SLIT INTERFERENCE AND DIFFRACTION PROBLEMS

More difficult problems are indicated with an asterisk.

1. What is the separation of fringes in a Young's double slits experiment with wavelength 579 nm where the slits are separated by 1.6 mm and are 355 cm from the receiving screen.

2. What is the separation of fringes in a Young's double slits experiment with wavelength 508 nm where the slits are separated by 1mm and are 119 cm from the receiving screen.

3. Light of 555 nm wavelength passes through a slit of 1.8 mm width to a screen 164 cm away. What is the width of the primary and secondary maxima of the diffraction pattern?

4. How many secondary maxima lie between adjacent primary maxima in a 7 slit interference pattern?

5. How many secondary maxima lie between adjacent primary maxima in a 5 slit interference pattern?

6. Light of wavelength 650 nm falls from a narrow slit onto two parallel slits whose separation is 0.150 mm. How far apart are the interference bands on a screen at a distance of 80.0 cm from the double slits?

7. Plane waves of wavelength 546.1 nm are incident normally on a slit, on the emergent side of which is a focusing lens of 40.0 cm focal length placed close to the slit. If the slit has a width of 0.450 mm, what is the distance from the principal maximum to the first minimum of the diffraction pattern?

8.* What is the effect on the diffraction pattern from a double slit if (a) the separation of slits is kept constant while the slit width is varied and (b) if the slit width is kept constant and the separation is varied?

9.* A Young's double slits experiment produces the characteristic sinusoidally varying interference pattern with maximum intensity I_o. What will happen to the pattern if one of the slits is replaced by another light source incoherent with the other slit but it?

ANSWERS to SELECTED PROBLEMS

1. 1.28 mm.

2. 0.605 mm.

3. primary maximum width: 1.01 mm;
secondary maximum width: 0.51mm

4. 5

5. 3

6. 0.347 cm.

7. 0.486 mm.

9. Because of the incoherence of the sources, there will be no interference pattern. Instead the receiving screen will be evenly illuminated by a pattern of intensity $I_o/2$.