Physics & Astronomy Articulation Committee Meeting Minutes

5 May, 2006

Okanagan College
Room C-234
Kelowna, BC

Present:

Barbara Frisken	Simon Fraser University
Onkar Rajora	Thompson Rivers University
Arnold Sikkema	Trinity Western University
Mike Hasinoff	University of British Columbia (Vancouver)
Murray Neuman	University of British Columbia (Okanagan)
Arthur Watton	University of Victoria
Kevin Dunphy	British Columbia Institute of Technology
Ann McArthur (System Liaison Person)	British Columbia Institute of Technology
John Pratt	Camosun College
Stan Greenspoon (Chair)	Capilano College
Mike Freeman	Capilano College
David Rourke	College of New Caledonia
Richard Hewko	College of the Rockies
Janusz Chrzanowski	Coquitlam College
Jennifer Kirkey	Douglas College
Don Mathewson	Kwantlen University College
Tom McMath	Kwantlen University College
Robin Macqueen	Langara College
Gregory G. Arkos	Malaspina University College
Mahmoud Ziaei	Northern Lights College
Helena Higgs	North Island College
Eric Turner	Northwest Community College
Richard Christie	Okanagan University College
Per Joensen	Selkirk College
Norm Taylor	University College of the Fraser Valley
Andy Sellwood	Vancouver Community College

Regrets:

Dan Phelps	Columbia College
Erik Jensen	University of Northern British Columbia

- Stan Greenspoon, chair of the Physics & Astronomy Articulation Committee, called the meeting to order at 9:30 a.m.

- Tom Roemer, Associate Dean – Science, Engineering Technologies, Health and Social Development of Okanagan College welcomed the members of the committee.

- Logistical matters for the meeting were dealt with.

Item 1: Introductions – Ann McArthur, the system liaison person (SLP) from BCIT was introduced. The attendees introduced themselves to their colleagues.

Item 2: Approval of the Agenda
The agenda as distributed by the chair was approved unanimously: moved by Norm Taylor, seconded by Richard Christie.

Item 3: Approval of Minutes of the 2005 Meeting
The web-published minutes of the 2005 meeting as corrected by Stan Greenspoon based on e-mail submissions, were further corrected as follows:

> Tom McMath from Kwantlen University College: replace "more focused on theory" with "more focused on applications"
> Robin Macqueen from Langara College" delete "for 20 hours a week", [Robin will email particulars to the chair].

Moved by Tom McMath (Kwantlen University College), seconded by Onkar Rajora (Thompson Rivers University), the minutes of the 2005 Articulation Committee Meeting were approved as corrected.

Item 4: Matters Arising from the Minutes
The chair pointed out that the Articulation Charts (textbook lists) were posted on the committee website (http://www.physics.capcollege.bc.ca/Articulation) and that changes could be submitted by e-mail anytime to the chair who would make the appropriate edits on an on-going basis.

Item 5: Confirmation of Date and Place of the 2007 Meeting
The meeting will be held at SFU's Surrey campus on Friday, 4 May 2007.
[The BCAPT AGM will be at the same location on Saturday, 5 May 2007.]

Item 6: Round Table Reports of Significant Curriculum Changes – represented below based on verbal and/or e-mailed reports.

Okanagan College, Richard Christie: Richard Christie reported on major developments resulting from the dissolution of OUC and the division of the facilities between Okanagan College and UBC (Okanagan). Labs were built and supplied for the September classes at the KLO Kelowna campus and library holdings in Physics and Astronomy were brought to an impressive level. The academic year 2005-06 went well with the integration of 700 new students and 55 faculty at the KLO Kelowna campus. Space was found for all the students and faculty. Only 1st year physics and astronomy was offered this past year. Plans are to expand to 2nd year this coming year, with both lectures and labs in modern physics and intermediate electricity and magnetism.

