**TFY4195 H2020 - Assignment 3: to be handed in Oct8, 2020**

**A3-1.** An electromagnetic wave is travelling in air/vacuum, specified by the following function:

$$\overline{E} = \left(-6\hat{x} + 3\sqrt{5}\hat{y}\right)\cos\left[\frac{1}{3}\left(\sqrt{5}x + 2y\right)\cdot\pi\cdot 10^{7} - 9.42\cdot 10^{15}t\right]\cdot 10^{2}\ \ \left[\frac{V}{m}\right]$$

The unit of length is [m] and time [s].

Find,

a) the electric ($E_0$) and magnetic ($B_0$) field amplitudes,
b) their directions (as unit vectors),
c) the direction of propagation,
d) the wavelength ($\lambda$), propagation number (k) and frequency ($\nu$),
e) the speed,
f) the irradiance (in $W/m^2$).

Draw a scheme that shows the directions of $E_0$, $B_0$ and $k$ (vector) in an *xyz* coordinate system.

**A3-2.** Analyze the polarization state of the following electromagnetic waves by plotting the electric field trace over a period $[0,2\pi]$ for $\omega t$ (for example at z = 0).

a) $\overline{E} = E_0\cos\left(kz - \omega t + \frac{\pi}{4}\right)\cdot\hat{x} + E_0\cos\left(kz - \omega t - \frac{\pi}{4}\right)\cdot\hat{y}$
b) $\overline{E} = E_0\cos\left(kz - \omega t + \frac{\pi}{4}\right)\cdot\hat{x} + 2E_0\sin(kz - \omega t)\cdot\hat{y}$
c) $\overline{E} = \frac{1}{2}E_0\cos(kz - \omega t)\cdot\hat{x} + E_0\sin\left(kz - \omega t - \frac{\pi}{2}\right)\cdot\hat{y}$