

Physics and Astronomy Articulation Minutes May 7 2021. Chair: Jennifer Kirkey

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Attendance

Kelly Cheung	Alexander College	Kellycheung5@gmail.com
James Brewer	BCIT	James_Brewer@bcit.ca
Stephanie Ingraham	Camosun College	ingrahams@camosun.bc.ca
Lauren Moffatt	Capilano University	laurenmoffatt@capilanou.ca
Regan Sibbald	Coast Mountain College	rsibbald@coastmountaincollege.ca
Barbara Rudecki	College of New Caledonia	rudecki@cnc.bc.ca
Ben Tippett	College of the Rockies	Btippett@cotr.bc.ca
Vladan Jovovic	Columbia College	vjovovic@columbiacollege.ca
Janusz Chrzanowski	Coquitlam College	janusz@coquitlamcollege.com
Saeed Faraji	Coquitlam College	sfaraji@coquitlamcollege.com
Alain Prat	Corpus Christi College	aprat@corpuschristi.ca
Jennifer Kirkey	Douglas College	kirkeyj@douglascollege.ca
Will Gunton	Douglas College	guntonw@douglascollege.ca
Peter Smith	Fraser International College	smip@learning.fraseric.ca
Takashi Sato	Kwantlen Polytechnic University	Takashi.Sato@kpu.ca
Bradley Hughes	Langara College	bhughes@langara.ca
Nina De Castro	LaSalle College	NDeCastro@lasallecollegevancouver.com

Dennis Lightfoot	North Island College	Dennis.Lightfoot@nic.bc.ca
Lisa Verbisky	Northern Lights College	lverbisky@nlc.bc.ca
Morteza Ghadirian	Northern Lights college	mghadirian@nlc.bc.ca
Kevin Douglas	Okanagan College	kdouglas@okanagan.bc.ca
Jason Nickel	Selkirk College	jnickel@selkirk.ca
Eldon Emberly	Simon Fraser University	eemberly@sfu.ca
George Weremczuk	Thompson Rivers University	Gweremczuk@tru.ca
Arnold Sikemma	Trinity Western University	Arnold.Sikkema@twu.ca
Christina Haston	University of British Columbia-Okanagan	Christina.haston@ubc.ca
Tom Mattison	University of British Columbia-Vancouver	Mattison@physics.ubc.ca
Erik Korolenko	University Canada West	erik.korolenko@ucanwest.ca
Norm Taylor	University of the Fraser Valley	norm.taylor@ufv.ca
Peter Mulhern	University of the Fraser Valley	Peter.Mulhern@ufv.ca
Lin Long	University of the Fraser Valley	Lin.long@ufv.ca
George Jones	University of Northern British Columbia	George.jones@unbc.ca
Mark Laidlaw	University of Victoria	laidlaw@uvic.ca
Adyan Berikov	Vancouver Community College	aberikov@vcc.ca
Adyan Berikov	Vancouver Community College	aberikov@vcc.ca

Brian Chapell, Dean of Science and Technology, Douglas College - System Rep

Anna Tikana, BCCAT

Guests: Agnes d'Entremont, UBC

MINUTES

Physics and Astronomy Articulation Minutes May 7 2021 via Zoom Chair: Jennifer Kirkey, Douglas College

#1	930 Am	SLP (BCCAT System Liaison Person) report. Brian Chapell chapellb@douglascollege.ca began the meeting by respectfully acknowledging we are gathered today on First Nation's traditional unceded territory. Members were invited to acknowledge the territory where they were located during this Zoom meeting. He introduced himself as this is his first time as our official SLP. A brief SLP report followed. He thanked everyone for the good work they had done during the last trying year. Everyone is waiting to hear from the government about back to campus plans, but the SLPs have the same information as the rest of us. Province of BC -Return to Campus Primer – April 30 2021 can be accessed here: https://www2.gov.bc.ca/assets/gov/education/post-secondary-education/institution-resources-administration/return-to-campus-primer.pdf
#2	9:35 Am	Welcome and Introductions – people introduced themselves alphabetically by institution and showed off coffee mugs, water bottles, children, dogs and cats, favourite desk items, document cameras made out of Lego and lab stands, etc.
#3	10:00 Am	Approval of the Agenda (Moved: Brian Dick VIU, Seconded: Erik Korolenko, Passed unanimously)
#4	10:05 Am	Minutes were approved. (Moved: Will Gunton, Douglas College Seconded: Peter Mulhern, UFV, passed unanimously) 2020 minutes can be found at: https://www.bccat.ca/articulation/committees/phys-astr
#5	10:10 am	Courses in the system that are still waiting transfer were reviewed. Members were encouraged to deal with these pending articulations.

		DOUG PHYS1234, OU PHYS228 and PHYS240 were briefly described to help aid in this process.																																										
		<table> <tr> <th>Course</th><th>Pending</th><th>Expires</th></tr> <tr> <td>COTR PHYS 103</td><td>1: CAMO</td><td>Apr 7 2022</td></tr> <tr> <td>COTR PHYS 202</td><td>5: CAPU, KPU, SFU, UVIC, UBCO</td><td>Mar 24 2022</td></tr> <tr> <td>COTR PHYS 201</td><td>4: CAPU, KPU, UVIC, UBCO</td><td>Mar 24 2022</td></tr> <tr> <td>DOUGLAS PHYS 1234</td><td>14: BCIT, CAPU, EC, JIBC, KPU, VIU, NVIT, SELK, SFU, UBCO, ALEX, AU, QU, LCV</td><td>Jan 26 2022</td></tr> <tr> <td>OC PHYS 228</td><td>14: CAPU, CCC, FDU, JIBC, KPU, LCV, NVIT, NLC, QU, SELK, TWU, UNBC, VCC, VIU</td><td>Jun 18 2021</td></tr> <tr> <td>OC PHYS 240</td><td>12: CAPU, CCC, FDU, JIBC, LCV, NVIT, NLC, QU, SELK, TWU, VCC, VIU</td><td>Jun 18 2021</td></tr> <tr> <td>VCC PHYS 1170</td><td>1: UNBC</td><td>Jun 17 2021</td></tr> <tr> <td>VCC PHYS 1200</td><td>1: UVIC</td><td>Jun 16 2021</td></tr> <tr> <td>VCC PHYS 1100</td><td>1: UVIC</td><td>Jun 16 2021</td></tr> <tr> <td>TRU EPHY 1270</td><td>1: UVIC</td><td>May 29 2021</td></tr> <tr> <td>TRU EPHY 1170</td><td>1: UVIC</td><td>May 29 2021</td></tr> <tr> <td>AU ASTR 310</td><td>5: CAPU, KPU, SFU, UNBC, UBCO</td><td>Mar 18 2022</td></tr> <tr> <td>AU ASTR 205</td><td>7: KPU, VIU, SFU, UBCV, UNBC, UVIC, UBCO</td><td>Mar 18 2022</td></tr> </table>	Course	Pending	Expires	COTR PHYS 103	1: CAMO	Apr 7 2022	COTR PHYS 202	5: CAPU, KPU, SFU, UVIC, UBCO	Mar 24 2022	COTR PHYS 201	4: CAPU, KPU, UVIC, UBCO	Mar 24 2022	DOUGLAS PHYS 1234	14: BCIT, CAPU, EC, JIBC, KPU, VIU, NVIT, SELK, SFU, UBCO, ALEX, AU, QU, LCV	Jan 26 2022	OC PHYS 228	14: CAPU, CCC, FDU, JIBC, KPU, LCV, NVIT, NLC, QU, SELK, TWU, UNBC, VCC, VIU	Jun 18 2021	OC PHYS 240	12: CAPU, CCC, FDU, JIBC, LCV, NVIT, NLC, QU, SELK, TWU, VCC, VIU	Jun 18 2021	VCC PHYS 1170	1: UNBC	Jun 17 2021	VCC PHYS 1200	1: UVIC	Jun 16 2021	VCC PHYS 1100	1: UVIC	Jun 16 2021	TRU EPHY 1270	1: UVIC	May 29 2021	TRU EPHY 1170	1: UVIC	May 29 2021	AU ASTR 310	5: CAPU, KPU, SFU, UNBC, UBCO	Mar 18 2022	AU ASTR 205	7: KPU, VIU, SFU, UBCV, UNBC, UVIC, UBCO	Mar 18 2022
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#6	10:10 am	<p>BCCAT update by Anna Tikana, atikina@bccat.ca. https://www.bccat.ca/articulation/resources is where you can find information about how Articulation Committee work and the Terms of Reference under which we operate. She highlighted items from the BCCAT Spotlight May Newsletter Bigger BC Transfer Guide https://www.bccat.ca/spotlight/BiggerBCTransferGuide as there are now many international articulations. The Spring Update can be found at: https://www.bccat.ca/articulation/announcements/2021SpringUpdate</p>																																										
#7	10:15 am	<p>Institutional reports. Highlights or additions to the written reports. One or two positive take-aways from the COVID year (i.e. something implemented specifically to address the COVID pandemic that you would continue to use post-COVID). Reports</p>																																										

		start on page 6 of this package and each institution can be found in the table of contents
#8	10:45	10:45 am – 11:00 am break time.
#9	11:00	Institutional reports (continued)
#10	12:00	<p>Engineering Common Core Curriculum update-Brian Dick, VIU with emphasis on the PHYS I II and III. BCcampus has one a review of open textbooks to match the curriculum and that report can be found at: https://pressbooks.bccampus.ca/engineeroer/</p> <p>As stated on the cover of the book “This guide was developed for first-year engineering programs in BC Post-secondary institutions. It contains a list of available open educational resources (OER) and free resources that could be used in first-year engineering courses found in the common core curriculum. All resource reviews were completed by BC faculty who teach or have taught courses in first-year engineering”. The one missing OER is for PHYSIII mechanics. This was an introduction to the next item on the agenda an update of a project that Jennifer Kirkey from Douglas College and Agnes d’Entremont from Mechanical Engineering at UBC have been working on in these Covid-19 times.</p>
#11	11:40	<p>WeBWorK questions for PHYSIII in the Common Core. PHYSIII = PHYS170 at UBC-V. Agnes d’Entremont agnes.dentremont@mech.ubc.ca has been working on making questions to replace Mastering Physics for second- and first-year physics for the last five years. A year ago BCcampus increased the funding so that more students and a graphic artist could be hired. There are currently about 400 problems and 1000 multiple choice questions available as an open resources. She also reviewed the other physics problems available in the OPL = Open Problem Library, an international library, that includes all of Open Stax College Physics and some from Open Stax University Physics. After this summer there will be hundreds more in the OPL after a “Code Camp”. BC faculty were encouraged to become part of this project. Send us your hand written worked out problem solutions and we will get them coded. Textbook sprints will be held soon. Committee members were encouraged to attend the optional workshop today at 130 pm or next Wednesday, hosted by</p>

