In the name of God

Advanced Biomedical Photonics

Chapter 3

Question (delivery time)

1. Plot temporal and spatial changes in temperature in a biological tissue (epithelium of retina) during and after exposure to a short laser pulse for three different energies of 1, 3, and 5. (Nov. 9, 2015)
   a) With pulse duration of 100 ns and beam diameter of 2 mm
   b) With pulse duration of 100 μs and beam diameter of 2 mm
   c) Plot these graphs for 10 Hz repetition rate (optional)

   T0 = 37 °C, $\mu_a = 1587\ cm^{-1}$, $\rho = 1.35\ g/cm3$, $c = 2.55\ J/gK$

2. Show that temporal evaluation of temperature for laser pulses durations $t<\tau$ and for $t>\tau$ can be stated as following: (Nov. 9, 2015)

$$\begin{cases} T_0 + \dfrac{\alpha I_0}{\rho c} t & t < \tau \\ T_0 + T_{max}\left(\dfrac{\tau}{t}\right)^{1.5} & t > \tau \end{cases}$$

3. The retina coagulation induced by green line (532 nm) can be studied by Arrhenius's equation. Please state your idea and calculate the damage degree as a function of time *t* (laser pulse duration of 1 mS, 10 ms and 100 microsecond). (Nov. 9, 2015)