1) **Dispersion**

started with look to the tables 2.1 and 2.2

Professor continued the topic which previous examinee didn't finish (or didn't explain)

Q. What does C=16ps/nm*km mean?

A. That after 1km 1nm bandwidth pulse would be 16ps length. 1nm → 10ps (didn't mentioned that it would be in 1.55µm, professor added)

Q. What would happen with 1ps pulse over 100km

A. I wrote down formula $\Delta f = \frac{c}{\lambda_0^2}\Delta\lambda$ and calculated → 16000ps

Q. Is there a way to compensate it?

A. yes, with dispersion compensating fibre. C=M+W, W can be changed by increasing difference between refractive indexes. To maintain V we need to reduce diameter of fibre.

Q. Below table 2.1 and 2.2 Δ difference is 3x. How V should change?

A. By $\sqrt{3} = 1.7$

Q. How much should we change radius of fibre?

A. 1.7 also (at some point I wrote down V and Δ formulas, with second one I got help)

Q. And why it is important to have V unchanged?

A. We want to have single mode fibre, so it should be lower than 2.405

Q. So how it does compensate the dispersion?

A. Two fibres, I wrote down $C_1L_1 + C_2L_2 = 0$, he asked where I get it from:

$$\Delta t_g = \Delta\lambda(C_1L_1 + C_2L_2)$$

Q. What happens with additional doping in a fibre?

A. Attenuation increases

Q. Why?

A. Rayleigh scattering

Q. Why the sky is blue?

2) **Amplitude – phase coupling**

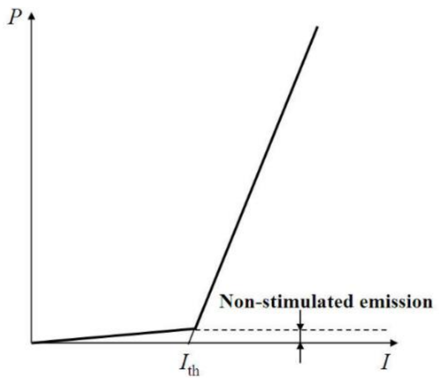
Q. We start laser, increase the current, number of carriers increases, what happens next?

A. Amplitude-phase coupling. Increase current, increases carriers, increases gain, decreases imaginary part of refractive index (or negative imaginary part), due to Kramers-Kronings relation real part of refractive index decreases and it leads to higher frequency. Forgot to mention, that $n \cdot w = const$, so he asked to derive from $2kL = 2m\pi$ (didn't remember the formula correctly, but he also helped)

3) **Current – power relation**

Q. Could you draw power dependence of injection current in semiconductor laser?

A. Ive painted similar, with flat line on the bottom, he asked what Ive ignored – spontaneous emission. Followed questions where threshold point is, transparency (left from threshold), why they are different (transparency – no reflection losses from mirrors, just material losses). Why do we need time to reach threshold current (I explained as delay time in the beginning, but in general it depends on carriers injection rate per second $\frac{I}{e}$ from laser rate equation).



My exam took ~20min, he was helping if I didn't remember formulas. Exam was not so smooth as the report, and there were more small related questions, I don't remember all. Its ok not to answer question at first try, he would guide to reach exact answer

Good luck!