OPTI-502 **Optical Design and Instrumentation I** John E. Greivenkamp

Practice Project 2

Most research-grade microscopes are designed as infinity-corrected systems. The object is placed at the front focal point of the objective lens, and each object point creates a collimated beam on the image space side of the objective. A tube lens forms the intermediate image that is viewed by the eyepiece. In these systems, there are two optical tube lengths to consider. The optical tube length is defined as the distance from the tube lens to the intermediate image plane (i.e. the tube lens focal length). The infinite optical tube length is defined as the distance from the rear focal point of the objective lens to the tube lens (in collimated space).

Design an Optical Microscope with the following Specifications:

Overall Magnifying Power:	200X	
Objective:	20X	
Eyepiece:	10X	
Tube Lens Focal Length:	200 mm	
Infinite Optical Tube Length:	100 mm	
The Objective is Telecentric in Object Space		
The Eyepiece is a Ramsden-Style Design		
The Field Lens is Displaced 10 mm from the Intermediate Image Plane		
Assume a Relaxed Eye (focused at infinity)		
Eye Relief:	8.0 mm	
Exit Pupil Diameter	1.0 mm	
Unvignetted Object Field of View:	1.0 mm	(Diameter)

Note: This is a first-order design problem. All lenses can be assumed to be thin lenses with no aberrations and no thickness. To aid in grading, this problem may be more completely specified than you would normally encounter. In fact, the approach specified may or may not be the "best" form of the solution.

All of the given specifications must be met exactly.

Important -- The problem is to be worked in sections. Each section must start on a new page of your solution. In addition, a summary page with a diagram of the microscope is attached where all of the pertinent details of your design must be shown. This summary page is to be used as the cover page of your solution.

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Section A: Determine the focal length of the objective lens, the working distance, and the location of the system stop. Use Gaussian Methods.

Section B: Design the eyepiece for the microscope. Provide the focal lengths of the field lens and the eye lens and the locations of these elements. Use Gaussian Methods.

Section C: Determine the diameter of the system stop and the NA of the objective. Use the method of your choice.

Section D: Determine the required diameters of all of the elements in the design. Use the raytrace sheet that is attached (copy as necessary).

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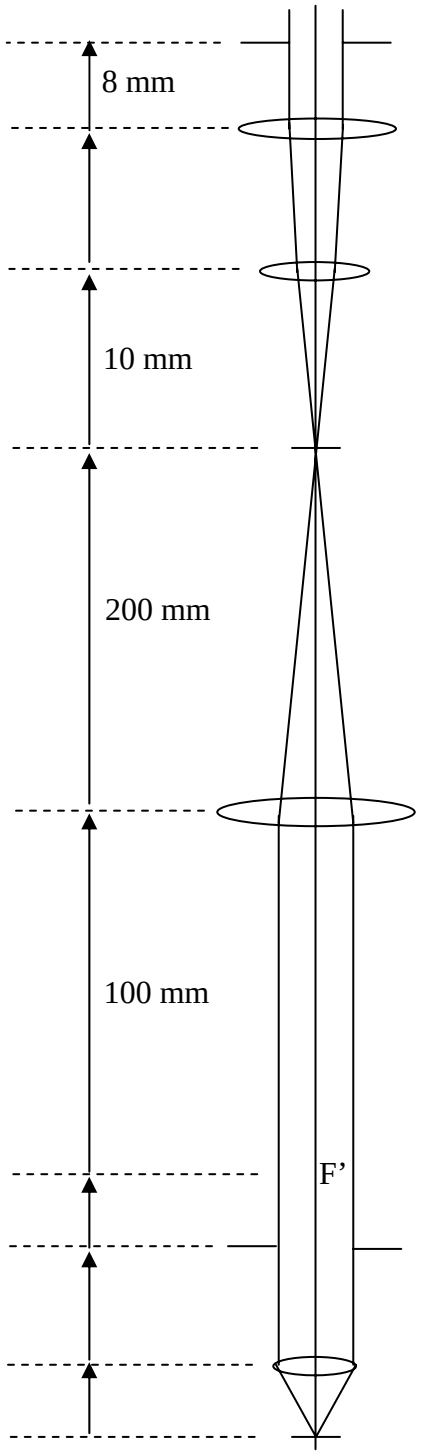
NAME _____ Cover Sheet for Solution



