2.797/20.310/3.053/6.024   Spring 2015

MOLECULAR, CELLULAR, & TISSUE BIOMECHANICS

Problem Set # 5   Distributed: 3/31/15
                                              Due by 5pm in drop box: Friday 4/8/15
(Please turn <u>problem 1 in Box1</u>, <u>problem 2 in Box2</u> and <u>problem 3 in Box3</u>)

Problem 1: Do Textbook Problem 7.10 part (a), (b) and (c).

Problem 2: Do Textbook Problem 7.11 on page 281 up through the first paragraph on
           page 282:

For models (a), (b), (c), and (d), sketch the magnitude of the frequency-dependent modulus versus frequency
(call it $|\hat{G}(\omega)| = |T|/|e|$ for models (a) – (c) and $|\hat{H}(\omega)| = |\sigma|/|\varepsilon|$ for model (d)). Justify your answers for each
model: state physical reasoning for the behavior at very low and very high frequencies. You do not have to
derive the mathematical formula for the modulus for each model if you can justify it based on physical
reasoning. Remember that the magnitude $|G|$ is different than G' or G" alone; $|G|$ is a function of both G, and G".

Problem 3: Do Textbook Problem 7.11 on page 282 ("The Two Layer Model"), parts (i).
           (ii), (iii), (iv), starting with:

Using the poroelastic approach of model (d), you should now attempt to approximate the depth-dependent
nonuniformity of the tissue in Figure 7.34(c) using the "two-layer" model shown in Figure 7.36, where the
confined compression modulus H and hydraulic permeability k take on different values for the upper and lower
tissue. A step in displacement having amplitude u_o is applied at $x = 0$, $t = 0$.

20.310J / 3.053J / 6.024J / 2.797J Molecular, Cellular, and Tissue Biomechanics
Spring 2015