**Physics Assessment Update**

October 14, 2010

The Physics department continues to work on its assessment matrix, which has been updated in a minor way to include Phys 205, Planetary Astronomy (formerly known as Planetary Geology). The department is also working on an assessment plan for the Physics minor. Our approach thus far has been that the minor is a “partial major”, and thus we will continue to use the FCI and CSEM as measures of student learning. It also has been suggested that a Physics minor (or a major, at the equivalent stage) should be able to critically read and analyze popular media and other claims that incorporate or invoke physical principles to support particular conclusions. We imagine that student should be able to read the science section of the New York Times, for example, and provide thoughtful commentary. We have some ideas of how we might do this, but foresee problems in the logistics of getting minors to participate in some sort of assessment measure. More progress on this point will be reported next spring.

Also included here is our updated analysis of MFT results, which includes the results from Spring 2010. Changes are shown in red. The average overall performance of Physics graduates during the years 2005-2010 continues to remain virtually equivalent to the average score of the 2010 cohort. As has been the case in recent years, the subscore analysis indicates that Albion students, on the average, do better than the national cohort in classical physics phenomenology, and about equivalent in quantum physics. They do not, on the average, do as well in optics and thermodynamics. We expect the recent changes in Phys 250, Modern Physics, and Phys 387, Quantum Mechanics, will boost the relative scores in the quantum area, but we have not yet specifically addressed the lower performance in Optics and Thermodynamics. The recent change of pedagogy and text in Phys 167 and 168 should indirectly improve these scores, but we think we will have to do more specific upper level coursework to address Optics and Thermodynamics. Our proposed respond in these areas will be discussed more fully in the report that will be submitted in the spring.

We also have updated our list of students who have pursued graduate school or other post-secondary academic endeavors after Albion with one student who is in law school. In the spring report, we will include a more extensive list of recent students who have received or are pursuing B.S. degrees in engineering and who have not subsequently pursued graduate level studies.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Outcome** | **Learning Objectives** | **105** | **105L** | **205/206** | **205L/206L** | **167** | **167L** | **168** | **168L** | **191/291** | **243** | **244** | **245** | **245L** | **250** | **308** | **322** | **325** | **336** | **350** | **380** | **384** | **387** | **Assessment Measure** |
| 1. Students in Physics courses will demonstrate knowledge of the fundamentals of physics and/or or astronomy principles.  | Students will explain and apply their understanding of mechanics | X |   |  x |   | x |  x |   |   |   |   |   |   |   |   |   |   | x |   | x |   |   |   | MFT |
| Students will explain and apply their understanding of electricity, magnetism, and optics | X |   |   |   |   |   | x |  x |   |   |   | x |   |   | x | x |   | x | x |   |   |   |
| Students will explain and apply their understanding of thermo-dynamics |   |   |   |   |   |   | x |  x |   |   |   |   |   |   |   |   |   |   |   |   | x |   |
| Students will explain and apply their understanding of quantum mechanics |   |   |   |   |   |   |   |   |   |   |   |   |   | x |   |   |   |   | x |   |   | x |
| Students will learn to interpret and create mathematical models and/or simulations of physical phenomena.  |   |   |   |   | x |  x | x  | x  |   | x | x |  x |  x |   |   |   |   |   | x | x |   | x  |
| Students will be able to explain and apply their understanding of astronomical phenomena. | x | X | X | x |   |   |   |   |   | x | x |   |   |   |   |   | x |   |   | x |   |   |
| 2. Students who take laboratory courses in physics will be able to (C) conduct experiments using accepted experimental methodologies and/or (D) design experiments to explore problems of practical and theoretical importance.  | Students will learn the skills that are necessary to conduct experiments that seek to elucidate physical phenomena |   |   |   |   |   | C |   | C |   |   |   |   | C, D |   |   |   |   |   | C,D |   |   |   | Lab Exam |
| 3. Students will clearly articulate theoretical and experimental concepts in oral and written presentations. | Students will learn how to make effective oral and written presentations. | x |   |   |   |   | X | X | x | x |   |   |   | x |   |   |   |   |   | x |   |   |   | Presentation |