		Engineering Articulation, to leave how to access these resources and start coding your own.
#12	12:00 pm	<p>Equity, Diversity and Inclusion in Physics and Astronomy. A report from Langara College. Mayra Tovar mtovar@langara.ca Langara College talked about the being an Equity, Diversity & Inclusion coordinator. This position at Langara has a 1/3 release time and it is to investigate and improve how the department provides a welcoming environment for those groups of people that have traditionally been underrepresented in physics & astronomy. Can there be collaboration between institutions on this topic. Bradley Hughes from Langara mentioned how it has had a positive effect on the whole department and encouraged others to do the same. Our institutions need to put money, time release towards this. As has been said “Don't tell me what you value, show me your budget, and I'll tell you what you value.” A simple thing is to have posters in the lab and office showing diverse scientists. Mayra asked for suggestions for such types of resources. We were all encouraged to think about how we can make our classrooms more welcoming.</p> <p>The Perimeter Institute was one that was mentioned. You can access them here: https://resources.perimeterinstitute.ca/collections/posters</p> <p>The Government of Canada has some great EDI resources that can be accessed at https://www.nserc-crsng.gc.ca/NSERC-CRSNG/EDI-EDI/Dimensions_Dimensions_eng.asp</p> <p>AAPT = American Physical Society has the STEPUP program. Sarah Johnson from SFU sarah_johnson@sfu.ca has run workshops on this and will gladly talk with anyone about it. Access them at: https://www.aps.org/programs/education/su4w/index.cfm</p> <p>Indigenizing the curriculum was mentioned. BCCampus has some resources: “There is no endpoint for equity, diversity, and inclusion work, nor for other avenues of inclusion, such as decolonization or Universal Design for Learning. They're all aspects and perspectives that must become part of the fabric of the</p>

		<p>post-secondary system.” —Mary Burgess, executive director, BCcampus https://bccampus.ca/projects/indigenization/indigenization-guides/ BIPOC (Black, Indigenous, People of Colour) was defined. https://www.nytimes.com/article/what-is-bipoc.html</p> <p>The Canadian Black Scientists Network https://www.blackscientists.ca/</p> <p>Ingenium is the brand name for three museums — the Canada Agriculture and Food Museum, Canada Aviation and Space Museum and the Canada Science and Technology Museum https://ingeniumcanada.org/channel/articles/honouring-black-canadians-in-science-and-technology</p>
#13	12:10 pm	<p>There was Discussion of closure of physics department at Laurentian University in Ontario. For more information see the link from the Canadian Association of Physicists at https://www.cap.ca/publications/cap-news/closure-of-physics-programs-at-laurentian-university/ The big concern after the fact that the Physics Department was eliminated is the political concern about how it was done. It was done under what is often called the Bankruptcy Act. “The Canadian Association of Physicists (CAP) strongly objects to the recently announced closures of academic programs at Laurentian University, particularly the closure of the physics programs. We stand in solidarity with CAP members and all faculty, students and staff at Laurentian, and we call for the Companies’ Creditors Arrangements Act (CCAA) closure decisions to be overturned.”</p>
#14	12:25 pm	<p>Discussion of location for Friday May 6 2022 meeting. The majority voted to NOT making a decision at this meeting. The chair committed to polling the committee in September or October once things were clearer. If we choose to meet in person and out of town, Regan Sibbald from Coast Mountain College in Terrace will be happy to host us. Many flights still in and out of Terrace right now so airplane flights will not be an issue.</p>
#15	12:30 Pm	<p>Chair election – I will do this for two more years but Chair Election will be a standing item on the agenda. No one else brought their</p>

		name forward so Jennifer Kirkey acclaimed as chair for one more year.
#16	12:35	Adjournment
	1:30 pm	<p>Optional Workshop : Using and developing problem for WeBWork</p> <p>This novice-friendly hands-on workshop covered the key knowledge needed to start using and developing problems for WeBWork. WeBWork is an open online homework system which was developed for math and is increasingly being used for other subjects (engineering, physics, economics, etc.). The workshop will include finding existing problems, modifying code to create new problems, adding images, and uploading files to a WeBWork course. No specific coding expertise is required. We will be using UBC's WeBWork instance for the hands-on portion. If you have a UBC Campus-Wide Login (CWL), please provide your CWL username. If you do not have a CWL, let her know and access will be arranged.</p> <p>Agnes d'Entremont Ph.D., P.Eng. (<u>She/Her/Hers</u>) <u>adentremont@mech.ubc.ca</u> Associate Professor of Teaching, Faculty of Applied Science Department of Mechanical Engineering, The University of British Columbia Vancouver Campus Musqueam Traditional Territory Phone 604 827 1960 Cell 604 739 0029 , http://mech.ubc.ca/agnes-dentremont/</p> <p>Note: 7 faculty attended this workshop. Reach out to Agnes if you want more information about WeBWork and this project.</p>

3-BCCAT Spotlight May Newsletter Bigger BC Transfer Guide

<https://www.bccat.ca/spotlight/BiggerBCTransferGuide>

4-BCCAT – Spring Update

<https://www.bccat.ca/articulation/announcements/2021SpringUpdate>

5-Province of BC -Return to Campus Primer – April 30 2021

<https://www2.gov.bc.ca/assets/gov/education/post-secondary-education/institution-resources-administration/return-to-campus-primer.pdf>

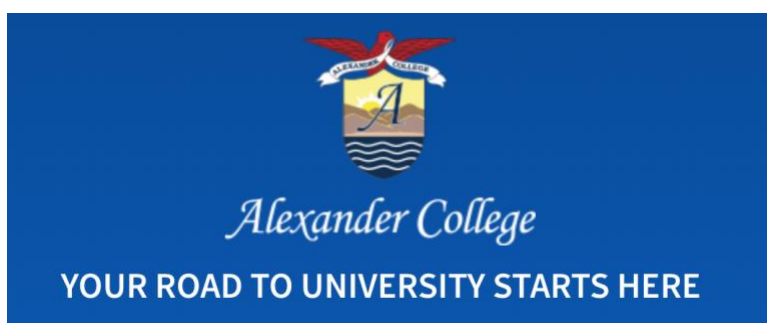
Upcoming events: Canadian Association of Physicists June 2021 Congress
<https://www.cap.ca/congress-conference/2021-cap-virtual-congress-june-6-11/2021-registration-fees/>

Institutional Reports

Alexander College

Kelly Cheung	Alexander College	Kellycheung5@gmail.com
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Information added at the meeting



Alexander College Physics Articulation Report: May 2021

Alexander College is a small private college that focuses primarily on foreign students who cannot get into the regular Provincial universities due to a lack of language and cultural skills. We offer about 100 different courses on two campuses, one in Burnaby near Metrotown and the other in Downtown Vancouver opposite SFU Harbour Centre.

Our general aim is to offer students a palette of first- and second-year courses along with intensive language training and small classes, where a large amount of personal attention is possible. The courses are designed to be at the academic standards of the corresponding introductory courses at SFU, UBC and UVic and, thus, to provide transferable credits to students who wish to gain entry to those institutions. We presently offer two-year Associate degrees in Arts and Science, all of which include laboratory science requirements.

The lecture components of our classes can have up to 35 students, and our in-person physics labs hold a maximum of 18 students. We strive to give students the opportunity to work with the concepts actively in class through interactions with the instructor and students. Typically, between 40% and 50% of the students registered in physics courses receive A or B grades.

All Alexander College courses have been running online since March 16, 2020 due to COVID-19. Instructors have been teaching through synchronous Zoom video conferencing and virtual physics labs using PhET. We considered having students complete labs using iOlab devices, but because some of our students are currently not in BC, it was determined that this is not currently feasible. We hope to be able to return to campus in the Fall and run labs on campus.

For major exams in physics during the pandemic, students are shown questions on Zoom and asked to solve them on paper. Students are then asked to take pictures and submit their solutions after a certain time(s). During the exam, student's workspace, face, and hands must be visible. To ensure academic integrity, students are also required to complete 10-minute oral exams with the instructor where students are asked questions relating to course concepts and how to approach and solve problems.

Physics courses offered the past year:

Physics 100: Introduction to Physics (150 students over last 3 terms)

A one-semester preparatory course for students lacking physics background at the BC 12 level.

(Text: Urone and Hinrichs, College Physics)

Physics 141-142: Engineering Physics I and II

I: Mechanics and Modern Physics (12 students over the last 3 terms)

II: Electricity and Magnetism, Optics (3 students over the last 3 terms)

Two sequential one-semester calculus-based introductory physics courses designed for science and engineering students.

(Text: Knight, Physics for Scientists and Engineers)

Physics 151-152-153: Our 3-course Engineering sequence

151: Mechanics for Engineers (16 students over the last 3 terms)

(Text: Hibbeler, Engineering Mechanics: Static and Dynamics)

152: Oscillations and Waves, Fluids, Heat, and Thermodynamics (14 students over the last 3 terms)

153: Electricity and Magnetism, Circuits, and Radiation (5 students over the last 3 terms)

(Text: Knight, Physics for Scientists and Engineers)

Physics 191: Introduction to Astronomy (90 students over the last 3 terms)

(Text: Franknoi, Morrison, and Wolff, Astronomy)

BCIT British Columbia Institute of Technology

James Brewer	BCIT	James_Brewer@bcit.ca
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Information added at the meeting: James had a song playlist for his astronomy classes and that worked well. There are many songs featuring the Moon. He plans to continue this in the fall. See the end of this report for that list. He found that using polling worked very well in his online classes.

James has started a MOOC = Massive Open Online Course on Metrology.
<https://www.bcit.ca/free-online-learning/mooc-0371-metrology-the-science-of-measurement/>



Articulation Report, May 2021

The BCIT Physics Department has 11 full time faculty members, 3 technicians, and teaches around 1000 students in 17 different technologies.

Like everyone else, we moved fully online after Spring break (March 2020). My impression is that most faculty and students are looking forward to the fall when (hopefully) classes will resume on campus.

The Medical radiography program is under review, and it looks likely that we will lose a couple of course that our department taught for them.

I am attaching our internal transfer guide and would appreciate it if readers would let me know of any errors or missing information in regard to their institutes.

James Brewer (jbrewer@bcit.ca)

BCIT Physics, Course Credit Transfer Guide

- See Table 4 for Grade 11/12 equivalencies.
- For BCIT programs with a Physics 11 or Physics 12 prerequisite, an equal grade in any single post-secondary “general” physics course will be considered as equivalent. A Physics 12/C is considered equivalent to Physics 11/C+. Recency requirement as in Table 1, Footnote 1.
- Only transfer credits for the current term will be considered.
- Find your BCIT physics course in Table 1, if in section B look in Table 2 for BC equivalents, if in section C, look in Table 3 for BC equivalents. Courses that are not listed in this guide will be considered on an individual basis.
- Comments/questions? Please contact James Brewer (jbrewer@bcit.ca).

Table 1: BCIT Physics Courses.

A: Credit granted only with instructor consent		
Technology	Courses	
Biomedical Engineering	1178 ¹	
Diagnostic Medical Sonography	1073, 2073, 3073	
Electro Neurophysiology	1280, 2280	
Food Technology	2112	
Medical Radiography	1276, 2276	
Nuclear Medicine	1274, 2274, 3274, 4274	
Radiation Therapy	5103	
Technology Entry	0311 ² , 0312	
B: Credit granted with a “General” post-secondary (PS) course (see Table 2) ³		
Technology	Term 1	Term 2
Architectural and Building Engineering	1140	2148 ⁴
Chemical and Environmental Technology	1181	2181
Electrical and Computer Engineering	1143	2143
Geomatics	1151	2151
Mechanical Engineering	N/A	2149
Mining and Mineral Exploration	1147	2147
Occupational Health and Safety	1288	2288
Mechatronics and Robotics	1164	2164
C: Credit granted with a calculus-based post-secondary (PS) course (see Table 3) ³		
Technology	Term 1	Term 2
Civil Engineering	1192	2192

Table 1 Footnotes:

- (1) Students must have covered optics and waves.
- (2) An exemption will be considered for students who have taken PHYS 0309.
- (3) Recency requirement: Course(s) taken within last 5 years (exceptions will be considered).

