1) (5 points) Pedrotti, problem 11-1.

2) (5 points) Pedrotti, problem 11-3.

3) (5 points) Pedrotti, problem 11-4.

4) (9 points) In class we saw that the electric field amplitude for a double slit diffraction pattern is given by

\[
E_p = \frac{E_L}{r_0} e^{i(kr_0 - \omega \theta)} \left[ \int_{-(a+b)/2}^{-(a-b)/2} e^{ikx \sin \theta} ds + \int_{(a-b)/2}^{(a+b)/2} e^{ikx \sin \theta} ds \right]
\]

where a is the slit spacing and b is the slit width. Evaluate the integrals and show that

\[
E_p = \frac{2E_L b}{r_0} e^{i(kr_0 - \omega \theta)} \frac{\sin \beta}{\beta} \cos \alpha
\]

where \( \alpha = \frac{1}{2} ka \sin \theta \), \( \beta = \frac{1}{2} kb \sin \theta \).

5) (9 points) Sketch the diffraction patterns that you would observe on a screen 100 cm from an aperture illuminated by a He-Ne laser, for the following cases:

a) single slit, slit width = 20 microns.

b) double slit, slit width = 20 microns, slit spacing = 80 microns.

c) four slits, slit width = 20 microns, slit spacing = 80 microns.

Draw these diffraction patterns on a one-to-one scale as you would see them on the screen, and label the position of the first zero due to the "slit width" term.