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College of Engineering & technology  
Electronics & Communication Engineering Department**



**EC443 EM Transmitting Media**

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**Problems Set #7**

**P1.1** A TE<sub>11</sub> mode is propagating through a circular wave guide . the radius of the guide is 5 cm and the guide contains air

- a- determine the cutoff frequency
- b- Determine the wave length in the guide for operating frequency 3 Ghz
- c- determine the wave impedance  $Z_g$  in the wave guide.

**P1.2** - an air-filled circular wave guide has a radius of 2 cm and is to carry energy at frequency of 10 Ghz. Find all the TE and TM modes for which energy transmission is possible.

**P1.3** a circular wave guide has a cutoff frequency of 9 GHZ in the dominant mode:

- a- Find the inside diameter of the guide, if it is air filled
- b- determine the inside diameter of the guides if it is filled with dielectric having a dielectric constant equals 4

**P1.4** air- filled circular waveguide has a radius of 1.5 cm and is to carry energy at a frequency of 10Ghz. Find all TE and TM modes for which transmission is possible

**P1.5** -an air-filled circular wave guide of radius 2 cm

Find the cutoff frequency of this mode. If the guide is to be filled with dielectric with constant= 2.25, to what value must its radius be changed in order to maintain the cut off frequency at its original value.

**P1.6** an air-filled circular wave guide is to be operated at a frequency  $f=6$  Ghz and is to have dimensions such that  $f_c=0.8f$  for the dominant mode. Find the guides diameter , the guided wave length and the velocity oin the guide.

**P1.7**-find the radius of a circular wave guide designed to operate in the dominant mode with  $f_c=3.2$  Ghz. Find the cut off frequency of the following mode. If the guide is filled with lossless dielectric with constant =4 what will be the cutoff frequency in this case

**P1.8**-find the cut off frequency of the 1<sup>st</sup> two propagating wave guide with  $a=0.5$ cm  
And dielectric constant of 2.25.

If the guide is silver plated and the dielectric loss tangent is 0.001, calculate the attenuation in db for a 50 cm length of the guide operating at 13Ghz. The conductivity of the silver is  $6.17 \times 10^7$  S/m

**P1.9**- a rectangular wave guide is to be connected to a circular wave guide. If the cutoff frequency of the dominant modes of both guides is the same. Find:

- a- the radius of the circular wave guide if the width of the rectangular wave guide equals 2.286cm.  $b=1.016$  cm.
- b- the max. frequency that can be used such that only the dominant mode in both guides can propagate
- c- the wave impedance at a frequency midway between the cutoff frequency and the max. frequency determined in part b