- (4) PHYS 2148 has insufficient course credits to be used in place of other Term 2 courses.

Table 2: BC Equivalents for Courses in Table 1, Section B.

Institute	Term 1 Equivalent General PS Course	Term 2 Equivalent General PS Course	Minimum Grade
BCIT	1301, Table 1: Term 1 Courses in B&C	2301, Table 1: Term 2 Courses in B&C, except 2148	P/50%
Alexander College	141	142	C+/67%
Camosun College	104, 114, 140	105, 115, (140&141)	C+/67%
Capilano University	110, 114	111, 115	C+/67%
College of New Caledonia	101, 105	102, 106	C+/67%
College of the Rockies	103	104	C+/67%
Columbia College	110	120	C+/67%
Coquitlam College	101	102	C+/67%
Douglas College	1107, 1110	1207, 1210	C+/67%
Fraser Intl. College	See SFU	See SFU	
Kwantlen P. University	1101, 1120, 1170	1102, 1220	C+/67%
Langara College	1101, 1125, (1219&2309)	1225	C+/67%
North Island College	100, 120	101, 121	C+/67%
Northern Lights College	103	104	C+/67%
Coast Mtn. College	101, 121	102, 122	C+/67%
Okanagan College	111, 112	121, 122	C+/67%
Selkirk College	102, 104	103, 105	C+/67%
SFU (before 2016)	(101&130), (120&131), 140	(102&130), (121&131), 141	C+/67%
SFU (2016 onward)	(101&132), (120&132), (125&132), 140	(102&133), (121&133), (126&133), 141	C+/67%
Thompson Rivers Uni.	1100, 1150	1200, 1250	C+/67%
TRU: Open Learning	(1103&1105)	(1203&1205)	C+/67%
Trinity Western Uni.	111	112	C+/67%
UBC, Vancouver	(107&109), (117&119), (170&119)	(108&109), (118&119), (158&159)	C+/67%
UBC, Okanagan	111, 112	121, 122	C+/67%
Uni. of Fraser Valley	101, 111	105, 112	C+/67%
Uni. of Northern BC	100, 110	101, 111	C+/67%
Uni. of Victoria	102 ¹ , 102a, 110, 120	102 ¹ , 102b, 216	C+/67%
Van. Comm. College	1100	1200	C+/67%
Van. Island University	111, 121	112, 122	C+/67%
Yukon College	101	102	C+/67%

Table 2 Notes:

- Students must apply for course credit and each application is subject to Institute approval.
- When both a letter grade and a % grade are given, the more favourable grade will be considered.

- Notation: (x&y) means courses x and y are both required, while x, y means either course x or course y is required.
- Grade 11/12 physics is insufficient for courses requiring a “general” post-secondary course.

Table 2 Footnotes:

- (1) As of 2018, this course was split into 102a and 102b.

Table 3: BC Equivalents for Courses in Table 1, Section C.

Institute	PHYS 1192: Equivalent Calculus PS Course	PHYS 2192: Equivalent Calculus PS Course	Minimum Grade
Capilano University	114, See Footnote 1	(115&116), See Footnote 1	C+/67%
Douglas College	1110	(1110&1210)	C+/67%
Kwantlen P. University	1120	See Footnote 2	C+/67%
Langara College	1125	(1125&1225)	C+/67%
North Island College	120	(120&121)	C+/67%
Simon Fraser University	(120&Lab) ³ , 140	See Footnote 4	C+/67%
Thompson Rivers Uni.	PHYS 1150, EPHY 1150	See Footnote 5	C+/67%
UBC (Pre-2018)	(153&170)	(153&170)	C+/67%
UBC (2018 onward)	TBD	(157&158&159)	C+/67%
Uni. of Fraser Valley	111	(111&112)	C+/67%
Uni. of Northern BC	TBD	111, See Footnote 6	C+/67%
Uni. of Victoria (Pre-2019)	102	102	C+/67%
Uni. of Victoria (2019 on)	110, 120	See Footnote 7	C+/67%
Van. Community College	1100	(1100&1200)	C+/67%

Table 3 Notes:

- Students must apply for course credit and each application is subject to Institute approval.
- When both a letter grade and a % grade are given, the more favourable grade will be considered.
- Notation: (x&y) means courses x and y are both required, while x, y means either course x or course y is required.
- PHYS 1192 covers kinematics, dynamics, equilibrium, stress, strain, work and energy, conservation of energy, linear momentum and collisions, rotational motion, and simple machines.
- PHYS 2192 covers fluids at rest and in motion, viscosity, calorimetry, thermal expansion and stresses, simple and damped harmonic motion, standing waves, resonance, electric field and potential, DC circuits, magnetism, induction, and AC circuits
- Fluids and heat are treated differently in chemistry courses, and these courses cannot be used for transfer credits.

Table 3 Footnotes:

- (1) Capilano PHYS 110 and PHYS 111 are insufficient.
- (2) Kwantlen PHYS 1220 has an insufficient overlap with PHYS 2192.
- (3) SFU Phys 120 has no lab, need 131 or 132, or other lab course.
- (4) SFU PHYS 121 has an insufficient overlap with PHYS 2192.
- (5) TRU PHYS 1250 and EPHY 1250 will be considered on a case-by-case basis (no fluid dynamics).
- (6) UNBC PHYS 111 covers fluids and heat (not stated on web description).
- (7) Uvic 111 and 130 have insufficient overlap with PHYS 2192.

Table 4: Physics 11/12 Equivalencies.

- For BCIT programs with a Physics 11 or Physics 12 prerequisite, an equal grade in any single post-secondary “general” physics course will be considered as equivalent. A Physics 12/C is considered equivalent to Physics 11/C+. Recency requirement: as given by program area.
- Add info from **internal notes** to this table!

Institute	Equivalent Grade 11 Course	Equivalent Grade 12 Course	Minimum Grade
BCIT	0309, 0311	0312	Check w/BCIT Program
Okanagan College			[as above]
New West Online Learning ¹			[as above]
Vancouver Learning Network ¹			[as above]

Table 4 Footnotes:

(1) Available via correspondence

BCIT Music list for Astronomy course

James Brewer

BCIT

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Here is the playlist James uses in his astronomy courses at BCIT.

Any other suggestions?

Song, Artist, Album

Space Oddity, David Bowie, Legacy

Blue Moon, Many Voices Speak, Blue Moon

Moonlight Shadow (remastered 2013), Mike Oldfield, Crisis (Super Deluxe Version)

The Killing Moon (featuring Melanie Pain), Nouvelle Vague, Banda à Part

Major Tom, Peter Schilling, Major Tom

Across the Universe (Take 2), The Beatles, Anthology Box Set

Laika, Moxy Fruvous, Bargainville

Laika, Sticky Fingers, Caress Your Soul

It's Not, Aimee Mann, Lost in Space

Moon River (single version), Andy Williams, The Graduate

Frozen Star, Kevin MacLeod, Wonders

Rocket Man (I think it is going to be a long long time), Elton John, Diamonds
 Fly Me to the Moon (with Count Basie and His Orchestra), Frank Sinatra, It Might as Well be
 Swing
 Venus, Air, Talkie Walkie
 Satellite of Love (Remastered), Lou Reed, Pure.. Singer Songwriters
 Bohemian Rhapsody Queen, Greatest Hits
 Kelly Watch the Stars, Air, Moon Safari
 Celestial Voives, Think Floyd, A Tribute to Pink Floyd – Live at Pomeji
 Duncan, Paul Simon, The Essential Paul Simon
 Planet Earth (single version), Duran Duran, KCC's Awesome Hits
 Reason or Rhyme, Bryan Ferry, Bitter-Sweet
 My Moon My Man (Boys Noize Remix), Feist, My Moon My Man – EP
 Drops of Jupiter (Tell Me), Train, Drops of Jupiter
 Life on Mars?, David Bowie, iSelect
 Brain Damage, Pink Floyd, The Dark Side of the Moon
 City of Stars, Gavin James, City of Stars – Single
 Sundance, Kitaro, The light of the Spirit
 New Star in the Sky, Air, Moon Safari
 Starman (2012 Remastered Version), David Bowie, The Rise and Fall of Ziggy Stardust and the
 Spiders from Mars

The Galaxy Song, Monty Python, Monty Python's The Meaning of Life

<https://youtu.be/buqtdpuZxvk>

This is the official Monty Python YouTube channel

More from Jennifer Kirkey

Diane Nalini "Kiss Me Like That" album featuring songs about astronomy, including six original
 ones with "Kiss Me Like That" being the most popular from the album. She is a physicist and
 Canadian as well as being a jazz singer.

<https://www.dianenalini.com/project/kiss-me-like-that/>

Here is a link to her TEDx talk about these Songs from Outer Space

<https://youtu.be/a3o2kGFU8iI>

Kiss Me Like That starts at 11:30 into this 17 minute talk.

Big Bang Theory Theme Song, Bare Naked Ladies

Big Bang Theory Theme Song performed with members of the cast

From the Bare Naked Ladies official YouTube channel

<https://youtu.be/TzhIfN4UQv8>

Camosun College

Stephanie Ingraham	Camosun College	ingrahams@camosun.bc.ca
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Information added at the meeting: All labs were online the past year.



Camosun College Department of Physics and Astronomy Articulation Report - May 2021

The Department of Physics and Astronomy at Camosun College is located in Greater Victoria on the traditional territories of the Lekwungen and W̱SÁNEĆ people. Our department consists of 7 continuing faculty, 1 technician, and 1 sessional instructor. Between our two campuses, Lansdowne and Interurban, Physics courses are offered for academic upgrading, university transfer, and various diploma programs. Our courses include:

PHYS 070- a 0-level ABE Physics 11 course that is tuition free for domestic students

PHYS 101- a college prep Physics course which can also serve as a pre-requisite in lieu of Physics 11

PHYS 104/105- Parts 1 and 2 of first year algebra-based Physics

PHYS 140/141- Parts 1 and 2 of first year calculus-based Physics

ASTR 101- Astronomy- Night sky, solar system and planets

ASTR 102- Astronomy- Stars and Galaxies

Along with reserved sections of PHYS 101 and 104, the following courses are restricted to students in Engineering programs at the Interurban campus:

PHYS 157- A first year Physics course focused on topics relevant to electronics and computer engineering students

PHYS 210- Electricity and Magnetism

PHYS 272- Energy and Sustainability

PHYS 295- A Physics course for Engineering Bridge students focused on Waves, Optics, Electricity and Magnetism

Service courses for other career programs include:

PHYS 160- Biomechanics- A service course for PISE (Pacific Institute for Sport Excellence)

AHLT 165- Physics for Medical Imaging and Radiation Therapy. This course services the Medical Radiography program.

Enrollment this year was varied compared to previous years. In general, we experienced increases in our upgrading or lower-level Physics courses, and decreases in the program courses. This was our second year running PHYS 070 and we were glad to see an improvement in enrollment. We were able to add an extra section for the Winter term. More students seemed to prefer the 0-level course opposed to the alternate option, 100-level PHYS 101. The increase in popularity of PHYS 070 may be due to the accessibility of online learning, so we will monitor the trend in future years. We are working on the development of a 0-level ABE Physics 12 course that would allow for a tuition free option for students wanting to upgrade Physics 12.