Malaspina University College, Greg Arkos: Malaspina U.C. ran a 2nd year program with strong initial numbers, but not all of the registered students showed up. The coming year looks better: Electrical Engineering to University of Victoria transfers to the 2nd year, Mechanical Engineering to do the same for 2007-08. There were a few engineering hires, with more to come. The physics faculty is at a steady number. Astronomy has 4 courses total, adding a 2nd astronomical science course and revising a course on cosmology.

Vancouver Community College, Andy Sellwood: the numbers are stabilizing with an activity-based approach doing well. The students are happy with this new approach.

Langara College, Robin Macqueen: The Langara Physics Dept. offered the same number of course sections during the past year as in previous years, but demand for the courses was weaker, as evidenced by shorter or absent wait lists. Our capacity in Fall and Spring terms is about 500 students, while in Summer term it is about 200 students.

The Langara College service plan projects weaker demand college-wide, based on decreasing numbers of Grade 12 graduates in Vancouver, Burnaby and Richmond, coupled with a strong economy and opportunities for students to join the work force. We ran 3 of our usual 4 second-year courses this year, with 5 students. Our Dean has given us warning that unless we get "double digit" enrolment in Fall 2006, the courses will not run. In the face of this, we are aligning our offerings better with UBC's Physics Majors program. We hope to continue to offer Newtonian Mechanics in the Fall term and Modern Physics in the Spring. We have a new 2nd-year lab sequence designed to better match UBC's Phys 209.

Our first-year courses are calculus-based, and we have learned that they are now significantly harder than the UBC's Phys 101 and 102, which our courses transfer to. We are considering creating a new course which better matches the topics and level of UBC's Phys 101, primarily for our life science students. We believe the engineering and physics students still need our calculus-based sequence.

University of Victoria, Arthur Watton: there are no significant changes. UVic has a minor in physics. The 2nd - year numbers are stable with approximately 50 students.

University College of the Fraser Valley, Norm Taylor: For 1st-year, the calculus-based stream is holding steady, while the algebra-based and astronomy stream is down 10 -15% with the 2nd-year having a 30% retention. They run two 2nd-year courses in the Fall semester and one in the Winter semester, running approximately ¾ full. Average 3rd-year class size is 12 to 14 students. Classes will be cancelled if the enrolment is not in the double digits. They had 5 graduates.

Northern Lights College, Mahmoud Ziaei: There were 8 students, in 1st year only.

SFU, Barb Frisken:

1. SFU Curriculum Initiative – WQB requirement for all students
    a. PHYS 190 has been revised to be quantitative and is now certified as B-Science and Q
    b. Please let me know if your astronomy course is not quantitative
2. New Program – Biological Physics (majors and honors). Good blend of physics and molecular biology and well supported by research strengths within both departments. Students can emphasize either physics or mbb, depending on area of interest.
3. Revising E&M stream
    a. Current second year course will only be for a few engineering (systems) students – less math background
    b. New 2-semester sequence based on Griffiths +, with Vector Calculus as a pre-requisite. This is consistent with UBC (301 and 401), UVic (326 and 422). We will offer these two courses starting in 07/08.

        <u>PHYS 321-3 Intermediate Electricity and Magnetism</u>
        Development and application of Maxwell's equations in vector differential form. Notation and theorems of vector calculus; electric charge, fields, potentials, capacitance and field energy; conductors; methods for solving electrostatic problems; electric fields in matter; electrical current and the magnetic field; Ampere's law and the vector potential; magnetic fields in matter; electromotive force, electrical resistance, Faraday's law and inductance; Maxwell's correction to Ampere's law and electromagnetic waves.

        Prereq: PHYS 131 or PHYS 141, MATH 252 or MATH 254, MATH 310. Students with credit for PHYS 221 may not take PHYS 321 for further credit.

        <u>PHYS 421-3 Electromagnetic Waves</u>

A continuation of PHYS 321: properties of electromagnetic waves and their interaction with matter. Transmission lines and waveguides; antennas, radiation and scattering; propagation of electromagnetic waves in free space and in matter; reflection and refraction at boundaries; polarization, interference and diffraction.

