Relevant points for the oral exam.

Chapter 1. Pages 1.1 – 1.7

Chapter 2. All definitions and propositions.

Chapter 3. This is central to the graph theory part of the lecture. Especially immersions, coverings and <u>foldings</u> prove to be very useful in all the following chapters

Chapter 4. You may skip the proof 4.9 of the Hanna Neumann bound and the related discussion 4.3 – 4.8. But 4.10 is important for Chapter 5 (Where exactly ?)

Chapter 5. The main result is not stated very clearly. so here is an outline to follow.

1. Statement 5.3 : a marked graph $\Gamma_H = \{\Gamma, f, b, T, e_1, \dots, e_n\}$ determines an automorphism of F_n. This is explained on pages 5.6 – 5.7 where also the main result is stated in the claim on page 5.6: Whitehead automorphisms generate $\mathrm{Aut}\, F_n$

2. The f in a marked graph is a homotopy equivalence $f : \Gamma \to R_n$. f decomposes into foldings $p_1, \dots, p_r$ and an immersion g, i.e. $f = g \circ p_r \circ \dots \circ p_1$. The proof of the claim is by induction on r. If $r = 0$, then f is

an immersion and 5.4. shows that then $f : \Gamma \to R_n$ is an isomorphism. So the marked graph determines an automorphism of R_n, and $\mathrm{Aut}\, R_n \hookrightarrow \mathrm{Aut}\, F_n$ (see page 5.2) are all Whitehead automorphisms.

3. On page 5.10 the scheme of the proof is explained and the induction step runs through the following 10 pages.

Chapter 6 : (pages 6.2, – 6.10 are only motivational. Not part of the exam) Do not skip page 6.1.

Understand the 2 definitions of outer space and describe the action of $\mathrm{Out}\, F_n$ on Out_n

Understand the weak topology 6.20 – 6.22

Have a good idea what the simplices of Out_2 look like 6.22 – 6.23

Have an intuitive idea how Out_n is contracted p. 6.36 – 38

Definition of axes of elements of F_n. and resulting choice of basepoint 6.42 – 6.47