Over the past few years, we have seen a steady increase in the interest in PHYS 104. It is often used as an entry requirement to college programs such as Medical Radiography and Engineering Transfer. This was our first year launching revised versions of PHYS 104 and 105 with curricula that align directly with UVic's PHYS 102a and 102b courses. This is also our second year of offering a hybrid PHYS 104 and Physics 12 in local high schools through the South Island Partnership program.

Our engineering program courses showed a lower enrollment than previous years and thus 2 lab sections were cancelled as well as our Summer offering of Phys 141. Astronomy courses (ASTR 101/102) continue to attract students in large numbers and we have maintained offerings of 3 sections per semester. This year we noticed a greater interest in ASTR 101 compared to 102, so offered more sections of 101.

This Summer we are running 3 courses: PHYS 101, PHYS 104, and PHYS 105, which will remain online. Summer enrollment is higher than previous years and we are hopeful that this will continue into the Fall with increased domestic student enrollment and a return to campus for many international students.

The second-year courses at our Lansdowne campus (PHYS 200, 210, 214, and 215) remain closed since 2010, though we are interested in reopening the courses in the future. Additional sections of PHYS 140 and 141 planned for students in the Civil Engineering Bridge to UVic have been put on indefinite hold along with the rest of that program.

Over the past year, all of our Physics courses were offered entirely online. The labs were delivered in a variety of formats including exercises focused on rigorous data analysis with video introductions, lab data supplied to students, online simulations, and at home labs with household equipment. Lectures were also delivered in different formats depending on the instructor with some using recorded videos and others preferring live sessions. Generally, we opted towards more frequent testing with reduced weighting on large assessments. We struggled, along with other departments at the college, in dealing with multiple cases of academic dishonesty.

For our first year Physics courses, we continue to use Physics- Principles with Applications by Giancoli for the algebra-based courses and Physics for Scientists and Engineers by Knight for calculus-based courses. There were no changes in textbooks used this year, other than Astronomy switching to OpenStax. Due to reduced service in the college bookstore and to increase accessibility for students, many of us chose to list textbooks as optional, opposed to required, and to supplement with our own notes.

Following the provincial directives, the college has announced a return to primarily face-to-face instruction for the Fall term. We are still working on what that will look like, but are scheduling courses as face-to-face, and are optimistic for a full return in September!

Stephanie Ingraham
Department of Physics & Astronomy
Camosun College

Capilano University

Lauren Moffatt	Capilano University	laurenmoffatt@capilanou.ca
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Information added at the meeting: One thing that will likely be kept after classes return to face-to-face is partially flipped classrooms. Interested in the WeBWork project for a homework system.



Capilano University Articulation Report - May 2021

Covid-19 Modifications to Course Delivery:

- Labs – We modified our labs so that they were split as 50% “at home” experiments, and 50% in-person on-campus labs. In order to do this, we limited our lab maximums to 14 students. This allowed students to alternate in-person/at-home labs and only having 7 students in the lab at any given time. At-home experiments utilized equipment borrowed from the department, or equipment that students already owned or could access for free from home (such as free sensor apps on smartphones).
- Lectures – All lectures were synchronous and hosted online via Zoom/MS Teams alongside content delivered on Moodle. Exact delivery method (live lectures, recorded video, partially flipped classrooms) was at instructor discretion. Lecture capacity was capped at ~28 for all lab-based classes to maintain the ability to host in-person labs.
- Exams – Exams were hosted online with the exception of the final exams for Phys 114, Phys 115, Phys 116 which were held in-person on campus. These were either held in the CapU Sportsplex (~30 students in a single gymnasium separated by 5 m distances) or across multiple classrooms.
- Online Homework – We have changed from subscription-based services (Sapling/Mastering) to in-house developed homework on Moodle. This

will be an ongoing development project. This is a challenge and she is interested in the WeBWork project.

Registration numbers were down for all courses, partially due the capping of class maximums (down from 35 – 28), but also due to low enrolment of our engineering transfer and transition programs. Low engineering enrolment numbers are being investigated.

For 2021-2022, we will be able to offer a similar course offering as 2020-2021 with a few modifications. The changes are summarized in the table below:

	2020	2021		2021	2022
	Fall	Spring		Fall	Spring
Astr 106	1	1		1	1
Astr 142	1	1		1	0
Astr 300	0	0		0	1
Phys 104	2	2		2	2
Phys 112	0	0		1	0
Phys 113	0	1		0	1
Phys 114	2	1		1	1
Phys 115	1	1		1	1
Phys 116	1	1		1	1
Phys 203	0	0		0	1

We have introduced a new Astronomy course, “ASTR 300: The Search for Life in the Universe”. This course is designed as an elective for non-science students and is being co-taught with a faculty member from the Biology department.

There are also two additional courses, PHYS 112, and PHYS 113, which are standard first-year physics courses designed for Life Sciences students. We will now be offering these courses alongside Phys 114/115 for all non-engineering students. The first offering of Phys 113 was this most recent semester (Spring 2021) and had decent enrolment considering that it was offered ‘last-minute’ as a replacement for one section of Phys 114.

Capilano University is currently in the process of developing new degrees. Firstly, the Bachelor of Science General was approved and will be offered soon. Additionally, the following degrees/majors are awaiting Stage I approval from the ministry:

- Bachelor of Science with a Major in Life Sciences

- Bachelor of Science with a Major in Applied Clean Technology.

Our department has been working primarily on the Applied Clean Technology major (alongside the Chemistry department), as a result we have been developing several 300 and 400 level physics courses to populate these majors. A 300 level Environmental Physics lab and 300 level thermodynamics course have been added already. In current development are a 400 level Environmental Physics Lab, a 300 level Remote Sensing course, and a 300 level Scientific Modelling course.

Coast Mountain College

Regan Sibbald	Coast Mountain College	rsibbald@coastmountaincollege.ca
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Information added at the meeting: Next year, some sections will be online and some will be blended. The online office hours worked so well that they will be continued next year even when things are back to face-to-face. The use of post exam interviews was one way that cheating was discouraged.



Coast Mountain College - Physics Articulation Report 2021

Coast Mountain College (CMTN) serves the rich and diverse communities and learners of BC's beautiful northwest region including Terrace, Kitimat, Smithers, Prince Rupert, and Haida Gwaii. In Prince Rupert and Terrace there were 19 students in physics.

We continue to run algebra-based physics 101/102 (introduction to physics) in Prince Rupert and in Terrace, and one section of calculus-based physics 121/122 (advanced physics) in Terrace which will have the lecture video-conferenced to Prince Rupert with face-to-face lab sections in both campuses. At both campuses the maximum permitted in our labs is 18. Both courses have 3 hours of lecture and 3 hours of lab each week for fourteen weeks and then one week for final exams in each term (Fall and Winter). Most of our advanced physics students continue in an engineering program at another institution, however this year we also have students moving on to chemistry and computer science degrees at other institutions, and our ACE (Applied Coastal Ecology) program in Prince Rupert.

There will be no change in curriculum to the existing courses and we will be reviving phys 135 – Engineering Mechanics I this spring to offer next Winter (2022), We will be using OpenStax textbooks this year for Phys

101/102/121/122, and Hibbler, Statics and Dynamics, for phys 135. Our newly designed Physical Sciences Program (one-year certificate) is now separate from the Engineering program and is outlined in the next page.

Our labs are being renovated and a new project room (design lab) is being created with normal physics instrumentation, a 3D printer, a 3D imager, and tools. We have a CNC plasma cutter available for use in cooperation with our trades department, ALCAN has donated a robotic arm for our ENGR program, and we have a new 3d virtual learning environment.

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Term	Course #	Course Name	Intended Degree					Hrs	Credits
			Phys	Chem	Computer Science	Earth Science	Math		
Fall	CHEM 111	Fundamentals of Chemistry I	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		90	3.0
Fall	CPSC 123	Computer Programming	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	90	3.0
Fall	ENGL 101	University Writing	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	45	3.0
Fall	MATH 101	Calculus I: Differential Calculus	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	67.5	3.0
Fall	PHYS 121	Advanced Physics I	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> or PHYS 101	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	90	3.0
Winter	CHEM 122	Principles of Chemistry II	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		90	3.0
Winter	CPSC 124	Data Structures			<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	90	3.0
Winter	ENGL 151	Technical Writing I	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	45	3.0
Winter	MATH 102	Calculus II: Integral Calculus	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	67.5	3.0
Winter	PHYS 122	Advanced Physics II	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> or PHYS 102	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	90	3.0
Winter	MATH 235	Linear Algebra	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> or elective*	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	45	3.0
Any	Elective			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> **	<input checked="" type="checkbox"/>	45 or more	3.0 or more
		Total Credits	30	30	30	30	30		
		Total Hours (depends on elective chosen)	720	675 - 720	675 - 720	675 - 720	675 - 720		

*Math 235 is highly recommended but not required for the first year of a Chemistry degree and students may take another elective instead. We recommend taking it during this course of study as it is required in the second year of a chemistry degree at most universities.

**It is recommended that the elective for a geoscience degree be either statistics (math 131) or a biology course.

College of New Caledonia

Barbara Rudecki	College of New Caledonia	rudecki@cnc.bc.ca
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Information added at the meeting: Things to keep as classes return to face-to-face: blended learning. Open Stax textbooks being used in many classes.



College of New Caledonia 2021 Physics Articulation Report

Due to Covid-19 pandemic, the physics courses at CNC were offered in a blended format over the past year. The lectures, tutorials and office hours were delivered online, but the labs were done in-person. Lab section size was reduced to 10 students in compliance with CNC Covid-19 safety protocol. Next year we are planning to return to campus, as all other institutions, but we are hoping to diversify the methods of instructions to include variety of blended models. All science labs should be in-person, and for the lectures we are considering the following options: scheduled in-person, scheduled online, unscheduled online, hybrid online, hybrid classroom/online, and hylfex.

In order to align with the requirements of Common First-Year Engineering Curriculum (CFYEC), the existing CNC First Year Engineering (Applied Science) Transfer Program was modified and offered in a new format. The enrollment in this program declined this year mainly due to the absence of international students.

Modified First-Year Engineering (Applied Science) Transfer Program		
No	Course	Lecture, Lab hours/week
1	APSC 101	(2, 2)
2	APSC 102	(2, 2)
3	CHEM 150 or CHEM 111 + CHEM 112	(4, 3) (3,3) + (3,3)
4	CSC 109	(3, 3)
5	ENGL 103	(3, 0)
6	ENGL 229	(3,0)
7	MATH 101	(4, 0)
8	MATH 102	(4, 0)
9	MATH 204	(4, 0)
10	PHYS 101	(4, 3)
11	PHYS 102	(4, 3)
12	PHYS 204	(4, 0)

CNC offers UT calculus-based (PHYS 101, PHYS 102, PHYS 204) and algebra-based physics courses (PHYS 105, PHYS 106). They are part of the curriculum of Applied Science (Engineering) transfer program and general science transfer programs.

PHYS 101 - Introductory Physics I – 16 students

PHYS 102 - Introductory Physics II – 9 students

PHYS 105 - General Physics I – 10 students

PHYS 106 - General Physics II – 3 students

PHYS 204 - Mechanics I Statics - 14 students

Additionally, Physics Department offers two physics courses for the Medical Radiography Program: PHYS 115 - Medical Radiography 1 and PHYS 225 - Medical Radiography 2. The maximum enrolment in these courses is based on the cohort admission, currently 16 students.