Exit Pupil: Dia = 1.0 mm

Eye Lens: f =
Dia =

Field Lens: f =
Dia =

Intermediate Image Plane
Dia =

Tube Lens: f = 200 mm
Dia =

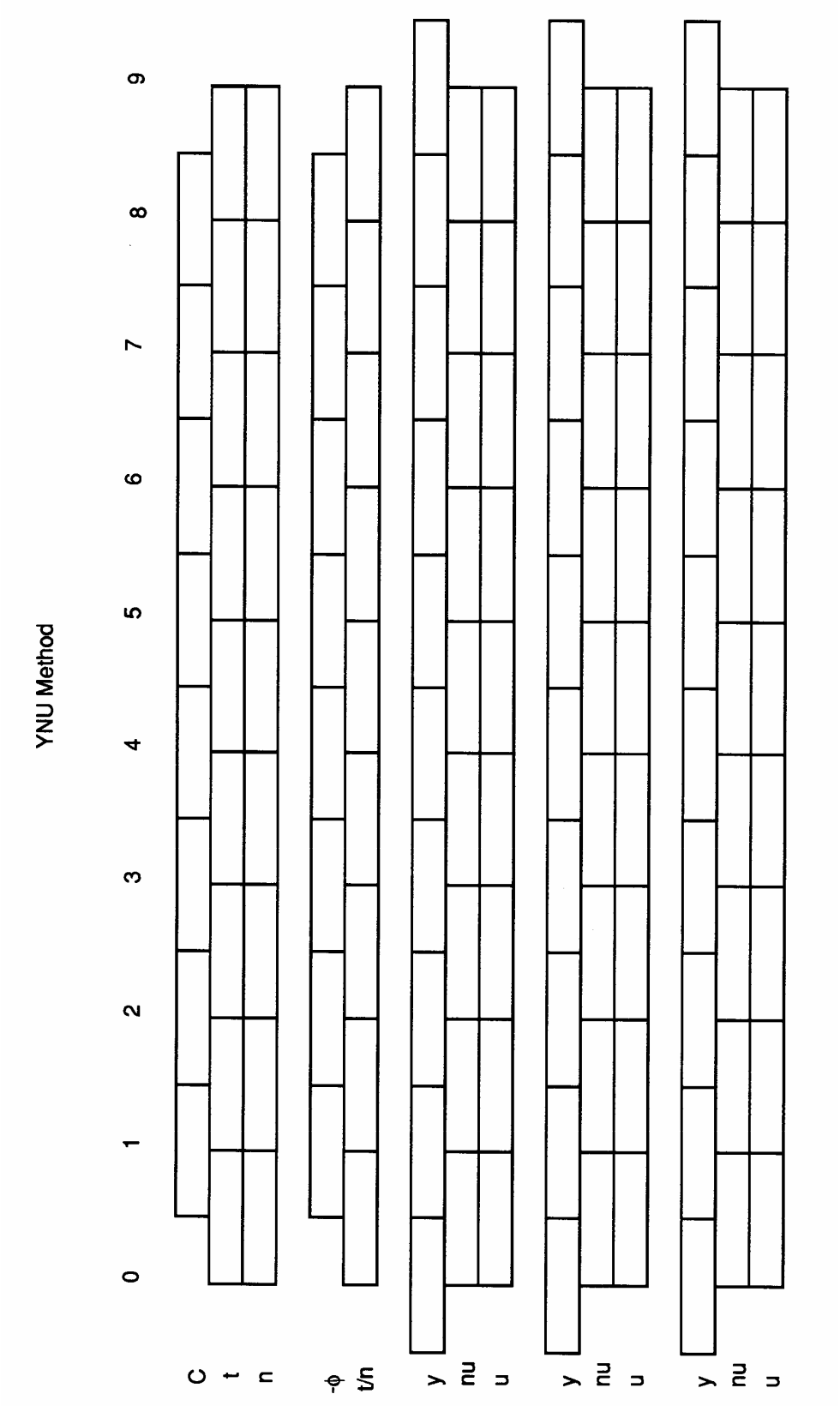
Rear Focal Point of Objective Lens

Stop: Dia =

Objective Lens: f =
Dia =

Object Dia = 1.0 mm

Objective NA =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