# Assessment guidelines (sensorveiledning) FYS5120[1]

The final oral exam counts for 60% of the grade (with the written midterm exam counting 40% of the grade). A prerequisite for taking the final exam is that the candidate has passed a written home assignment during the second half of the course (to be completed within 10 days). The final exam lasts for about 40 minutes. The candidate, the lecturer of the course, and a further examiner are present during the exam (typically the same person who was examiner also for the midterm exam). The lecturer is usually leading the exam, but the external examiner can also ask questions to test the candidate's understanding. The candidate has pen and paper available to draw sketches or write down equations; alternatively, it is possible to use the blackboard. The candidate can choose between Norwegian and English for the language of the exam.

The candidate is not permitted to bring any books, notes, or other aids. Exam questions will be presented during the exam and not before. It is not foreseen to allocate a given amount of time for reflection after a question is presented. Instead, the examiners will engage the candidate in a discussion. Usually the examiners will start with relatively simple and general questions, and afterwards increase the level of difficulty to test the candidate's understanding of the subject. The examiners will move on to another subject when they feel that the candidate has little understanding of a specific part of the curriculum. The candidate may also ask to change the subject if he/she feels to have insufficient knowledge to give any meaningful answers on a given topic. This will count negatively towards the grade, but will give the candidate the chance to show his/her knowledge on another topic.

It is considered positive if the candidate is active and presents explanations and insights beyond a specific question. Occasionally the examiners will stop the candidate in order to have time to move on to another subject.

The exam will test the candidate's understanding of advanced aspects of quantum field theory that were studied in the course. This includes the ability to derive Feynman rules for arbitrary Lagrangians, combined with working knowledge of how to justify these derivations from path integral and/or canonical quantization; the role of symmetries in constructing particle physics theories, how to quantize such theories and how to discriminate physical from unphysical degrees of freedom; spontaneous symmetry breaking including applications like the Goldstone boson equivalence theorem; the structure of non-Abelian gauge symmetries and the standard model of particle physics; various aspects of renormalization, with a focus on perturbative renormalization as well as the (continuum) renormalization group equations; the role of effective field theories. The candidate may be asked for short derivations or calculations, or to sketch the main ideas behind longer ones. In these cases the focus is not on remembering by heart or avoiding small mistakes, but on overall understanding combined with the demonstration of a successful strategy to solve the task at hand. The examiners will try to keep such more technical excursions discussion-oriented, aiming to evaluate problem-solving skills (not knowing the answer initially thus does not count negatively in these cases).

[1]These guidelines present a slightly adapted version of the generic guidelines provided by the department of physics, originally prepared for FYS4570 (autumn 2018).

The following describes typical performances that would result in grades A, C, and E.

A: The candidate shows profound understanding of the topics and concepts that were introduced in the course, and he/she has a very good overview of how they relate to each other. The candidate is able to explain how particle-physics models are constructed and how to relate these (in principle) to observables. He/she uses proper terminology, and his/her explanations are clear, precise, and well organized. The candidate appears as a full-fledged discussion partner for the examiners within the context of the curriculum. Minor inaccuracies are acceptable.

C: The candidate is familiar with the most important concepts and understands the main features of the topics that were introduced in the course, but may lack overview of their relation to each other. The candidate is aware of typical phenomena related to the various theoretical concepts introduced in the course, and he/she is able to physically interpret consequences of these concepts (e.g. by identifying potential experimental observables) with some help and hints from the examiners. His/her explanations are understandable, but can have formal shortcomings, and terminology may be improperly used.

E: The candidate is familiar with a few concepts, but understands only the most basic aspects of the topics and theories that were introduced in the course. He/she fails to recognize the relation of the different concepts and models in a wider context. The candidate is struggling to give explanations and he/she uses only very simple arguments. He/she recognizes phenomena only after significant help from the examiners. The candidate's statements are largely understandable, but reveal clear mistakes and misunderstandings.