Prereq: PHYS 321 (or PHYS 221 and MATH 252) and PHYS 255 (or ENSC 380).

c. Articulation issues – courses that previously had credit for PHYS 221 could get credit PHYS 2XX(3) + PHYS 321(0)? Consistent with thermodynamics – previously PHYS 244 now PHYS 344 and college courses get PHYS (3) + PHYS 344(0). If anybody feels that their E&M is really a third year level course, please let me know.

Camosun College, John Pratt: For University transfer programs in the Fall 2005 there was a rise in enrolment of 6% in Physics, but a drop of 11% in Science. There is support for 2nd year courses. Engineering students' demand for physics courses rose. Physics for Sports course introduced - an introduction to mechanics for athletes and trainers; Needs to be articulated with other physics courses. 4 new sections were added, There is development for biomech 3rd year courses. There is a new position part-time, for 2006/07: get in touch with Dr. Nelson for information, Teaching duties will be 1st year physics class with ½ lab and lab for engineering. There will be a 2nd - year quantum mechanics course in 2007.

UBC (Okanagan), Murray Neuman: Major curriculum development is going on for the science undergraduate program (but little in Physics). A medical school is planned for 2009. Physics enrolment is stable, with 1st year statistics showing no change: 164 students enrolled in algebra-based physics, 126 in 2nd semester . 95 students in calculus-based physics with 70 in 2nd semester. There is a shift in enrollment from algebra-based to calculus-based courses as quality of intake changes. A major increase in 1st-year Science enrolment is expected in the coming year, with applications up 50%. Can't fill all seats funded for with school-leavers in the Okanagan catchment area alone. Astronomy enrollment declined compared to OUC, 34 in 1st year astronomy, 13 in 2nd semester. A new appointment in Astronomy, due to Radio Telescope observatory. Maybe a revival in astronomy with a postgraduate program in radio astronomy being planned in collaboration with the Herzberg Institute of Astrophysics. 2nd year courses have 8 to 15 students enrolled in classes. A major in physics is offered. No new courses in the degree program, except for mathematical physics course and a general relativity course in 4th year An Applied Science program started, which depleted available pool for Physics. There is competition with them, with no spin-off benefit for Physics Department. There is autonomy for developing new courses.

UBC(Vancouver), Mike Hasinoff: Our Physics & Astronomy enrollment is basically unchanged from 2004. However, the numbers are about double the 1995 numbers and about 40% higher than the 2000 enrollment numbers. The biophysics honours program has grown from 9 students in 1999 (when it was introduced) to 50 students in 2005. It was observed that many Physics students lacked sufficient skills in computational (numerical) physics. Consequently a new course, Physics 210, *Introduction to Computational Physics,* will be offered as a two term course in parallel with Phys 209

Intermediate Experimental Physics. This will allow students to balance their course load over the two terms and create opportunities for synergy between the lab course which has computational elements and the computational physics course. Students will learn numerical techniques with UNIX, MATLAB (as the principal programming environment), etc. In the other new course Phys 348 *Frontier Problems in Physics*, students will read original literature and learn about recent discoveries and unsolved frontier problems in physics. They will also carry out a literature-based research project on a selected topic in physics, selected by the student in consultation with the instructor. No laboratory work will be involved and there will be no expectation of original research. This course will be useful to majors students as their only research-like experience and beneficial to honours students in preparation for their 4th – year honours thesis. Both of the above courses will be recommended electives starting in Fall 2006, probably becoming compulsory in 2007 or 2008. [Detailed course descriptions have been e-mailed to Articulation Committee members.]

Capilano College, Mike Freeman, Stan Greenspoon: Enrollment for 1st - year Physics courses showed softening, but it was worse in Math and Computing Science. Major problems with the 2nd - year program, which had been doing well in the past with double digits enrollments, but had been getting worse in recent years. In the Fall, there were only 2 students in the single (Mechanics) 2nd year course offered, with no courses offered in the Winter semester. Modern Physics has never been offered. No 2nd - year courses are planned for Fall 2006 Astronomy course is popular. Engineering program 1st year physics enrollment is down.

