Problem Set 2023-7
Physics 265
First Semester, AY 2023– 2024
Release Date: 22 September 2023
Due: 6 January 2024
Ten points per number

1. Primary Aberration of a Thin Lens (Section 5.6 Born & Wolf). Plot the Seidel aberration function (similar to Figure 5.3) that is due to a double convex thin lens which is made of your first dielectric material (n_1 = = n_2 = n_{air} = 1; r_1 = 3 cm, r_2 = 4 cm, A = 550 nm*, b_1 = 0.8, b_2 = 0.9) for the following cases (via Eqn 15): (a) Spherical aberration, (b) Coma, (c) Astigmatism, (d) Curvature of Field and (e) Total aberration.

2. Primary Aberration of a Thin Lens. Plot the aberration function due to a thin lens that is made of your second dielectric material (n_1 = = n_2 = n_{air} = 1; r_1 = 3 cm, r_2 = 4 cm, A = 550 nm, b_1 = 0.9, b_2 = 0.8) for the following cases (via Eqn 15): (a) Spherical aberration, (b) Coma, (c) Astigmatism, (d) Curvature of Field and (e) Total aberration.

3. Which of the two lens materials produces less (total) aberration effect? Explain your answer.

4. At what object distance s1 (from the apex of the first lens surface) will the thin lens produce no coma for the corresponding image produced? Plot the object distance value versus wavelength A in the range: 400 nm □ A □ 800 nm (oA = 0.1 nm) for each of your two dielectric materials. Briefly discuss your results.

*Note: For materials with operating ranges that are outside the visible spectrum (400 – 750 nm), please use the center wavelength of the stated range.

END.