Physics Department also delivers three physics courses for the Sonography Program: PHYS 170 – Physics for Sonography I, PHYS 173 – Physics for Sonography II and PHYS 175 – Physics for Sonography III. The maximum enrolment in these courses is based on the cohort admission, currently 16 students.

Barbara Rudecki Department of Physics & Applied Science

College of the Rockies

Ben Tippett	College of the Rockies	Btippett@cotr.bc.ca
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Information added at the meeting: Things to keep as classes return to face-to-face: Astronomy labs were done at home. The students were given binoculars and a list of objects to look at. Worked so well that this will be continued.



College of the Rockies Physics Articulation Report May 2021

In 2020-2021 College of the Rockies (COTR) ran the regular first year calculus-based physics (Phys 103,104) which served both our engineering program students and our university studies students. We also ran Astronomy 100, which satisfies a laboratory credit for students who are not science majors. For the first time in several years, we had sufficient enrollment to offer second year physics courses: Phys 201- Analytical Mechanics, and Phys 202 – Modern Physics. All of the above courses involve a weekly 3-hour lab.

COTR also runs high-school level physics courses: Phys 080, Phys 090 for upgrading students. Both of these courses also involve weekly labs.

September 2020

Phys 103 : 14 Students

Phys 201: 3 Students

Phys 080: 6 Students

January 2021

Phys 104: 9 Students

Phys 202: 3 Students

Astro 100: 13 Students

Phys 090: 4 students

Enrollment in PHYS 103-104 was lower than previous years. Enrollment in Astro 100 was at capacity, and Enrollment in Phys 201 and 202 were the minimum for the college to offer these courses in a lecture-based format. Enrollment was decimated in the high school upgrading Physics. It is usually around 12 in Phys 080 and 16 students in Phys 090.

Adaptations to delivery during COVID-19 and reflections of effectiveness

Due to the COVID epidemic, COTR delivered most of its courses online. Phys 103, 104, 201, and ASTRO 100 were delivered asynchronously by providing students with instructional videos which the students could download at the start of each week. Phys 202 was delivered as live lectures over Microsoft Teams.

Each class also included a 3-hour weekly lab, which was delivered in-person. COTR decided to run in-person labs for sciences and trades; doing so while following social-distancing regulations and limiting the quantity of individuals on campus at any time. Students, faculty and technicians were screened with a health check by security guards at the entrance to the building and were required to wear a mask at all times while inside the buildings. All Physics and Astronomy labs were redesigned to eliminate the practice of giving students lab partners to facilitate social distancing.

For Phys 103 and 104 labs, each student's in-person lab session was reduced by half, to 1.5 hours of lab time each week. In order to do so effectively without substantially reducing the quality of activities, they were required to familiarize themselves with the equipment and lab instructions at home before their assigned lab period. Instructional videos were recorded in the summer of 2020, to facilitate this activity. I found that the students regularly arrived well prepared, and successfully worked independently, collecting and analyzing nearly the same amount of data as they would have during non-COVID times.

Phys 201 and 202 lab had low enough enrolment that they could social-distance and work independently without needing to split their amount of lab time.

Astro 100 labs were re-designed by splitting the class in half, and requiring the students attend on alternating weeks, while the other half worked on different activities at home at their own pace. This required that we design a suite of at-home activities. For example, we sent the students home with binoculars and had them observe a list of celestial objects. The effectiveness of self-guided lab activities was a mixed bag: exploring the RA-Dec coordinates using the Stellarium App gave them a much stronger

understanding of the celestial sphere; while working through Project CLEA activities without a supervisor present to answer their questions and relate it to the course left most of the students fairly confused.

For Phys 080 and Phys 090, Labs and exams were delivered in the traditional face-to-face way, but lectures were delivered live online over Microsoft Teams.

Traditional assessment was also modified because students would be writing their exams at home, and the instructor has limited control over the student's environment.

For Phys 201 and 202, the traditional "take home" examination format was adopted: students were given 24 hours to turn in their solutions to a set of challenging questions.

For Phys 103, and 104, I modified the structure of traditional questions in a way which would make googling the answer unhelpful. I gave the students a description of a type of question, and then asked them to generate the "most difficult, novel question" they could imagine which satisfied the description, and then answer it. I graded them according to how well their question fit the description, how difficult and original the question was, and how correct their answer was. Part of the purpose of this exercise is to encourage the student to think holistically about what types of questions we are trying to answer with physics; and I found that the activity served this purpose well, while also giving me a strong sense of their mastery of each topic. I would encourage my colleagues to try something similar.

For Astro 100, I replaced the final exam with a research project, while emphasising to the students that they would be graded not only on the quality of their understanding but also (since this was to replace a final exam testing their knowledge of course material) on how many connections to the course material they could find. For example, a student reporting on Saturn would lose marks if they did not explain how we used the EM spectrum to determine the chemical composition and temperature of the atmosphere. Many students were successfully able to demonstrate mastery of the course content by linking their research topic to the course in a dozen ways, however the overall success of the activity was a mixed bag.

Benjamin K. Tippet
Instructor Math, Physics, Astronomy

Columbia College

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Information added at the meeting: Things learned in the last year that will be kept when we are back to face-to-face learning: Online submissions of labs and assignments.

Using Open Stax textbooks as a secondary resource, and might switch



Physics & Astronomy Articulation Report 2021

The enrolment in Physics courses at Columbia College, for the 2020/2021 academic year, was like this:

Summer 2020:

Physics 110 - 21
 Physics 120 - 9
 Physics 130 - 9
 Physics 200 - 3
 Physics 12 - 22

Fall 2020:

Physics 110 - 30 (2 lab sections)
 Physics 120 - 6
 Physics 130 - 8
 Physics 118 - 4
 Physics 205 - 5
 Physics 11 - 19

Winter 2021:

Physics 110 - 22 (2 lab sections)

Physics 120 - 9
Physics 130 - 5
Physics 118 - 5
Physics 200 - 8
Physics 12 - 42 (two sections)

The enrollment was good in high school Physics courses and in Physics 110 (Newtonian Mechanics). On the other hand, it was rather low in the rest of first year UT Physics courses for science and engineering majors (Physics 120, 130 and 118). The interest in our second year Physics courses was steady, although not high.

Physics courses was steady, although not high.

As almost everybody else, the College switched to the online mode during Winter 2020 for both high school and UT level programs. In Winter 2021, we decided to go back to the physical classroom for our high school, while most of our UT programs stayed online.

Since most of the students at the College are international, we expected a striking decrease in general enrolment due to the effects of COVID-19.

Anyhow, the decrease was much less significant than expected, so we continued offering most of our courses and even hired some sessional instructors in Summer 2020, as well as in Fall 2020.

Vladan Jovovic, Ph.D.

Coquitlam College

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Saeed Faraji	Coquitlam College	sfaraji@coquitlamcollege.com

Information added at the meeting



Coquitlam College Report to Articulation May 2021

There have been minor changes in the Physics Curriculum at Coquitlam College during the academic year 2020/2021. Due to the current pandemic, the College decided to run solely the on-line UT courses during the past three semesters (Summer and Fall 2020, Spring 2021). The problem regarding the Physics labs has been solved by designing several home-based labs for students taking Physics 101 (simple experiments in mechanics that students could perform at home) and adapting a hybrid model for students taking Physics 102. Half of the labs the students conducted in the College's lab, and the other half online.

Coquitlam College continue to offer 1st year calculus-based Physics courses. Physics 101 (mechanics with an introduction to thermal Physics) and Physics 102 (electro-magnetism and optics) are currently offered in all semesters, which differs from the past, when Physics 102 was offered only once a year in the spring semester.

There are no plans for the second-year courses.

The enrolment in Physics 101 courses has been so far rather stable (20 – 35 students/semester). However, the number of students interested in Physics 102 (electromagnetism and optics) dropped substantially at the beginning of

the year 2020, so that the Administration of the College decided not to offer the course in the spring semester 2020, and instead to go ahead with Physics 101. At the beginning of this year the Administration decided to offer both Physics courses in every semester.

There have been significant changes in the demographics of the international students at Coquitlam College. We observe a steady increase in the number of students from India, and a decline in the number of Chinese and other international students. The current enrolment at the College is about 3000 students. The College has currently one (main) campus in Coquitlam and a second one in Surrey.

Corpus Christi College

Alain Prat	Corpus Christi College	aprat@corpuschristi.ca
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Information provided at the meeting: Academic Integrity, the lack thereof, was a big problem in the last year.



Report from Corpus Christi College 2021

Founded in 1990, Corpus Christi College is a Catholic two-year liberal arts college located on UBC's campus. The college offers over eighty courses in a variety of subjects, including two physics courses and one astronomy course. Approximately 20% of the students at the college are international students.

Since 2010, Corpus Christi College has been offering PHYS 101 (Energy and Waves). Enrolment in this course over the last three years has been steady with between 20 to 30 students. Since 2015, the college has been able to offer the course on campus after purchasing permanent lab equipment for this course. There is currently no required textbook for PHYS 101.

Since 2020, a second physics course has been offered (PHYS 100 - Introductory Physics: Mechanics and Heat). This course will again be offered in the upcoming term in summer 2021, with the OpenStax college physics book as the course textbook.

Since 2016, Corpus Christi College has offered an introductory astronomy course (ASTR 210: Exploring the universe – The Solar System). Enrolment has been steady with between 5 to 15 students enrolled in the course each time. Since 2020, the textbook for the course is the free open source OpenStax astronomy textbook.

Douglas College

Jennifer Kirkey	Douglas College	kirkeyj@douglascollege.ca
Will Gunton	Douglas College	guntonw@douglascollege.ca

Information added at the meeting: Lessons learned from the last year: It was fine. Not great, not horrible, just fine. The overall course percentages were about the same. The face-to-face labs are going to improved and updated.



Physics and Astronomy Articulation 2021 Articular Meeting Report

Due to the ongoing COVID-19 pandemic, all our Physics and Astronomy courses and labs ran online in the S2020, F2020, and W2021 semesters. Our S2021 semester is also online, with a planned return to in-person activities in W2021. Despite the shift online, our enrollment was steady across our course offerings. New for this year, we added a second section of PHYS 1208 in the Fall (in addition to the section that is regularly offered in the Winter semester).

Course	Sections S F W	Students S F W	Textbook
PHYS 1104	1 1 1	35 36 35	OpenStax College Physics - Custom Edition
PHYS 1107	2 2 1	66 69 36	OpenStax College Physics - Custom Edition
PHYS 1207	0 1 1	0 25 17	OpenStax College Physics - Custom Edition
PHYS 1110	0 2 1	0 74 36	OpenStax University Physics
PHYS 1210	1 0 2	28 0 53	OpenStax University Physics
PHYS 1170	0 0 1	0 0 33	Engineering Mechanics (Hibbeler)
ASTR 1105	0 2 2	0 70 71	OpenStax Astronomy - Custom Edition

**S/F/W = Summer 2020 Semester (May-Aug) / Fall 2020 Semester (Sept-Dec) / Winter 2021 Semester (Jan-Apr)*

Starting in the F2020 semester, in PHYS 1110 and 1210 we changed the course textbook from Halliday, Resnick, and Walker to OpenStax University Physics. From our regular Physics/Astronomy offerings, the only remaining course not using an OER is PHYS 1170 (but there is work ongoing with BCCampus to create a “Hibbeler clone”).