Columbia College: Columbia College sends "regrets" because no one is able to come to the May, 2006 meeting.
The college uses three equal terms that begin in September, January, and May. All courses listed in the Articulation Charts are "on the books" however, because of low enrollment only the Physics 11, 12, 110 and 120 have been given recently. And again, because of low student numbers the Physics 11 course is offered once a year and currently Physics12 course is offered once a year as well. Typically each course has 12 to 15 students.
Physics 110 is given in May (typically 25+ students) and in September (starting with up to 33 students). Physics 120 is given in January (typically 15+ students).
Dan Phelps is retiring effective June 30, 2006 but will remain the "contact person" via <wyeast@uniserve.com> until a replacement has been found.

Trinity Western University, Arnold Sikkema: *Trinity Western University*, Arnold Sikkema: Offers a minor and a concentration in Physics; Calculus-based Physics introductory sequence, revised about half of the labs to improve conceptual learning and use some computer-interfaced measuring equipment. Having the conceptual modern physics course serve both as preparation for quantum mechanics and as a course for non-science majors increased the enrolment from 3-8 annually to over 20.

College of the Rockies, Richard Hewko: Physics enrollment is up 40%, 2nd year up to 2-3 students taught as individual study courses. Richard to take a leave at Arizona State University to work on issue of math anxiety.

College of New Caledonia, David Rourke: There are no changes. Algebra and calculus-based introductory physics courses offered; enrollment is softer, decline due to graduates, 2nd year transfer Engineering mechanics course labeled 204 is really a first-year course.

Kwantlen University College, Don Mathewson, Tom McMath:
Effective in Fall 06 all of our lab science courses will be 4-credit courses instead of 5-credit courses. This brings credit transfer to the Universities into better alignment; there is no change in content or style of delivery.
New course: This Fall for the first time we will be offering Phys 1112 Pulp Physics (a critical and open discussion on impossible physics in pop culture). This is a science course for non-science students.
We are looking into the possibility of running a biophysics course Phys 3202 in the coming year. There is some continuing debate on the details of the course and what biology prerequisites there should be, but it must meet the needs of life-science students. It may also it in with the new BSc Psychology program (see below).
We have more Astronomy courses on the books than have been showing on the charts. ASTR 2101 and 2102 are second year 3-credit Science courses with Math and Physics prerequisites, matching UBC's ASTR 201 and 202 – no lab. These are meant to bolster our second year science programs in general. They have not been offered yet but are under active consideration. ASTR 3110 and 3111 are for non-science students in upper levels (similar to UBC's ASTR 310 and 311). 3110 has run, and will run again this Fall. Second year Physics courses continue on a guided study basis with very low numbers.
Enrollment: We saw a slight decline in Physics numbers this year, and at the same time, our Math enrollments were down overall by about 30%, and by about 40% in the pre-calculus algebra course; way more than can be explained by population demographics.
Of peripheral interest, Kwantlen's BAA in Psychology is being augmented by a parallel BSc version. Students will take standard science first and second year, with psychology options, and can get an ASc from it, with all parts corresponding to UBC's program. Third and fourth years would be essentially the same as the existing program.

Thompson Rivers University, Onkar Rajora: There are no changes; enrollment numbers are steady, 12 to 20 in 2nd year, 10 in upper years.

Coquitlam College, Janusz Chrzanowski: Coquitlam College offers only 1st - year Physics, which is quite popular. Despite general decline in enrollment numbers Physics is still ok (full classes).

Northwest Community College, Eric Turner: The Terrace campus is only offering a calculus based course while the Prince Rupert campus is only offering an algebra based course. Only 1st year courses are offered at NWCC with 10 to 18 students. Enrollment had dropped down but is picking up.

