OPTI-502 **Optical Design and Instrumentation I** John E. Greivenkamp
Homework Set 7 Fall, 2011

Assigned: 10/6/11 Lecture 14
Due: 10/13/11 Lecture 16

7-1) A thin lens with a focal length of 6.0 cm has an aperture diameter of 6.0 cm. A 6.0 cm diameter aperture is located 2.0 cm in front of the lens, and a 4.0 cm diameter aperture is located 2.0 cm behind the lens. An object 4.0 cm high is located on the axis 12 cm in front of the lens. Determine, using Gaussian methods, which of these apertures serves as the system stop. Now, determine the locations and sizes of the entrance and exit pupils. Sketch the system and the marginal and chief rays for this object.

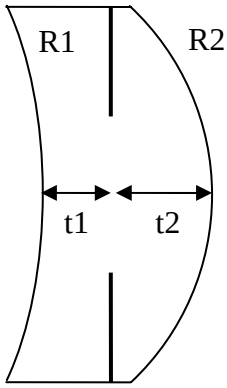
7-2) An afocal system is constructed out of two positive thin lenses. The first lens has a focal length of 200 mm, and the magnitude of the lateral magnification is 0.1:

$$|m| = 0.1$$

a) Determine the focal length of the second lens and the spacing between the two lenses.

b) The first lens serves as the aperture stop of this afocal system, and the diameter of the first lens (or stop) is 50 mm. Determine the locations and diameters of the Entrance Pupil and the Exit Pupil. Use Gaussian methods.

7-3) A plano-concave lens and a plano-convex lens have been glued together to create a thick lens. When the lenses were glued togeter, the system stop was placed between the two lenses. The lens is used in air.



R1 = -100 mm

R2 = -50 mm

t1 = 10 mm

t2 = 15 mm

n = 1.5 (both lenses)

Stop Diameter = 20 mm

a) Use Gaussian methods to determine the location and diameter of the Entrance Pupil of the system.

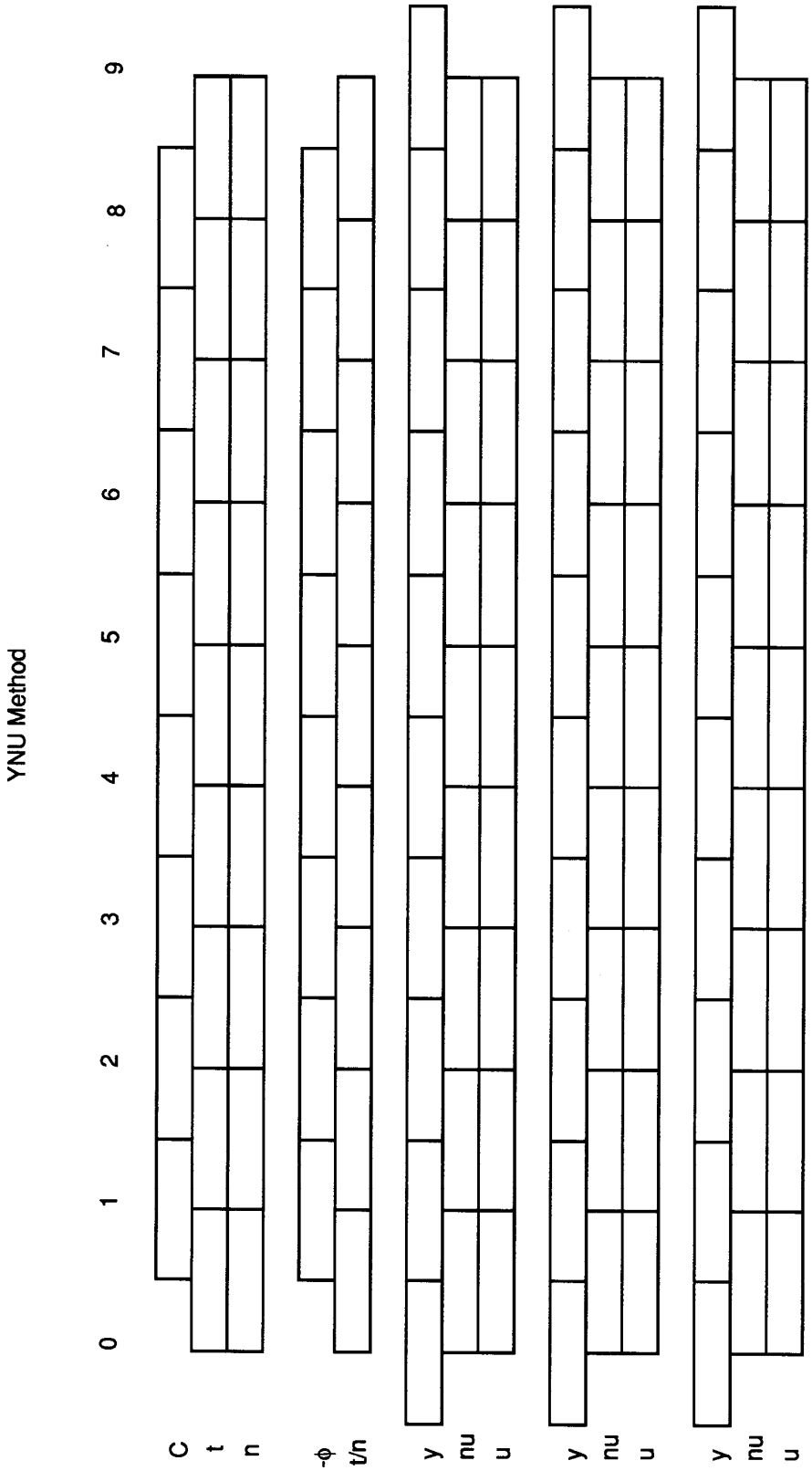
b) Use paraxial raytrace methods to determine the system Focal Length, the Back Focal Distance, the Exit Pupil location, and the Exit Pupil daimeter. Note that the results from part (a) are not needed for this solution.

7-4) The following is a prescription for a photographic objective. It is an f/5.6 system designed to cover a total field of 45° ($\bar{u}$ = tan 22.5° in object space).

Surface	Curvature	Index	Thickness	
1	.30845			
		1.6202	.599	
2	-.01725			
		1.0000	.655	
3	-.17094			
		1.5785	.288	
4	.36219			
		1.0000	.455	
5	----			Stop Position
		1.0000	.200	
6	-.01725			
		1.5315	.215	
7	.38197			
		1.6202	.879	
8	-.23607			

Using raytrace methods:

a) Locate the entrance and exit pupils
b) Determine the back focal distance and the effective focal length
c) Determine the Lagrange invariant and the stop and pupil diameters
d) Locate the cardinal points and determine the principal point separation
e) Draw the system to scale showing the marginal and chief rays, the pupils, and the cardinal points.


YNU Method
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