**Table 1. MFT Score Analysis**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | **Ranked results of students who took Physics MFT between 2005-2010** |  |
|  |  | **Introductory** | **Percentile** | **Advanced** | **Percentile** | **Overall** | **Percentile** |
|  |  | 73 | 85 | 85 | 95 | 181 | 95 |
|  |  | 75 | 90 | 67 | 80 | 174 | 90 |
|  |  | 62 | 75 | 70 | 85 | 168 | 85 |
|  |  | 62 | 75 | 64 | 80 | 165 | 80 |
|  |  | 55 | 60 | 46 | 40 | 151 | 55 |
|  |  | 47 | 45 | 55 | 60 | 151 | 55 |
|  |  | 49 | 50 | 53 | 60 | 147 | 45 |
|  |  | 47 | 45 | 43 | 35 | 145 | 40 |
|  |  | 47 | 45 | 40 | 25 | 144 | 40 |
|  |  | 36 | 20 | 43 | 40 | 139 | 25 |
|  |  | 34 | 15 | 47 | 45 | 135 | 15 |
|  |  | 31 | 10 | 37 | 20 | 133 | 10 |
|  |  | 44 | 40 | 22 | 1 | 133 | 10 |
|  |  | 36 | 20 | 22 | 1 | 129 | 5 |
|  |  | 31 | 10 | 31 | 10 | 130 | 5 |
|  | **Albion Average** | **48.6** | **45.7** | **48.3** | **45.1** | **148.3** | **43.7** |
|  | National Average (2010) | 48.5 |  | 49.5 |  | 149.4 |  |
|  |  | std dev | 27.1 |  | 30.8 |  |  |
|  |  | std dev mean | 8.2 |  | 9.3 |  |  |
|  |  | national std dev | 16.0 |  | 15.7 |  |  |
|  |  | nat'l std dev mean | 0.4 |  | 0.4 |  |  |

**Table 2. MFT Subscore Analysis**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year** | **Classical Mechanics / RelativityAverage Score** | **Percentile** | **Electromagnetism Average Score** | **Percentile** | **Optics/Waves Thermodynamics Average Score** | **Percentile** | **Quantum Mech., Atomic Physics Average Score** | **Percentile** | **Special TopicsAverage Score** | **Percentile** |
| 2006-071 | 57 | **75** | 33 | **5** | 42 | **50** | 31 | **1** | 33 | **25** |
| 2007-082 | 57 | 75 | 67 | 95 | 46 | 70 | 47 | 50 | 50 | 90 |
| 2008-093 | 57 | 75 | 53 | 70 | 31 | 10 | 48 | 60 | 28 | 5 |
| 2009-104 | 48 | 55 | 58 | 85 | 36 | 20 | 44 | 40 | 45 | 75 |
| Weighted average | **54.0** | **68.3** | **55.6** | **73.3** | **37.2** | **31.1** | **44.6** | **44.6** | **39.1** | **49.4** |
| Nat’l mean |  | 47.5 |  | 45.9 |  | 40.6 |  | 46.1 |  | 38.3 |

1one pre-engineering student did not take this MFT

2two students did not take this MFT

3two pre-engineering students did not take this MFT

4includes one pre-engineering student took this MFT

**Provide data on graduate school admissions (In whatever format and timeframe you can provide):**

During the past decade, 14 Physics or Combined Course Physics majors have attended graduate programs in physics, engineering, chemical physics, applied math, or physical chemistry. Two physics minors also have attended or will attend graduate programs in a physics-related area.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name** | **Yr.** | **Institution** | **Degree after Albion** | **2nd and 3rd degrees** |
| Andrew Sharp | ‘10 | University of Colorado | Law School |  |  |
| Laura Pollum\* | ‘10 | Oxford University | Physical Chemistry | Ph.D. |  |
| George Wimbrow | ‘09 | Michigan State | Civil/Env. Engineering | BSE | accepted to MS program |
| Lesley Simanton | ‘09 | U. Toledo | Astronomy | Ph. D |  |
| Tim Rambo | ‘09 | Northwestern | Engineering | M.S. |  |
| Ryan Graham | ‘09 | U. Tennesee - Knoxville | Engineering | Ph. D. |  |
| Andrew Fidler | ‘08 | U. Chicago | Chemical Physics | Ph. D. |  |
| Marci Howdyshell | ‘08 | Ohio State | Physics | Ph.D. |  |
| Erich Owens | ‘08 | Columbia University | Engineering | B.S. | Brown, appl. Math (Ph.D) |
| Shane Walton | ‘08 | Wayne State University | Engineering | M.S. |  |
| Dan Coupland | ‘06 | Michigan State | Physics | Ph. D. |  |
| Kathleen Brewer | ‘06 | Yale | Public Health | M. S. |  |
| Nick Moroz | ‘05 | University of Michigan | Engineering | B.S.E. | U Mich (M.S., Ph.D) |
| William Green | ‘05 | UIUC | Mathematics | Ph.D. | Eastern Illinios (asst. prof.) |
| Christine Riker\* | ‘04 | Stanford | Engineering | M. S. |  |
| David Hansen | ‘03 | Northwestern | Applied Math | Ph. D. |  |
| Dan Holland | ‘03 | Cal. Inst. Technology | Physical Chemistry | Ph. D. |  |
| Art Bragg | ‘99 | Berkeley | Chemical Physics | Ph. D. | Johns Hopkins (asst. prof) |
| Phil Shaltis | ‘99 | Michigan | Engineering | M.S. | MIT (Ph. D.) |
| Kevin Chalut | ‘99 | Duke | Physics | Ph. D. | Cambridge U. (Post-doc) |

\*physics minor