Although registration for S2021 is ongoing, our PHYS 1104 (1 section) and PHYS 1107 (2 sections) courses are full with a waitlist. Our PHYS 1210 section is down from this point last year (to 16 from 28 students) but is comparable to the S2019 enrollment (18).

In addition, we offered several courses as guided study sections this year, including PHYS 2250 (Introduction to Modern Physics) and PHYS 1108 (Physics for Life Sciences I) which is a lecture only course designed to match SFU PHYS 101. In S2021, we will be offering PHYS 1208 (Physics for Life Sciences II) as a guided study section for the first time.

Course	Sections (S F W)	Students (S F W)	Textbook
PHYS 2250	0 0 1	0 0 4	Modern Physics (Krane)
PHYS 1108	0 0 1	0 0 7	OpenStax College Physics (Custom Edition)

**S/F/W = Summer 2020 Semester (May-Aug) / Fall 2020 Semester (Sept-Dec) / Winter 2021 Semester (Jan-Apr)*

In our lab-based Physics courses, we ran a full complement of 8-10 online labs in each course that closely followed our in-person labs using a combination of online simulations, data sets, and recorded videos of experiments. We took a similar approach to our Astronomy course, making use of Stellarium and other online resources (simulations and virtual telescopes) to recreate or reimagine most of our in-person labs. While these online labs were moderately successful, we are looking forward to a return to in-person activities!

Our Engineering program now has several guaranteed transfer pathways with UBC, SFU, and UVic which we hope will continue to grow our enrollment in the courses related to this program (PHYS 1110, 1210, and 1170) over the coming years.

We have created a first-year physics course (with a lab) for liberal arts students which is (cleverly) titled PHYS 1234 – Physics for Liberal Arts. We had planned to offer this course for the first time in the Winter semester, but did not have enough interest (in part, we suspect, due to the shift online and lack of ability to advertise the course). We will likely try to offer this course again in two years (Winter 2023).

We are beginning to work on updating the lab component of our physics courses, starting with the calculus based physical science stream (PHYS 1110 and PHYS 1210) to better align with the lab offerings at other institutions. The goal of this update is to allow for the possibility that the lab component of the courses could be separated from the lecture part and to introduce a stronger focus on lab skills, student-based inquiry, and protocol/procedure creation for experiments. We hope to have these changes put through the articulation system by next year.

Will Gunton Physics and Astronomy Department Chair

Note: On June 13 2020 Douglas College hosted, online, a discussion about online labs. James Charbonneau and Joss Ives from UBC presented what they had done in the summer and we planning for the fall of 2020, and Will Gunton presented what Douglas College had done and was going to do in the fall, due to this forced pivot to online. About 30 people from around the province attended and a rich discussion with a useful exchange of information occurred.

Fraser International College

Peter Smith	Fraser International College	smip@learning.fraseric.ca
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<https://www.fraseric.ca/>

As stated on their website, “FIC provides international students a direct pathway to year two at Simon Fraser University. The FIC pathway provides a smooth transition into Simon Fraser University. University designed programs, taught by qualified instructors on the main Simon Fraser University Campus, ensure that our students have the very best preparation for the demands of higher education in Canada. FIC students are treated like university students and, with the added benefits of smaller classes, students receive more personalized attention in a dynamic and supportive environment that better equips them for life at university.”

FIC does not offer Astronomy courses.

The following Physics courses were offered in the 2020/2021 academic year.

- 1) PHYS 100: Introduction to Physics – 111 students - Text: OpenStax College Physics - PHYS 100 was offered for the first time during the first semester of online instruction (Summer 2020) as part of the new Science Pathway being offered by FIC.
- 2) PHYS 140: Studio Physics - Mechanics and Modern Physics – 170 students - Texts: Workshop Physics Vols. 1 and 2, FlipItPhysics
- 3) PHYS 141: Studio Physics - Optics, Electricity and Magnetism – 83 students Texts: Workshop Physics Vol. 4, FlipItPhysics

4) PHYS 1141 Optics, Electricity and Magnetism Lab – 83 students - PHYS 1141 is equivalent to ENSC 120, a course which is offered to first-year engineering students at SFU. The soldering project that typically makes up a significant part of this course was separated from 1141 during online instruction and deferred to when in-person instruction resumes. Students entering into engineering must complete this project before graduation.

Due to COVID-19 FIC transitioned online in April 2020. Courses have and will continue online until the end of the Summer semester in 2021. The Physics Department has continued throughout the academic year with 1 continuing instructor and 1 sessional instructor. The department has seen a decline of approximately 16% over the course the academic year but no cancellation of courses. Fall 2021 will see a return to in-person instruction, as possible.

Focusing on international students, FIC is preparing to continue some online courses depending on the number of students being able to secure a student visa in time for the September intake.

Takashi Sato	Kwantlen Polytechnic University	Takashi.Sato@kpu.ca
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Kwantlen Polytechnic University 2021

Kwantlen Polytechnic University has campuses in Richmond, Surrey, Cloverdale and Langley and the Physics Department operates on three of them. At Langley Campus, PHYS 1400 & 1401 run as part of the long-standing Environmental Protection Technology program. At Surrey and Richmond Campuses, we run our complement of first year courses in physics (calculus-based physical science stream and calculus-based life science stream) and engineering, as well as courses in astronomy for non-majors. In addition, Richmond Campus is home to the 2nd, 3rd and 4th year courses for the ***B.Sc. Physics for Modern Technology***.

The first year of this degree curriculum is a familiar mix of science courses but due to the very applied nature of this program, courses become specific for our degree from second year onwards. We see students transferring into our degree after (and during) first year fairly seamlessly but those arriving with some second and third-year credits are seeing some glitches, as one normally would when changing majors mid-stream, even within the same university. Since our last report (May 2020), we ran our usual offerings for Summer, Fall and Spring* semesters. They ran predominantly online, with the following notes/exceptions.

- I. In upper-level courses with project oriented components, some students reported to campus for individual work, under pandemic protocols that needed to be approved at the institutional level.
- II. Students in the first year engineering project course worked on campus on limited occasions.

- III. We previously reported on our offerings of online lab sections for PHYS 1100 as well as online “lecture” sections where students perform experiments using “home kits” built around the IOLab (<http://www.iolab.science/>) and remotely operated equipment (CloudLab). This course ran more or less unchanged, with the exception of issues arising from volume. Our supply of home kits was not sufficient for all sections running online, prompting us to refer students to rent IOLabs directly from Macmillan.

There have been challenges with mass online learning.

Administration reports a 6x increase in reports of academic integrity violations in our Faculty.

Official data have not yet been presented but discussions with colleagues indicate course completion rates have seen a marked decrease.

Takashi Sato

Langara College

Bradley Hughes	Langara College	bhughes@langara.ca
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Mayra Tovar mtovar@langara.ca was also present. Mayra is the Equity Diversity and Inclusion Coordinator. As Bradley said they decided the department had to do “more than just have good intentions”.



Langara College Physics and Astronomy Articulation Report 2021

snəwəyət̚ lələm̚ - Langara College

During the pandemic we were able to offer almost the same number and range of courses as before. The exception is that we were unable to find a way to offer our second year lab either online, or safely in-person. Over the last year we offered 45 sections university transfer physics & astronomy classes entirely online. Our offerings included first and second year university transfer physics, an engineering mechanics class, courses for students who do not have grade 11 or grade 12 physics, and two semesters of first year astronomy courses for science students and a set for non-science students. In total around 1200 students are enrolled each year. About a third of them are international students who contribute a disproportionately large fraction of the college's revenues.

This fall our administration is planning for a transition semester with the majority of courses offered on campus and in-person. There will also be a few introductory courses online to allow international students who cannot travel to BC to enroll.

The biggest change in our department is our creation of and Equity, Diversity and Inclusion Coordinator. After the June 2020 scholar's strike for Black lives, <https://www.shutdownstem.com/>, our department decided to create a position to recruit, welcome and encourage women, LGBTQ and BIPOC students in our department. We elected Mayra Tovar into this position, and

we are using release time that is usually given to the chair to provide 1/3 release from teaching for this work.

Mayra will give a report to this meeting, so I will just provide a few highlights. Over the last two semesters, she has, among other things, organized representatives of the Indigenous Education Services, and the Centre for Intercultural Engagement to come to our department meetings; organized a student survey and focus groups; regularly provided resources and inspiration for making our classes more welcoming; and started working on an EDI strategic plan. I hope we will be able to collaborate with other intuitions on this.

Bradley Hughes
Chair, Department of Physics & Astronomy
snəwəyət̚ lələm̚ - Langara College
on the unceded land of the Musqueam nation.

LaSalle College

Nina De Castro	LaSalle College	NDeCastro@lasallecollegevancouver.com
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Saeed Faraji who teaches at Coquitlam College also teaches at LaSalle. There were no face-to-face labs last year. All were online simulations.
sfaraji@coquitlamcollege.com



LaSalle College will not be sending a representative this year.

From the LaSalle College web page:

Make Creativity Your Way of Life!

LaSalle College Vancouver (LCV) opened its doors in 1998 as an English as second language school (ESL). In 2002, the school began to focus and expand on design-based programs such in Fashion Design, Fashion Merchandising, Artistic Make-up, Interior Design, Jewellery Design, Graphic Design, and 2D/3D Animation as well as on-line training programs in Interior Design, Fashion Marketing, Video Game 3D Modelling, and Administrative Assistant.

North Island College

Dennis Lightfoot	North Island College	Dennis.Lightfoot@nic.bc.ca
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Information provided at the meeting: Lessons learned from the last year: Students do not want asynchronous lessons, even though they had asked for them before the Covid-19 forced pivot to online.



**NORTH ISLAND
COLLEGE**

NIC Physics Articulation Notes 2021

Numbers

Our enrollments in physics (and most of the math/science courses) were down again this year. Second semester enrollment, particularly in our calculus-based physics, were particularly dreadful. This can be attributed to greater attrition in both first-semester calculus and first-semester physics. More students were also electing to take fewer courses due to online delivery. Second-year physics and Space Science courses were both cancelled as part of a contraction due to budget shortfalls.

The completion numbers for this year and last are shown below. This does not include students who withdrew from the course before the deadline at the end of October or February.

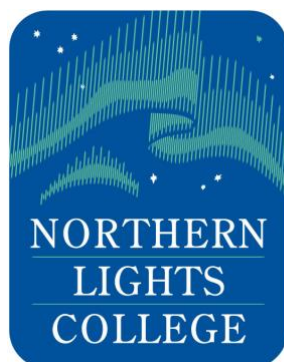
Course	Course Code	19/20 Completions	20/21 Completions
First-year Algebra based Physics	PHY 100/101	15/8	17/9
First-year Calculus based Physics	PHY 120/121	17/9	10/4
Second-year E&M	PHY 216	3	Not offered
Space Science & Astronomy	SSA 100/101	12/13	Not offered

Adaptation during COVID-19 Crisis

All of our physics labs this year were a combination of online simulations and take-home labs using kits that students would pick-up from the campus. We are planning to return to full on-campus labs for next year. Lectures may still be online so that we can serve multiple campuses with a single lecture. All exams were also invigilated online this year.

