Homework 2

[1] A uniform plane wavefunction has the instantaneous expression

$\Phi(x,t) = 5 \sin(200\pi t + 0.4\pi x + 30^0)$.

Identify or calculate the following:

i) the radian frequency ω of the wave in radns/s
ii) the frequency f in Hz of the wave
iii) the direction of propagation of the wave
iv) the wavelength λ in m of the wave
v) the amplitude A of the wave, and
vi) the phase velocity v_{ph} in m/s of the wave.

[2] A uniform plane scalar wave represented by the function Φ(x,t) is specified as having the following properties:

The wave propagates in the -x direction

Wave amplitude = 10

Wave frequency = 500 Hz

Wave's phase velocity = 100 m/s

The wavefunction Φ(0,0) at x = 0 and t = 0 has the value Φ(0,0) = 5.

Find the expression Φ(x,t) of the wave function.

[3] Consider two scalar UPW's of the same amplitude which have incrementally different frequencies and thus incrementally different wavelengths. Both waves are given to be propagating in the +z direction. Show that the effect of interference between the two UPW's is to generate an amplitude-modulated carrier wave (cw) signal moving in the +z direction such that the cw component of the signal propagates with phase velocity $v_p = \omega/k$ while the envelope signal propagates with group velocity $v_g = d\omega/dk$.