Quiz 7

Name: _____

Total = 10 marks

1. (4 marks) Quarter Waveplate
   a) A quarter waveplate is constructed using a 30 μm thick piece of mica. If the waveplate is designed to operate at yellow light what must be the index of refraction difference for ordinary and extraordinary rays.

Phase Difference $\Delta\varphi = \frac{(n_o - n_e)\, d\, 2\pi}{\lambda}$.

For $\lambda/4$ plate $\Delta\varphi = \frac{\pi}{2} \Rightarrow \Delta n = \frac{\lambda}{4d}$

$= \frac{6 \times 10^{-7}\ m}{4 \times 3 \times 10^{-5}\ m}$

$= 5 \times 10^{-3}$

   b) Explain why or why not the quarter waveplate can also be used for red light.

Wavelength affects $\Delta\varphi$. ∴ waveplate designed for yellow light doesn't work as well for red light.

2. (3 marks) What are 3 differences of acousto and electrooptic modulators.

- acousto-optic modulators operate at lower frequencies typically hundreds MHz instead of several GHz.
- output of AO are spatially separated beams at various frequencies
- AO modulation frequencies are more widely tunable

3. (3 marks) A Pockels cell is used to rotate green linearly polarized light. by 90°;
   a) Find the required voltage if the electrooptic constant is 10.6×10^{-12} m/V.

$$V = \frac{\lambda}{2 r_0^3 \Gamma}$$

$$= \frac{5.5 \times 10^{-7} \text{ m}}{2 (1.5)^3 \, 10.6 \times 10^{-12} \text{ m/V}}$$

$$= 7.7 \text{ kV}.$$

   b) Comment on whether this voltage is dangerous or not.

This voltage can be lethal!