Optical Engineering Protocol

Xiang Gao
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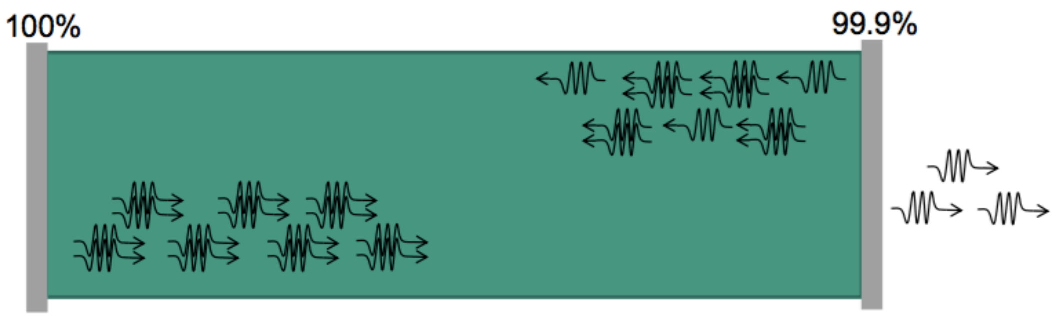
To those who will take the exam:

My experience on the exam is a bit special, because I didn't choose the optical systems that most participants preferred. In my case, I chose laser because I personally did related experiments during my bachelor study, though only a little was covered in the lecture slides. Sometimes it can be beneficial if you chose a topic like that because many chose lens, microscope, telescope or spectacles, which might already make the professor fed up. (I remember Prof. Stork responded "interesting" when I chose laser.) However, you should know how to handle your topic if you chose one like mine because many questions will be beyond the lecture slides.

Here is my story:

1. What is optical engineering good for? Ans: It is a scientific approach to design and manufacture the systems and devices on need of market or applications.
2. Which system do you want to talk about? Ans: Laser.
3. Could you draw a simple scheme of laser? Ans: see the picture below



4. What kinds of lasers do you know? Ans: Ruby, He-Ne, solid state, semiconductor, fiber lasers.
5. How about their pump sources? Ans: Ruby laser -> flash lamp, He-Ne and semiconductor lasers -> electric current, solid state and fiber lasers -> like laser diode.
6. (Not covered in the slides) How to make a fiber? Ans: I just described roughly the process from preform to the fiber.
7. (Not covered in the slides) How is the transverse section of fiber looking like? Ans: I drew the core, cladding and outer layer.
8. (Not covered in the slides) How to make a preform? Ans: Glass melting and cooling, or you can make the pre-cladding and then fill in the core material in the central area. I also mentioned the profile and size of the preform, and how long a fiber one preform can produce.
9. (Not covered in the slides) How to pull the light into the fiber? Ans: Use a lens to

construct a collimator.

10. (Not covered in the slides) Why is laser different from other light sources? Ans: It has high coherence.
11. (Not covered in the slides) Could you describe the coherence? Ans: Temporal and spatial coherence.
12. (Not covered in the slides) Which coherent do you use for laser pointer? Ans: Spatial coherence.
13. How do you get it? Ans: By resonance to form a Gaussian profile (due to Central Limit Theorem) of output, which could be very slowly diverging even after passing through a rather long distance.
14. How is the structure of a laser pointer? Ans: see the picture below

15. (Not covered in the slides) Could you describe the output mirror in the fiber? Ans: It can be small end-mirror, or fiber Bragg grating (FBG) for reflection.
16. (Not covered in the slides) Could you draw a FBG? Ans: I drew a FBG with a period g.
17. (Not covered in the slides) How can we make fiber Bragg grating? Ans: By etching into the core.
18. (Not covered in the slides) How long should the period g be? Ans: $g \cdot (\sin\alpha + \sin\beta) = \lambda$, since $\alpha = \beta = \pi/2$, we get $g = \lambda/2$. (I am not sure whether that is right or wrong, so please check it.)
19. Could you draw a telescope? Ans: I drew a Kepler one.
20. How to derive the magnification? Ans: Use some simple geometrical relations.
21. What kind of magnification have you seen? Ans: 10x magnification for some terrestrial telescopes.
22. Are there telescopes with magnification of 1,000? Ans: Yes, for astronomy.
23. How large should the diameter be at least? Ans: 3 mm (diameter of eye pupil) *

1,000 = 3 m.

That is over. Good luck in the exam!

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