First Examination for PhD Program in Physics

It is traditional in American universities for Ph. D. candidates to pass an examination which tests their knowledge in the basic fields of physics. This examination goes under many names, including the qualifier, comprehensive examination, among other names. At the City University it is called the First Examination. The examination consists of four parts, quantum mechanics, analytic dynamics, electromagnetic theory, and statistical mechanics. These subjects are the traditional ones and are taken by all entering students in their first year of study. The examination is given twice yearly, in June and January. The main learning goal is to demonstrate proficiency in problem-solving in the four main subject areas listed above. This then serves as a basis for study of more advanced topics, for example quantum field theory, quantum theory of solids, or advanced electrodynamics. Facility in solving problems in the four subject areas also serves as a foundation for undertaking dissertation research, in which understanding and proficiency in basic physics is required. This is in keeping with national standards for physics PhD programs.

All first year students are required to take the examination at the end of their first year of study. The examination is made up by a committee consisting of the professors teaching the courses. Because the Exam is made up by faculty who actually teach the first year courses, the Curriculum obviously prepares them for it. Each year, a new Exam is made up to reflect the Curriculum being taught, which in turn may undergo slow change in concert with national norms. Typically there are five members of the Exam Committee. Each part of the examination is graded by two members. The identity of the students is not known in that a student is assigned a number and the students name does not appear on the examination paper, only the number.

All four parts of the examination are weighted equally and the official passing grade is 60, although the passing grade may be adjusted downward by the committee. It is never adjusted upward. Typically out of an entering class of 21 approximately 3 to 5 students fail. The by-laws of the program allow a student two chances and students that fail the examination in June are required to take it again the following January. If the student fails again he/she may petition the executive committee to take it again and permission is usually granted. Typically out of a class of 21 one or two students leave the program due to failure of the qualifier.

Student Exam results are the primary source of evaluation. Pass/Fail rates have been fairly constant and in keeping with national norms. Each semester, the Physics Program Executive Committee reviews and certifies the exam results. In cases where changes are warranted, such recommendations are returned to the First Exam Committee for the following round. This a relatively rare occurrence, the last such event being 2007 when it was determined that the General Physics portion of the exam, covering a very wide range of undergraduate level material would be discontinued and replaced with graduate level Statistical Mechanics. There are two student members of the Executive Committee who are encouraged to provide feedback on their experience (and those of their peers) with the First Exam. At this time the consensus of the Executive Committee is that there is no need to change the current format or content (subject to the material being taught in the first year classes) of the First Exam.