UNIVERSITÀ DEGLI STUDI DI BRESCIA

Nanophotonics Final Test
June 22, 2022

Student ID:
Name:
Instructions: You have 2 hours to complete the test. Please write everything with blue or black ink pen so that all your work can be read easily. You can use your calculator. Use of course notes or internet resources will invalidate the results of the test.
VERY IMPORTANT: Please WRITE YOUR FULL NAME AND STUDENT ID on this sheet and all your sheets where the problems are solved!

Questions:

1. An optical element has the following Jones matrix representation:

$$M = \begin{bmatrix} 1 & 0 \\ 0 & j \end{bmatrix}$$

Is this element:

A. A quarter-wave plate?
B. A circular polarizer?
C. A linear polarizer?
D. A half-wave plate?

Motivate your answer.

2. Calculate the phase velocity of a surface plasmon propagating on a flat silver-air interface at λ=532nm and compare it to the phase velocity of light in air. Is the surface plasmon slower or faster than light in air? Assume the dielectric constant of silver at λ=532nm is ε_{Ag}=-9.3-j0.05 whereas the permittivity of air is ε_{Air}=1.

3. What are the differences between a resonant and a non-resonant metamaterial?

4. An object is placed on the left hand side of a slab made of a right-handed medium [Figure 1(a)] and a left-handed-medium [Figure 1(b)].
Draw the refraction of light at each interface in the two scenarios. Under what circumstances one can achieve the refraction illustrated in Figure 1(b)?

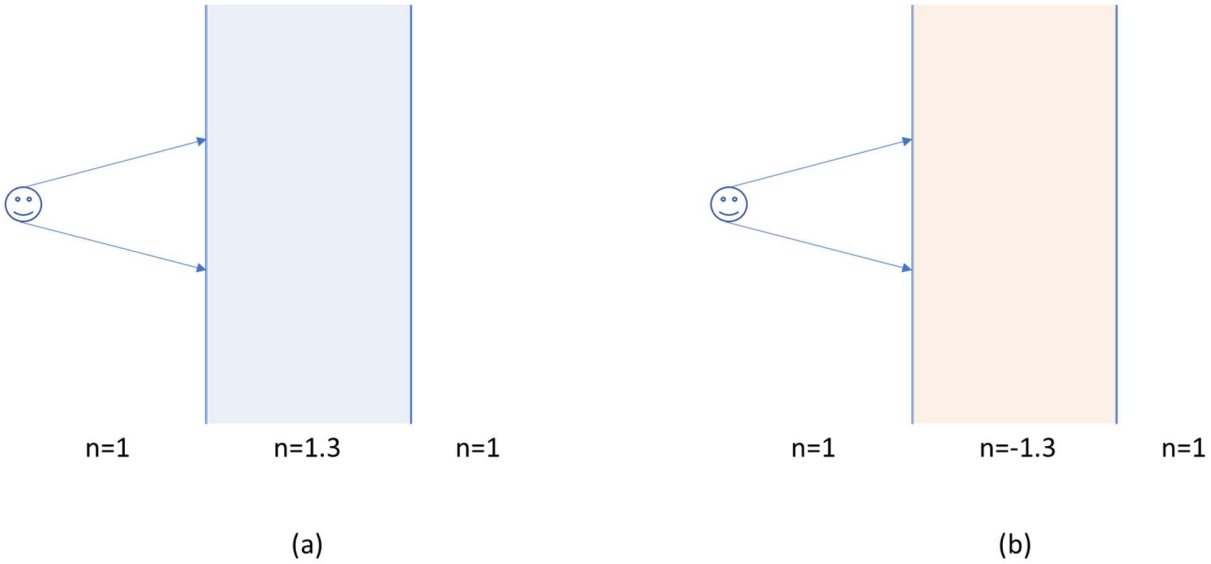

Figure 1