Northern Light College

Lisa Verbisky	Northern Lights College	lverbisky@nlc.bc.ca
Morteza Ghadirian	Northern Lights college	mghadirian@nlc.bc.ca



NLC offered two physics courses in the 2020/2021 academic year:

- 1) PHYS 103 Mechanics and Waves - calculus based (9 students)
- 2) PHYS 104 Electricity and Magnetism and waves - calculus based (6 students)

These courses primarily serve the following credentials at NLC:

- 1) Engineering Studies Certificate – common core first year transfer to Engineering Degree granting institutions in BC
- 2) Engineering Certificate – first year transfer agreement with UofA
- 3) Associate of Science degree

The expected increase in student numbers did not materialize in September 2020. This is likely due to Covid although many of the science and engineering courses at NLC were offered as face to face.

Four of the students in the physics courses were in an engineering program. Currently, the one-year certificates in engineering offered by NLC do not meet the two-year duration desired by international students to obtain their post-graduate work permit. As such, most international students interested in engineering take the Associate of Science degree and subsequently contribute to the student numbers in PHYS 103 and PHYS 104.

Okanagan College

Kevin Douglas	Okanagan College	kdouglas@okanagan.bc.ca
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Information added at the meeting: There were hybrid labs at the Kelowna campus. Lessons learned from the last year: Online office hours were popular and will be kept.



Okanagan College –Physics & Astronomy Articulation Report – April 2021

Okanagan College has four main campuses: Salmon Arm, Vernon, Kelowna, and Penticton. Kelowna is our largest campus, accounting for ~65% of Arts & Science students. The Physics & Astronomy Department has 8 full-time faculty members, two of whom share appointments with the Mathematics & Statistics Department. We had one term faculty person teaching with us in the Winter 2021 semester.

Kevin Douglas replaced Robert Stutz as (interim) Department Chair on 2 January 2021, as Robert went on parental leave. Kevin will start a three-year term as chair in July. One faculty member will be on Extended Study Leave for the 2021-2022 academic year.

Recent enrollment history at OC for the Associate of Science across all OC Campuses:

	2015 – 2016	2016 – 2017	2017 – 2018	2018 – 2019	2019 – 2020	2020- 2021
Applied	772	773	1005	925	814	627
Enrolled	294	319	417	346	345	231

Enrolment notes:

- Applications & enrollments down significantly, especially for international students. Domestic enrollments were actually quite strong. Strong second year enrollment in PHYS & ASTR courses.

Course/Enrolment Updates:

- Our courses offered at Okanagan College remain mostly the same, with one addition, a biophysics course.

	2018-19 Numbers	2019-20 Numbers	2020-21 Numbers
PHYS112/122 – Algebra-based Physics I & II	250	229	179
PHYS111/121 – Calculus-based Physics I & II	128	95	80
PHYS126 – Physics for Electronic Engineering	22	22	21
PHYS200 – Relativity and Modern Physics	3	7	7
PHYS215 – Thermodynamics	12	38	27
PHYS202 – Engineering Mechanics I	7	13	9
PHYS240 - Biophysics	Not Offered	Not Offered	8
ASTR110/111/112/120/121/122 – Astronomy I & II	80	74	90
ASTR220 – Astrobiology	22	32	28
ASTR230 – History of the Universe	24	34	46

- Course changes in 2020/2021:

o Addition of a second section of ASTR 230, and an out-of-sequence ASTR 11X stream, resulted in increased numbers.

o New course PHYS 240 was attractive to some students. PHYS 228 (Classical Mechanics) was also offered, but subsequently was collapsed after enrollment dropped to zero (from maximum of 2).

- Prospects for 2021/2022: Expect ~15 students for Common First-Year Engineering Curriculum (CFYEC) intake. Current College plan is for return to in-person instruction. Departmental planning follows College plan, with contingencies being formed.

- Attrition: not too significant, possibly half of previous years. Several students in Fall PHYS 111/112 failed and so our PHYS 112 out of sequence had more 'repeat' students than usual.

Selkirk College

Jason Nickel	Selkirk College	jnickel@selkirk.ca
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Information added at the meeting



Selkirk College serves the West Kootenay region of BC and continues to offer the same physics courses in 2020-2021 as in the previous eight years. Our physics courses serve students in the first-year engineering transfer program, the rural premedicine program, as well as students enrolled in general arts and science. No major changes occurred to course content this year.

The courses offered include:

- PHYS 102/103 – Algebra-based.
- PHYS 104/105 – Calculus-based.
- PHYS 200 – Engineering Mechanics - Statics.
- Astronomy 102 (not offered since 2013).

Textbooks utilized:

- OpenStax College Physics, for PHYS 102/103.
- OpenStax University Physics, for PHYS 104/105.
- Statics and Dynamics (13th ed.) by Hibbler, R.C., for PHYS 200.

Enrollment in the physics courses at the Castlegar campus is down roughly 20% from last year, with approx. 42 students starting in the Fall and 32 completing both semesters. We expect an increase in enrollment for the upcoming year.

On an exciting note, our Castlegar Campus physics laboratory is being renovated this Summer and Autumn, bringing the original 1966 space into a modern learning environment. I'm curious to learn about lab design from other institutions that have recently renovated their first-year lab space.

Simon Fraser University

Eldon Emberly	Simon Fraser University	eemberly@sfu.ca
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Additional Information shared at the meeting: Lessons learned from the last year: There is a new awareness of academic dishonesty. The online chat was very popular with increased student participation with hundreds of questions.



SFU Departmental Report 2021

1. Revised QM stream:

- Our prior 2nd year Modern Physics course (PHYS 285) is now solely on two-state quantum systems and has few pre-requisites. Our 3rd and 4th year courses have been updated to reflect current content.

Quantum I PHYS 285 (3)

The concepts of quantum mechanics introduced through two-level systems and explored in a way that requires only familiarity with general concepts of linear algebra. Introduction to concepts in classical and quantum information theory, bits and qubits, quantum dynamics, quantum communication and cryptography, and quantum circuits. Prerequisite: Either MATH 232 or MATH 240, with a minimum grade of C-. Quantitative.

Quantum II PHYS 385 (3)

Stern-Gerlach experiments and the structure of quantum mechanics; operators; angular momentum and spin; Schrödinger equation and examples for time evolution; systems of two spin- $\frac{1}{2}$ particles; density operators; wave mechanics in one dimension including the double slit experiment, particle in a box, scattering in one dimension, tunnelling; one-dimensional harmonic oscillator; coherent states. Prerequisite: MATH 252 or 254; MATH 260; PHYS 255; PHYS 285 or ENSC 380 or CHEM 260. All prerequisite courses require a minimum grade of C-. Recommended prerequisite: PHYS 211. Quantitative.

Quantum III PHYS 415 (3)

Wave mechanics in three dimensions; orbital angular momentum and spherical harmonics; central potentials, hydrogen atom; time-independent perturbation theory, Stark effect, Zeeman effect; identical particles, helium atom; scattering, Born approximation; time-dependent perturbation theory, interaction picture. Prerequisite: PHYS 385; either PHYS 384 or MATH 314. All prerequisite courses require a minimum grade of C-. Quantitative.

2. New course in special relativity

- due to the removal of special relativity from PHYS 285, we have created a new course that covers special relativity and is required for our majors and honours students.

Special Relativity PHYS 313 (3)

A detailed presentation of Einstein's Special Theory of Relativity and how it revolutionized physics. Topics covered include: constancy of the speed of light, Lorentz transformations, time dilation, length contraction, relativistic paradoxes, space-time diagrams, relativistic particle kinematics and dynamics, electromagnetism as a relativistic phenomenon, and an introduction to general relativity.

3. First offering of Observational Astrophysics course

Introduction to Observational Astrophysics PHYS 391 (3)

Hands-on introduction to observational astronomy including the astrophysics of stellar clusters, galaxies, nebulae, and the expanding universe; calculation of the conditions for observing target objects; and analysis of photometric and spectroscopic data with Python. Data will be acquired using the Trottier Observatory, weather permitting, otherwise, archival data will be used. Prerequisite: PHYS 233 or equivalent. Recommended Prerequisite: CMPT 120 or equivalent.

4. First-year Textbook Summary:

Physics 100 (physics 12): OpenStax College Physics

Physics 101/102 (life sciences): Flipit Physics + Freedman et al., College Physics 2nd Ed.

Physics 120/121 (calculus): Flipit Physics + Tipler (optional)

Physics 140/141 (studio, calculus): Flipit Physics + Tipler (optional)

Physics 125/126 (enriched): Halliday, Resnick and Krane (considering Chabay and Sherwood)

The complete textbook list is attached as a separate page.

Eldon Emberly, Chair, Physics Undergraduate Curriculum Committee, SFU
March 31, 2021

Course #	Course Name	Title	Author
PHYS 100	Introduction to Physics	SFU version of OPENSTAX COLLEGE PHYSICS	Openstax
PHYS 101	Physics for the Life Sciences I	College Physics + Fliplt Physics	Freedman
PHYS 102	Physics for the Life Sciences II	College Physics + Fliplt Physics	Freedman
PHYS 120/140	Mechanics and Modern Physics	Fliplt Physics	
	Studio Physics-Mechanics	Physics for Scientists and Engineers	Tipler
PHYS 121/141	Optics E+M	Fliplt Physics	
	Studio Physics - E+M	Physics for Scientists and Engineers	Tipler
PHYS 125	Mechanics and Relativity	Physics (V1)	Halliday, Resnick and Krane
PHYS 126	Electricity, Magnetism and Light	Matter and Interactions	Chabay and Sherwood
PHYS 132	Physics Laboratory I	MEASUREMENTS AND THEIR UNCERTAINTIES : A PRACTICAL GUIDE TO MODERN ERROR ANALYSIS	Hughes/Oxford
PHYS 133	Physics Laboratory II	MEASUREMENTS AND THEIR UNCERTAINTIES : A PRACTICAL GUIDE TO MODERN ERROR ANALYSIS	Hughes/Oxford
PHYS 190	Intro to Astronomy	OPENSTAX ASTRONOMY	Openstax
PHYS 211	Intermediate Mechanics	INTRODUCTION TO CLASSICAL MECHANICS	David Morin
PHYS 231	Physics Laboratory III	MEASUREMENTS AND THEIR UNCERTAINTIES : A PRACTICAL GUIDE TO MODERN ERROR ANALYSIS	Hughes/Oxford
PHYS 233	Physics Laboratory IV	MEASUREMENTS AND THEIR UNCERTAINTIES : A PRACTICAL GUIDE TO MODERN ERROR ANALYSIS	Hughes/Oxford
PHYS 255	Vibrations and Waves	VIBRATIONS & WAVES	FRENCH/Norton

PHYS 285	Quantum I	A first introduction to quantum physics	Kok
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PHYS 313	Special Relativity	TBD	
PHYS 321	Intermediate Electricity Magnetism	INTRO TO ELECTRODYNAMICS	GRIFFITHS/Pearson
PHYS 326	Electronics/Instrumentation	ELECTRONIC PRINCIPLES	MALVINO/McGraw-Hill
PHYS 332W	Advanced Physics Lab I	MEASUREMENTS AND THEIR UNCERTAINTIES : A PRACTICAL GUIDE TO MODERN ERROR ANALYSIS	HUGHES/Oxford
PHYS 344	Thermal Physics	Basic Thermodynamics	Carrington, Gerald
PHYS 347	Intro. To Biological Physics	PHYSICAL BIOLOGY OF THE CELL	PHILLIPS/Taylor& Francis
PHYS 365	Semiconductor Device	SEMICONDUCTOR PHYSICS & DEVICES	NEAMEN/McGraw Hill
PHYS 384	Methods of Theoretical Physics	Mathematical Physics	BUTKOV/Pearson
PHYS 385	Quantum II	A Modern Approach to Quantum Mechanics	Townsend/USB
PHYS 390	Introduction to Astrophysics	Introduction to Cosmology	Ryden/Addison-Wesley
		Extragalactic Astronomy & Cosmology	Schneider/Springer
PHYS 391	Introduction to Observational Astrophysics	None	
PHYS 395	Computational Physics	None	

