

Optical Engineering Protocol

Examiner: Prof. Dr. Wilhelm Stork

Duration of exam: 30 mins

Prof. Stork starts with a common question which is not countable for the grade. The next question to it has an impact on the direction of the following conversation between you and the Prof. Stork So I put the questions and their respective answers in the following:

1. What is optical engineering?

=> It is the field of study where the behavior of optics is utilized in order to design and manufacture optical systems to satisfy the market demand in the field of optics. (I think it is good to put the term 'market' while defining optical engineering. Prof. Stork likes to hear that).

2. Tell me a simple optical element that you know.

=> Lens.

3. Draw a lens and show what happens when parallel rays incident on the lens.

=> I drew a biconvex lens and drew the required phenomenon for parallel rays.

4. How to design a lens?

=> Lensmakers' equation (Put the complete formula with the term d , and said that the thickness of the lens is assumed to be zero for thin lenses).

5. What is the difference between a lens and a mirror?

=> In focal length. Because for spherical mirrors $f=R/2$ but for lenses (he mentioned plano-convex lenses in this case) $f=R/(n-1)$. So in lenses f depends on n beside R .

6. How refraction is calculated?

=> Snell's law: $n_1 \sin x_1 = n_2 \sin x_2$.

7. What happens for small angles?

=> Snell's law: $n_1 x_1 = n_2 x_2$.

8. Prof. Stork drew a 90 degree prism and asked what happens when white light comes?

=> White light will be dispersed. The blue light will be refracted more than green light and green light will be refracted more than red light. So blue light will have smaller f and red light will have bigger f and green light will have f in between red and blue.

9. Draw the graph for n vs λ .

=> I drew it.

10. What is the purpose of a prism?

=> To make spectrum.

11. How can we get spectrum other than using prism?

=> Spectrometer.

12. Draw a spectrometer.

=> I drew a grating spectrometer.

13. Can we make spectrometers using lens instead of mirrors?

=> Yes.

14. Which one is better among a lens and a mirror to design a spectrometer?

=> Mirror.

15. Why?

=> Because it has a loss of 4% due to one surface but lens will have a loss of 8% due to two surfaces.

16. What is at the back of a mirror?

=> Metal coating of Al and Ag.

17. Why these two?

=> High conductivity and low resistance.

18. How we see image?

=> The light is an electromagnetic incidence on the mirror while there are free electrons is moving due to metal coating. The electrons start to vibrate with force $F=qE$. But due to ohmic resistance electrons have little obstacles in movement. Due to the response to the vibration we see images and due to the obstacles there is 4% lost.

Prof. Stork said that this is not the real reason that why we will use mirrors instead of lenses in spectrometers. The real reason is that mirrors can focus light more effectively than lenses because the focusing of mirror doesn't depend on n . I answered it at the beginning of my exam.

19. Draw a grating.

=> I drew a grating.

20. What is the diffraction grating equation?

=> $a \sin x = m\lambda$ (a is the distance between slits).

21. Draw the intensity patterns due to single slit and multiple slits.

=> I drew them.

22. What is the difference between refractive lenses and diffractive lenses?

=> In refractive lenses f increases with longer λ and in diffractive lenses it is other way around.

That is what my exam was all about.

I would say Prof. Stork is a very nice person and very friendly with the students. He never confuses you by asking same questions over again to see whether you are sure about your answer or not. He gives a lot of hints to get you to the desired answers of his questions.

I think the following tips will work:

1. Give a straight answer of the questions. Don't say much about it.
2. If you don't know an answer, say you don't know. He will help you to find the answer.
3. Draw figures to build your answers even if he doesn't ask.
4. Use as much as hints he gives, those are absolutely free.

Best of luck,

Ahmed