BCIT, Kevin Dunphy: In September 2005 BCIT started the *Degree Transfer Program in Science and Technology*, (DTST) starting with first year university transfer courses, these include physics, chemistry, mathematics and biology. The DTST program allows a

student to complete first year and second year courses that are require before entry into BCIT programs such as nuclear medicine, radiation therapy, etc. Additionally it allows student to preview BCIT and its programs. If BCIT's programs are not suitable to the student, then the student can transfer their acquired university credit to other colleges and universities.

Fifteen students entered the DTST program in September 2005, nine of which took calculus based Phys 1110 (text book *Physics fo r Scientists and Engineers* by *Giancolli)*. All students entering the physics course had a BCIT program as their desired destination. At the end of the first term two students were accepted into their programs of choice. Five students began the second term Phys 2100. One student dropped the course and four satisfactorily completed the course and applied to programs of their choice. None of the students entering Physics 2100 had intention of taking second year physics.

Selkirk College, Per Joensen: No significant changes. 2nd year is still running. 50 students in 1st year and 10 students in 2nd year. Second-year Modern Physics course in Fall and E & M course in Winter.

Douglas College, Jennifer Kirkey: no significant changes. Ran astronomy at the David Lam campus and it went great. The enrollment numbers are a concern, with astronomy 92% full and physics 70% full. May be growth due to Sports Science degree program. Engineering enrollment numbers are down to "20 ish".

North Island College, Helena Higgs: A significant enrollment decline, more so in Arts and Humanities than Physics or the other sciences.
1st year Physics has been re-introduced at the Port Alberni campus. NIC does not offer any 2nd year courses.
Space Science and Astronomy is a distance lab science course and it is very popular with students going into education.

UNBC, Regrets from Erik Jensen: Enrollment at UNBC in the Physics major and associated joint degrees with Math, (CPSC, CHEM) has been stable. We found that enrollment increased substantially last year in out 1st year Physics with Calculus courses (PHYS 110/111) so that we have had to add additional lab sections. This growth is driven by the popularity of the new Molecular Biology degree program at UNBC and by students doing a "pre-Med" program, which is probably due to the new Northern Medical Program that is beginning its second year at UNBC.

We are trying to deal with a large number of students who lack PHYS 12 (or equivalent) upon entry to UNBC, but who require it for their degree program. These students must take our PHYS-115 course in the Fall term, but are then "out of sequence" for the regular PHYS 100/101 or PHYS 110/111 streams, These students are then trying to fit in first year Physics in later years of their degrees. We are trying a pilot this year of offering PHYS 115 in the July/August term to get more students having the required prerequisites before the Fall term of their first year.

This past year we ran a pilot program in conjunction with the Learning Skills Centre, in which "Student Instructors" ran tutorial sessions for first year Physics classes. The SI is a student in 3rd or 4th year who attends the course lectures and then coordinates

tutorial sessions. So far we have found some success with the "lower level" first year Physics courses (PHYS 115, aka Phys-12 and Phys 100) but the program seemed less successful with the calculus based PHYS 110/111 stream.

UNBC Physics hired one new tenure-track Assistant Professor this past year- Dr. Matthew Reid is interested in both fundamental studies of Terahertz radiation as well as industrial application of THz radiation to non-invasive testing of materials, particularly wood products.

One of our Physics MSc graduates, Glen Goodvin, was awarded the UNBC Governor General's Gold Medal award this year, having been ranked as the top Graduate student to graduate this past year. He was the student of Dr. Mark Shegelski and Glen's thesis topic was on theoretical aspects of quantum mechanical tunneling for molecules. Glen is now doing PhD research at UBC.

Dr Ahmed Hussein, who retired from UNBC last year, will be recognized for his many contributions to UNBC and given Emeritus Professor status at the May 2006 convocation ceremony. Many of the members of the articulation committee will remember Ahmed from his long participation on the committee as the Chair of Physics at UNBC.

