Tutorial-5 (PHY201) Due on Wednsday

1. When a plane wave traverses a medium the displacement of particles is given by y(x,t) = 0.01sin($4\pi t$-0.02πx) where y is in meters and t is in seconds. Calculate: (i) Amplitude, wavelength, velocity and frequency, (ii) the phase difference between two positions of the same particles at a time interval of 0.25s, (iii) the phase difference between two particles 50m apart at same instant.

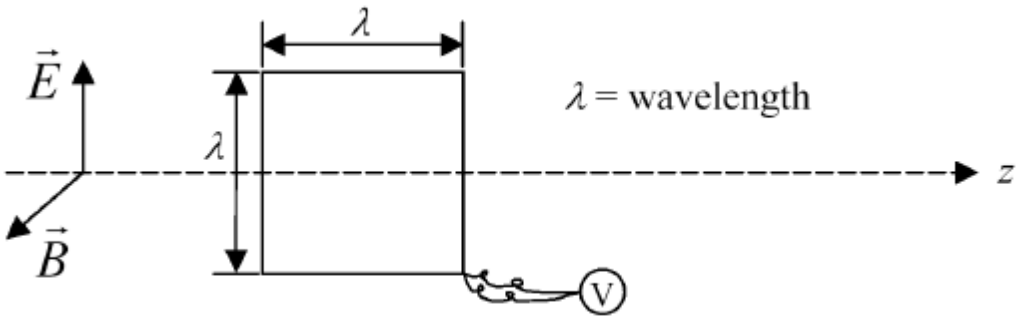
2. Assuming that all the energy from a 1000W street lamp is radiated uniformly, calculate the values of electric and magnetic fields of radiation at a distance 2m from the lamp. Explain if one can measure this Electric and Magnetic field in laboratory?

3. A pulse travelling along a stretched string is described by the following equation:

$$y(x,t) = \frac{b^3}{(2x-ut)^2 + b^2}$$

   (a) Sketch the graph of y against t at t=0
   (b) What are the speed of the pulse and its direction of travel?
   (c) The transverse velocity of a given point is of the string is defined by, $v_y = \partial y/\partial t$. Calculate it as a function of x at t=0, and show by means of a sketch what this tells us about the motion of pulse during a short time Δt.

4. The B field of a certain electromagnetic wave is given by, $\boldsymbol{B}(x,y,z,t) = B_0 \sin(\omega t - kz)\hat{x}$



   (a) Use Maxwell's equation to calculate the corresponding E field for this wave. A square sinle-turn loop of wire, with sides of length equal to λ is used to pick up signal from the wave by detecting the voltage V appearing between two ends. This will be of form $V = V_0 \sin(\omega t + \phi)$
   (b) The loop is placed as shown. With two sides parallel to **E** and the other two sides parallel to z. What is the value of V_0 in this situation?
   (c) What is the maximum possible value of V_0, and how should the loop be oriented to obtain it?