HW #5: Due Mar. 30, 2015 in Class

Problem 1: (60 pts, 20 pts each)

Using the Fig. 9N, pp167, of the Jenkins and White, Fundamentals of Optics,

1) Prove that the on-axis aplanatic construction satisfies a perfect imaging condition for an incoming spherical wave converging towards the point M. No Paraxial Approximation.
2) Prove that the on-axis aplanatic construction satisfies the Abbe's sine condition.
3) Prove that delta(u/n) = 0 is satisfiled for the aplanatic construction.

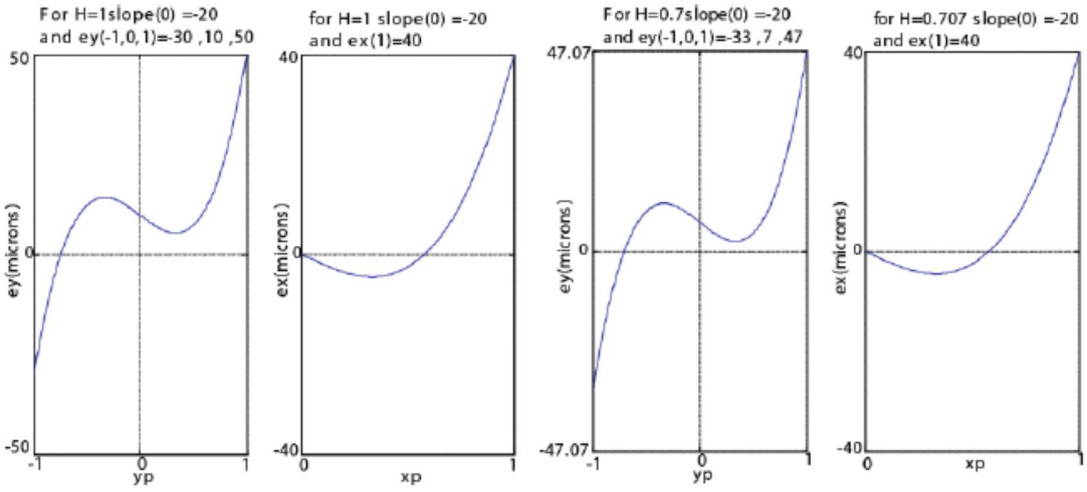
Problem 2: (5pt each)

The length of the line image at the sagittal focus for an F/5, at full field is 60 μm long (λ = 0.5 μm).

a. How many waves of astigmatism (W222) are present?
b. What is the longitudinal separation (focus shift) between sagittal and tangential focus?
c. What is the diameter of the medial circle?

Problem 3: (5 pt each)
For an F/10 optical system used at λ = .5 μm, the following ray fans were found. The field of view is 0°, 14° and 20°.

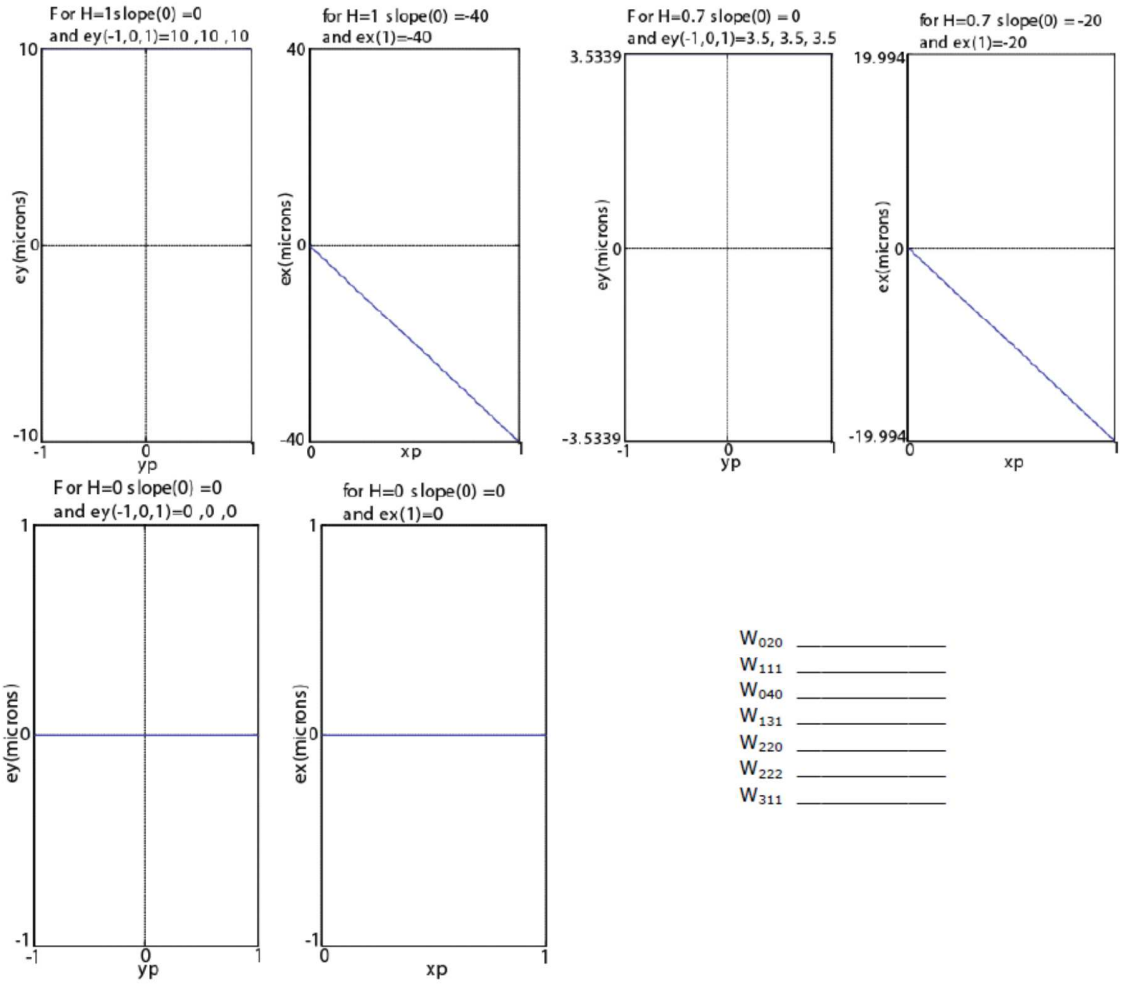
a. What aberrations are present?
b. What is the value (in waves)



W_{020} _____
W_{111} _____
W_{040} _____
W_{131} _____
W_{220} _____
W_{222} _____
W_{311} _____

Problem 4: (5pt each)
For an F/10 optical system used at λ = 0.5 μm wavelength, the following ray fan plots were found. The field of view is 0°, 14° and 20°.

a. What aberrations are present?
b. What is the value (in waves) for each aberration coefficient present (Wk,l,m) rounded to the nearest $\lambda/4$? Fill in the table below



W_{020} _____
W_{111} _____
W_{040} _____
W_{131} _____
W_{220} _____
W_{222} _____
W_{311} _____