Item 7*: *Topics for additional discussion

A number of topics were proposed by committee members, with votes taken to choose order of discussion of topics. Among these were:

- level of 1st year courses and the issue of multiple streams of introductory courses; differentiation between algebra and calculus-based courses.
- math anxiety
- textbooks, what are they good for?
- electron flow direction or conventional current direction?
- high school/university transition problems
- optional provincial exam for Physics12

Item 8: Students transferring from college ABE courses to universities.

Suggested and introduced by Helena Higgs, North Island College

The discussion included the following issues:

- Universities require college ABE students to write provincial exams; there are problems with timing of provincial exams (i) relative to deadlines for application to universities (ii) June provincial exams for courses ending in April
- if a high school student does not meet the minimum grade for university entry, he/she is not allowed to upgrade with ABE courses.
- what are the academic performances of ABE students who then go into the regular university-transfer streams at colleges compared to qualified high school students? ABE course of 17 weeks expected to cover year's course at high school
- ABE courses vary greatly from college to college

- Should ABE Physics courses have to be taught by physicists?
- As number of relevant students is low and of varying backgrounds, allow students from ABE with questionable ability to register for UT courses and to be given the opportunity to pass or fail (with appropriate warnings).
- "prep" UT courses are not available at many colleges – ABE is the only option.
- Universities should show flexibility in considering students with ABE backgrounds and admit on an individual-consideration basis

Item 9*: *Discussion of topics chosen by the committee

(i) **Level and content of 1st year courses/multiple streams, etc**

The discussion included the following issues:

- amount of mechanics included in introductory calculus-based courses at various institutions. No mechanics is done in UBC Physics 101, based on assumption of students' previous knowledge/skills from high school Physics 12. Does this variation among institutions a transfer problem?
- Transfer to universities with only a calculus-based stream of courses of students from institutions offering both calculus-based and algebra-based streams.
- Increase of number of public universities to seven creates increased articulation problems for some colleges, especially smaller ones. More articulation on an individual basis may be in the future, rather than letting Registrar's offices make decisions based on formal policies.
- Colleges cannot offer a wide variety of 2nd-year courses to match the differing ones at the various universities. But universities do grant 3rd year exemptions for 2nd – year college courses, opening up slots in 3rd year for students to make up 2nd-year courses not taken at college.

(ii) **High school to university/college transition issues**

- Evidence reported that high school students are having increased problems with their transition to universities/colleges; increased attrition from university/college courses; poor study habits; students don't realize amount of time required for courses outside of class.
- More drill is used in high school than in post-secondary – should there be more of it in college and university? Students are not used to independence.
- Is it this is a societal and generational issue?
- some students don't seem to be aware of the consequences of having an F on their transcripts. Some high school students are used to being able to do extra work to pass the course if they are failing. TWU has a mandatory credit course "University 101" where these types of consequences are explained
- Techniques to motivate students having transition problems such as optional evaluation methods, e.g., passing the final exam guarantees pass of course, When should these options be publicized to students?
- Credit given for assignments, tutorials, etc can help students with the transition from high school to university.

- Randomly-timed quizzes motivate students to keep up-to-date.

(iii) **Textbooks, what are they good for?**

- Discussion of merits of various recently-adopted/considered books, such as Knight's *Physics for Scientists and Engineers* and Wolfson's *Essential University Physics*, a less-expensive and shorter textbook than the standard ones.

(iv) **Optional provincial exam for Physics 12**

- has there been a problem of "teaching to the exam", leading to insufficient emphasis on important content such as labs, or has it been "teaching to the curriculum"?
- Universities do not appear to require provincial exams to have been passed to legitimize results in courses with optional provincial exams. It was noted that before the optional policy was introduced by the provincial government, university early admissions have been based on Grade 11 results in courses which do not have final exams.

(v) **Electron flow direction or conventional current direction?**

- A brief discussion of this topic which is involved in teaching electric current/circuits.

Meeting was adjourned at 3:57 p.m.