PHY385H1F – "Introductory Optics"
Practicals Day 7 – Presentations on Geometrical Optics
November 14, 2011

Group Number: ____.

Facilitator Name:________________________________.

Record-Keeper Name:__________________________________. [Turn this sheet in for marks]

Time-keeper:______________________________.

Computer/Wiki-master:________________________________.

NOTE: The roles for the above must be *different* than last week!

Activity 7.0 – Presentation to your Peers

[6 points based on quality of presentation] All groups must do ***all*** 6 problems below for marks on this worksheet. However, your team must give a short presentation on ***one*** of the problems in this Theory Module (the one with the number corresponding to your group). At least 2 of your members must speak, and you should talk at the white-board to the entire class. The presentation should not be more than about 5 minutes, and should convey how you got the answer to the problem.

For Marker:

Presentation [audibility, use of white-board]	______/ 2
Clarity [was explanation understandable?]	______/ 2
Accuracy [correct and complete answer?]	______/ 2
Total	______

Activity 7.1 – Image Formation from a Plane Mirror

[4 points] – Group 1 must present answer on white-board at 3:30.

A plane mirror of height d is held a distance L from your eye. You observe a virtual image of yourself that is $2L$ away from your eye.

A. If your face is 25 cm high and you hold the mirror at a distance of $L = 40$ cm away from your eye, what is the minimum height d_{min} of the mirror such that you can view your entire face? [Sketch the situation.]

B. If now the mirror is placed a distance $L = 5.0$ m away, what is the minimum height d_{min} of the mirror such that you can view your entire face?

Activity 7.2 – Grinding a Spherical Lens

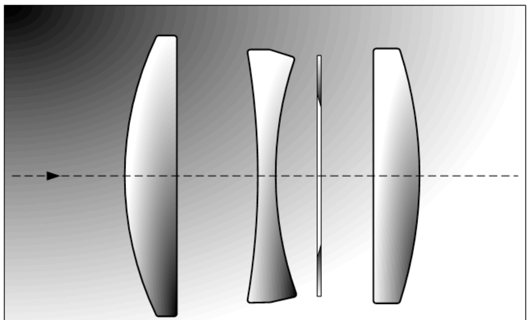
[4 points] – Group 2 must present answer on white-board at 3:45.

Imagine you are a lens-maker, and you wish to create a converging plano-convex lens made of glass with index of refraction n = 1.52. The lens must have a diameter of 8 cm and its *f*-number should be F5. To what radius of curvature should you grind the convex side?

Activity 7.3 – Cooke-triplet

[4 points] – Group 3 must present answer on white-board at 4:00.

A "Cooke-triplet" consists of three thin lenses in succession, and is often used in cameras. It was patented in 1893, and was the first lens system that allowed elimination of most of the optical distortion or aberration at the outer edge of lenses.



Cooke Triplet

The focal lengths of a particular triplet are: $f_1 = +12$ cm, $f_2 = -40$ cm, and $f_3 = +12$ cm. Lens 2 is located 6 cm behind lens 1, and lens 3 is located 6 cm behind lens 2.

An object is 2 cm high and is located 40 cm in front of lens 1.

A. How far beyond lens 3 will the final image of this object appear?
B. What will be the height of the image? Will it be inverted?

Activity 7.4 – Image Formation with a Spherical Mirror

[4 points] – Group 4 must present answer on white-board at 4:15.

A rose is held 25 cm in front of a concave spherical mirror. The mirror projects a real image of the rose onto a screen 100 cm away. What is the radius of curvature of the spherical mirror?

Activity 7.5 – Step-Index Multimode Communications Fibre

[4 points] – Group 5 must present answer on white-board at 4:30.

A step-index fibre is used to carry a digital signal composed of optical pulses from a laser. The core has an index of refraction of $n_f = 1.62$, and the cladding has an index of refraction of $n_c = 1.52$. The glass in the fibre core has an attenuation coefficient of 20 dB per km.

A. If the end of this fibre is in air, what is the maximum acceptance angle relative to the fibre-axis for light rays which will be internally reflected in the fibre?
B. For a 200 m length of fibre, what is the ratio of the output power to the input power?
C. For a 200 m length of fibre, what is the intermodal delay? How many non-confused pulses per second could be sent along such a fibre?

Activity 7.6 – Laser Irradiance

[4 points] – Group 6 must present answer on white-board at 4:45.

A child who lives near the airport has a green laser pointer, with a wavelength of 532 nm and an initial beam diameter of 4.0 mm. This naughty child shines the laser up at an aircraft that is coming in for a landing. The airplane is 500 m above the child, and the system is diffraction limited, meaning it is the narrowest possible beam.

A. What is the diameter of the beam when it reaches the airplane?
B. The child's laser is a Class 2 laser with a power of 0.7 mW. Estimate the irradiance at the position of the airplane.