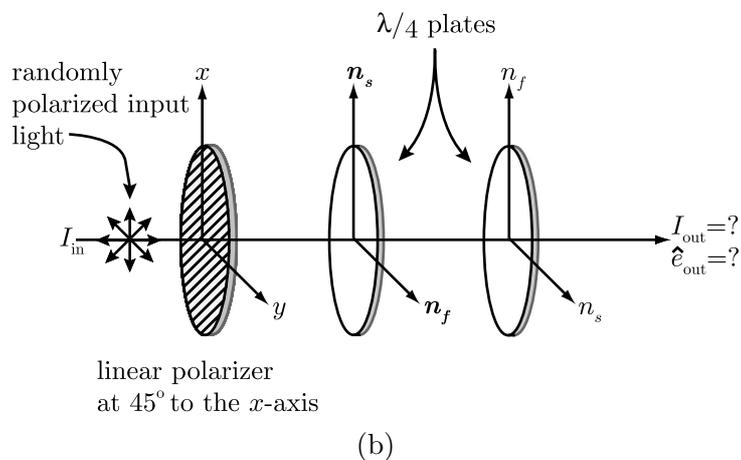
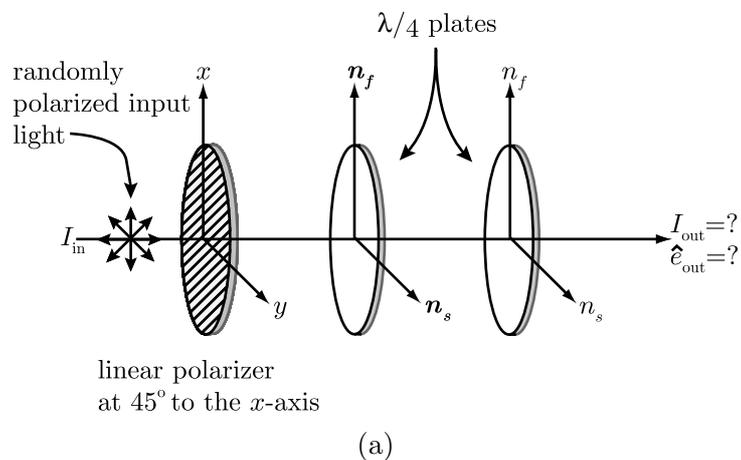


Reading recommendation: 6.637 Class Notes, Chapter 1;

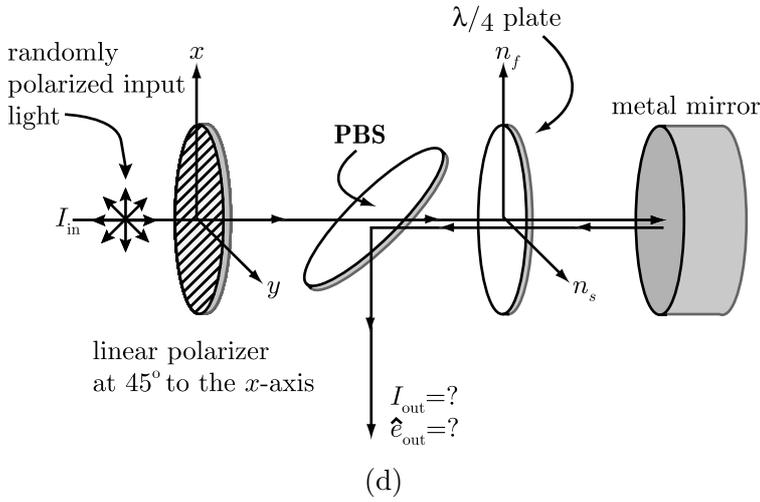
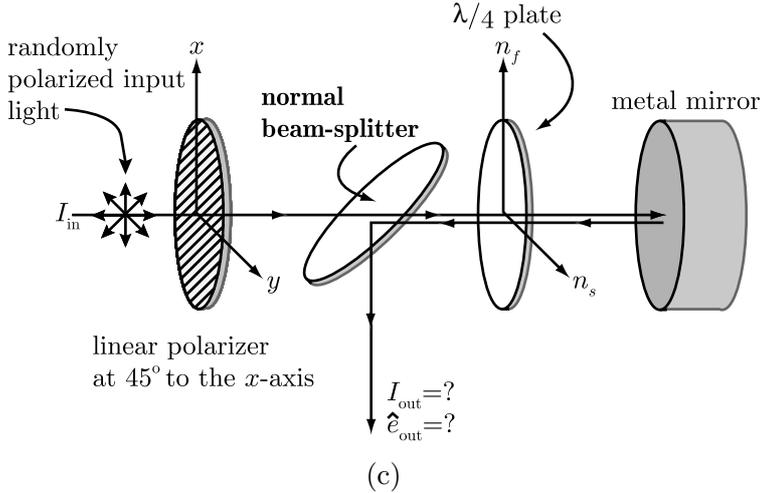
Problem 1.1

The goal is to determine the polarization state, \hat{e}_{out} , and the relative intensity, I_{out} , of the output light in each of the four systems shown below. Derive your answers by writing the amplitude and the polarization state of the light on both sides of all the components.

Notes: (1) A polarization beam splitter (PBS) passes TM and reflects TE light. The operation of a normal beam splitter is polarization independent. (2) Ignore phase changes on reflection and transmission in this problem.



Problem 1.1 Continued



(e) Apply the Jones matrix methods in (a)-(d) to confirm your findings.

Problem 1.2

The Young's double slit experiment is modified, as shown below, by placing a thin parallel glass plate of thickness d and refractive index n over one of the slits. Here a is the slit width in the x direction and b is the slit separation also in the x direction. The system is excited with on-axis collimated laser light of wavelength λ . A lens of focal length F is placed immediately behind the slits and a screen is placed a distance F away from the lens, so that a set of well-defined interference fringes are visible on the screen. Ignore all phase changes from reflection and transmission in this problem.

- For the case where the glass plate is absent, derive an expression for the position, X_{2m} , of the m th maximum on the screen.
- Derive an expression for the spatial frequency shift $\Delta f = [(\sin \theta')/\lambda - (\sin \theta)/\lambda]$ that occurs when the glass slide is inserted in the position shown in the diagram. What important conclusion do you draw from your expression?
- Derive an expression for the lateral spatial shift $\Delta X_{2m} = X'_{2m} - X_{2m}$ on the screen as a result of inserting the glass slide.
- In which direction do the fringes shift?

