PH 202 Course coordinator/ Instructor**: Alika Khare**
Problem Set no. X

Note: Please try to solve the problems. If the time permit, then it will be discussed on April 26, 2024, else the key steps for solving these problems will be shared.

1. Find the expression for the electric and magnetic field and the frequency for TM modes excited in a rectangular wave guide.

2. Find the maximum and minimum size of a squared cross section of wave guide so as to propagate only TE_{01} mode.

3. Estimate the power flow and the energy loss along the axis of a rectangular wave-guide for TE_{mn} and TM_{mn} modes.

4. A rectangular wave guide with dimensions a=2.5cm, b=1cm is required to be operated below 15.1 GHz frequency. How many TE and TM modes are possible in this wave guide if it is filled with a medium having $\mu = \mu_o$, $\varepsilon = 4\varepsilon_o$ and $\sigma = 0$.

5. A power of 1.2kW is launched to a copper ($\sigma = 5.8 \times 10^7$ S/) plated wave guide at an operating frequency of 4.8GHz. The wave guide is filled with polystyrene ($\varepsilon = 2.55\varepsilon_o$ and $\sigma = 10^{-17}$ S/m. the dimensions of wave guide are a=4.2 cm, and b=2.6cm. Determine the power dissipated inside the wave guide over a travel length of 60cm for TE_{10} mode..

6. An air filled rectangular wave guide is 150 cm long. One end of it is terminated with a metal cap. An EM wave in the form of a pulse of very short duration and of frequency 7.2 GHz is launched inside the waveguide from the input end (open end). How much time is taken by this pulse to return back at the input end, assuming that cutoff frequency of the wave guide is 6.5 GHz.

7. Calculate the Power dissipated in TE_{mn} mode of a rectangular wave guide at the metallic walls having reflectivity R, conductivity σ and skin depth δ.