# Answers to Selected Problems: Chapter 10

## 10.4

2.
$\varepsilon(t) = \sigma_o \left\{ \ln(t+1) + B\left[(t+1)\ln(t+1) - t\right] \right\}$

3.
(ii) b
(iii) no instantaneous elastic recovery; has permanent deformation
(iv) $\varepsilon(t) = t^2 - t + \left(1 - e^{-2t}\right)/2$

4. $$\varepsilon(t) = \begin{cases} \dfrac{\sigma_c}{Et_1}\left\{t - (\eta/E)\left(1 - e^{-(E/\eta)t}\right)\right\}, & 0 < t < t_1 \\ \dfrac{\sigma_c}{Et_1}\left\{(2t_1 - t) + (\eta/E)\left(1 + e^{-(E/\eta)t}\left(1 - 2e^{(E/\eta)t_1}\right)\right)\right\}, & t_1 < t < t_2 \\ \dfrac{\sigma_c}{Et_1}(\eta/E)e^{-(E/\eta)t}\left(1 - e^{(E/\eta)t_1}\right)^2, & 2t_2 < t \end{cases}$$

## 10.5

2. $J(t) = \dfrac{t}{\eta_1} + \dfrac{1}{E}\left(1 - e^{-(E/\eta_2)t}\right)$

## 10.6

1.
$$\begin{aligned} \varepsilon(t) &= \sigma_o\left(J_1 \cos\omega t + J_2 \sin\omega t\right) \\ &= \sigma_o\left(\frac{E}{E^2 + (\eta\omega)^2}\cos\omega t + \frac{\eta\omega}{E^2 + (\eta\omega)^2}\sin\omega t\right) \end{aligned}$$

At low frequencies, it behaves like an elastic material.