}{Gd^4}$

11.4-11. $\phi_B = 0.0768$ rad **11.4-13.** $\theta_B = 1.167(10^{-3})$ rad

11.4-15. $\Delta_{B_\sigma} = \dfrac{4PL^3}{Ebh^3}$, $\Delta_{B_\tau} = \dfrac{12PL(1+\nu)}{5Ebh}$

11.5-1. $\Delta_B = \dfrac{Pa^2L}{3EI}\left(1 - \dfrac{a}{L}\right)^2$

11.5-3. $\theta_A = 6.26(10^{-3})$ rad

11.5-7. $v_C = -0.1570$ in.

11.5-13. $u_B = \dfrac{PR^3}{EI}\left(\dfrac{3\pi}{4} - 2\right)$

11.5-15. $u_B = 3.60(10^{-3})$ in.

11.5-17. (a) $R_A = \dfrac{w_0L}{10}$, (b) $\theta_A = -\dfrac{w_0L^3}{120EI}$

11.5-21. (a) $R_B = \dfrac{5}{16}w_0L$, (b) $\theta_C = -\dfrac{w_0L^3}{768EI}$

11.5-31. $\Delta_A = \dfrac{w_0L^4}{30EI}$, $\theta_A = \dfrac{w_0L^3}{24EI}$

11.5-37. $u_B = 0.0562$ mm

11.5-41. (a) $R_A = \dfrac{w_0L}{10}$, (b) $\theta_A = \dfrac{-w_0L^3}{120EI}$

11.5-43. (a) $R_B = \dfrac{5}{16}w_0L$, (b) $\theta_C = -\dfrac{w_0L^3}{768EI}$

11.5-51. (a) $R_A = \dfrac{3}{16}w_0L$, (b) $\theta_A = \dfrac{w_0L^3}{96EI}$

11.7-1. (a) $u_B = \dfrac{PL}{3AE}$, (b) $F_1 = \dfrac{2P}{3}$, $F_2 = -\dfrac{P}{3}$

11.7-3. $v = 0.810$ mm, $F_1 = -189$ kN, $F_2 = -162$ kN

11.7-7. (a) $u_D = 4.46$ mm, $v_D = 0.0994$ mm, $F_1 = 79.8$ kN

11.7-13. (a) $\theta = 2.94(10^{-3})$ rad,
(b) $\sigma_1 = 102.9$ MPa, $\sigma_2 = 147.1$ MPa

11.7-17. (a) $u_D = 9.54(10^{-3})$ in., $v_D = 2.84(10^{-3})$ in.,
(b) $F_1 = 3.56$ kips

11.9-1. $\Delta_{max} = \Delta_{st} + \Delta_{st}\left[1 + \dfrac{1}{\Delta_{st}}\left(\dfrac{v^2}{g} + 2h\right)\right]^{1/2}$

11.9-3. (a) $\mathcal{U} = 0.814$ kN · m, (b) $\mathcal{U} = 0.382$ kN · m,
(c) $\mathcal{U} = 0.110$ kN · m, (d) $\mathcal{U} = 2.12$ kN · m

11.9-5. $h_1 = 21.6$ in., $h_2 = 86.3$ in.

11.9-7. (a) $\sigma_{max} = 35.8$ ksi, (e) $W = 622$ lb

11.9-9. $\sigma_{max} = 19.95$ ksi

CHAPTER 12

12.2-1. $(\sigma_{max})_a = 16.6$ ksi, $(\sigma_{max})_b = 18.4$ ksi, $(\sigma_{max})_c = 33.1$ ksi

12.2-3. $(P_{max})_a = 61.0$ kN, $(P_{max})_b = 71.4$ kN,
$(P_{max})_c = 82.0$ kN

12.2-5. $\sigma_{max} = 9.15$ ksi, (b) $d_{min} = 3.43$ in.

12.2-9. (a) $(\tau_{max})_1 = 10.58$ MPa, $(\tau_{max})_2 = 9.47$ MPa,
(b) $\tau_{max} = 7.96$ MPa, $(\tau_{max})_1$ is 33% greater

12.2-11. $r_{min} = 0.25$ in. **12.2-13.** $\mathcal{P}_{max} = 67.3$ hp

12.2-15. (a) $(\sigma_{max})_1 = 41.5$ MPa, $(\sigma_{max})_2 = 35.3$ MPa,
(b) $\sigma_{max} = 25.0$ MPa, $(\sigma_{max})_1$ is 66% greater

12.3-1. $(\sigma_x - \sigma_y)^2 + 4\tau_{xy}^2 = \sigma_Y^2$

12.3-3. Fails according to maximum-shear-stress theory, but not according to maximum-distortion-energy theory.
$\sigma_M = 34.6$ ksi

12.3-5. $FS_s = 1.20$, $FS_d = 1.38$

12.3-9. (a) $FS_s = 0.96$, (b) $FS_d = 1.10$

12.3-15. $FS_m = 1.05$ (a very small margin of safety)