PHYS 413	Advanced Mechanics	MECHANICS (V1)	LANDAU/Butterworth-Heinemann
		CLASSICAL MECHANICS	GOLDSTEIN/Pearson
PHYS 415	Quantum III	MODERN APPROACH TO QUANTUM MECHANICS	TOWNSEND/USB
PHYS 421	Electromagnetic Waves	INTRO TO ELECTRODYNAMICS	GRIFFITHS/Cambridge
PHYS 431	Advanced Physics Lab II	No textbook	
PHYS 445	Statistical Physics	STATISTICAL AND THERMAL PHYSICS	Gould/Princeton University
PHYS 455/855	Modern Optics	OPTICAL PHYSICS	LIPSON/Cambridge
PHYS 465	Solid State Physics	The Oxford Solid State Basics	Simon/Oxford
PHYS 485/871	Particle Physics	MODERN PARTICLE PHYSICS	THOMSON/Cambridge
		INTRO TO ELEMENTARY PARTICLES	GRIFFITHS/Wiley
PHYS 490/881	Relativity and Gravitation	Spacetime and Geometry: An Introduction to General Relativity	Carroll/Pearson

		Gravity: An Introduction to Einstein's General Relativity	Hartle/Benjamin- Cummings
PHYS 492/881	HEP Techniques	Particle Detectors	Gruppen, Claus/ Cambridge
		Introduction to Experimental Particle Physics	Fernow, Clinton, Cambridge

George Weremczuk	Thompson Rivers University	Gweremczuk@tru.ca
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THOMPSON RIVERS UNIVERSITY

Physics Articulation Report 2021

Department news

Two faculty retirements out of seven full-time faculty took advantage of the early retirement incentives. There is a search for one new tenure-track replacement position. We are looking for an experimentalist or someone whose expertise would be able to help broaden the spectrum of our physics offerings.

We expect to be graduating five physics major students this year.

As TRU also has Open Learning all physics courses offered by TRU will be face to face in the fall. <https://www.tru.ca/distance/>

Course delivery during COVID-19 restrictions

Table 1: Courses offered in 2020-21 and mode of delivery

Fall	ASTR 1140	Virtual
	EPHY 1150	Virtual
	EPHY 2200	Virtual
	PHYS 1100	virtual with guided enquiry labs
	PHYS 1150	virtual with guided enquiry labs
	PHYS 1510	virtual with simulated labs
	PHYS 1580	virtual with simulated labs
	PHYS 2000	Virtual
	PHYS 2150	virtual with simulated labs
	PHYS 3080	Optics - virtual with simulated labs, a few labs were face-to-face
	PHYS 3250	Virtual
	PHYS 3400	Virtual
	ASTR 1150	Virtual
	EPHY 1250	virtual with guided enquiry labs
	EPHY 1700	Virtual

Winter	EPHY 2300	virtual with simulated labs
	PHYS 1200	virtual with guided enquiry labs
	PHYS 1250	virtual with guided enquiry labs
	PHYS 1610	virtual with simulated labs
	PHYS 2200	Virtual
	PHYS 2250	virtual with simulated labs
	PHYS 3500	Selected Topics in Physics: Particle Physics replaced PHYS 4500 - Advanced Laboratory
	PHYS 4140	Virtual
	PHYS 4400	Virtual

All physics and astronomy courses were offered on-line synchronously, that is, at a scheduled time, with asynchronous components. Courses and their components were handled through the Moodle learning management platform. Synchronous student interaction through lectures, labs and seminars used Moodle's BigBlueButton or the BlueJeans videoconferencing service. The asynchronous components usually consisted of recorded lectures and PowerPoint presentations. Faculty were available for questions and additional material during the scheduled lecture times but were also able to answer questions posted in Moodle forums. This coverage provided students in other time zones with what was hoped to be fair opportunities to interact with course instructors.

To avoid academic integrity issues associated with virtual delivery, most faculty adopted frequent evaluations to reduce the course mark dependence upon a single mid-term or the final examination.

The first-year labs were synchronous with sufficient evening sections that most out-of-province students could attend. The B.Sc. first-year labs were done in a form of guided inquiry. Students were told ahead of time what at-home materials they might require or what PhET simulation they would use. During the lab period instructors and TAs would introduce various error analysis techniques, lead students through an experiment, have the students analyze their results and complete a report which was handed in by the end of the lab period. The experiments progressed from looking at variations in repeated measurements of the same quantity to comparing results with theoretical expectations to linearization of data and linear regression techniques.

Other labs either used a variety of simulations and simulators, or students were provided with data to analyze. The third-year optics course offered several face-to-face experiments. With the small enrolment in that course each student

was able to work in isolation on an individual apparatus.

It was decided that the PHYS 4500 Advanced Laboratory would not be offered due to difficulties with safety, so a selected topics course, Particle Physics, was offered instead.

Fall 2021 "Return to Campus"

Thompson Rivers University is planning a return to face-to-face instruction in the fall. There will, of course, still be restrictions due to COVID-19 such as mask-wearing, reduced class capacities and increased cleaning.

For physics and astronomy faculty who are now more comfortable with the technology, there are opportunities for more innovative instruction techniques such as flipping the classroom.

The plan for laboratories is hands-on with half of the lab section's students on alternating weeks. On-line preparations for experiments involving error analysis or experiment design would take place the other weeks.

Enrolments:

Enrollments in physics courses was not significantly different than the previous year. Physical and biological sciences enrolments do not depend upon international students.

Traditionally, the upper-level physics courses have a capacity of 12 but several courses saw significant capacity increases. Some of this was due to general science students planning to go into STEM education after completing their degrees; physics and mathematics courses are favoured due to the anticipated demand for teachers in those subjects. There was concern that the particle physics course which was offered instead of the advanced lab this year would have poor enrolment.

Unexpectedly, it saw one of the highest enrolments ever for an upper-level course.

*Table 2: Course enrolments in 2020-21 (2019-20 numbers in parentheses, *course not offered in previous year)*

Course	Title	Enrolment
ASTR 1140	Astronomy: The Solar System	60 (53)
EPHY 1150	Physics for Engineers 1	60 (56)

EPHY 2200	Elec Properties of Materials	16	(14)
PHYS 1100	Fundamentals of Physics 1	117	(148)
PHYS 1150	Mechanics and Waves	49	(55)
PHYS 1510	Applied Physics 1	26	(24)
PHYS 1580	Physics for Resp Therapists	53	(41)
PHYS 2000	Relativity and Quanta	8	(13)
PHYS 2150	Circuit Analysis	35	(31)
PHYS 3080	Optics	11	*
PHYS 3250	Advanced Electromagnetism	13	*
PHYS 3400	Principles/Appl Quantum Mech 1	21	*
ASTR 1150	Astronomy: Stars and Galaxies	59	(57)
EPHY 1250	Physics for Engineers 2	48	(45)
EPHY 1700	Engineering Mechanics 1	53	(55)
EPHY 2300	Digital Electronics	12	(10)
PHYS 1200	Fundamentals of Physics 2	83	(96)
PHYS 1250	Thermodynamics/Elec/Magnetism	26	(24)
PHYS 1610	Applied Physics 2	26	(24)
PHYS 2200	Mechanics	11	(13)
PHYS 2250	Intermediate Electromagnetism	17	(21)
PHYS 3500	ST: Particle Physics	24	*
PHYS 4140	Radioactivity/Nuclear Physics	13	*
PHYS 4400	Principles/Appl Quantum Mech 2	18	*

New and revised courses

PHYS 3000 – Introduction to Quantum Computing was postponed and will be offered for the first time in winter 2022. This cross-disciplinary course is intended for upper-level students in physics, computing science and mathematics.

EPHY 1170 – Physics for Engineering 1 and EPHY 1270 – Physics for Engineering 2 will replace EPHY 1150 and EPHY 1250 in the 2021-22 academic year. EPHY 1170 and EPHY 1270 were developed to meet the requirements of the First-year Engineering Common Curriculum courses, PHYS I and PHYS II. The EPHY 1170 course has a 3-hour weekly lab which its predecessor, EPHY 1150, did not.

PHYS 3100 – Digital Electronics is to be renumbered as PHYS 4100 to become one of three choices of capstone course in the program. The other two choices will be PHYS 4480 – Directed Studies in Physics and PHYS 4500 – Advanced Physics Laboratory.

Texts used or recommended

ASTR 1140/1150 – *Astronomy*, OpenStax

PHYS 1100 - *College Physics*, Urone, Hinrichs, Dirks & Sharma, OpenStax

PHYS 1150 - *Physics for Scientists and Engineers*, R.A. Serway and J.W. Jewett, 8th

or 9th edition
PHYS 1200 - *College Physics*, Urone, Hinrichs, Dirks & Sharma,
OpenStax

PHYS 1250 - *Physics for Scientists and Engineers*, R.A. Serway and J.W. Jewett, 8th

or 9th edition
PHYS 1580 - *College Physics*, P.P. Urone, R. Hinrichs, K. Dirks and M.
Sharma, OpenStax

PHYS 2000 - *Modern Physics*, Randy Harris, Pearson/Addison-Wesley, 2nd ed.

PHYS 2150 – *Introduction to Electric Circuits*, Richard C. Dorf, James A. Svoboda,

Wiley, 9th edition
PHYS 2200 - *Analytical Mechanics*, G.R. Fowles and G.L. Cassiday,

Thomson Learning Inc., 7th edition
PHYS 2250 - *Introduction to Electrodynamics*,

David J. Griffiths, Prentice Hall (any edition)

PHYS 3080 – *Introduction to Optics*, Pedrotti, 3rd edition

PHYS 3250 - *Introduction to Electrodynamics*, David J. Griffiths, Cambridge, 4th edition

PHYS 3400/4400 - *Introduction to Quantum Mechanics*, David J. Griffiths, Cambridge,
2nd edition

Trinity Western University

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Information added at the meeting: Lessons learned from the last year: Thinking of “flipping out”, going to the flipped classroom model. The videos will be used again. Please note that the flipped classroom model is that the active work is done in the classroom while the passive learning is done outside the classroom, often by watching pre-recorded videos.

There is interest in continuing with the blended/hybrid model. Many faculty were surprised at how well online learning worked.



TWU is located on the traditional ancestral
unceded territory of the Stó:lō people.

Report for the BC Articulation Committee Meeting 2021

Dr. Arnold E. Sikkema (Professor of Physics & Chair of the Mathematical Sciences Department)

- TWU Physics mainly serves our B.Sc. programs in Biology and Chemistry, as well as our pre-engineering options. We also provide one option among 15 for our required liberal-arts and -sciences core in our “scientific method & lab research” category.
- Physics is part of our Department of Mathematical Sciences, which includes math, computing science, physics, pre-engineering.
- All 200+ level courses are scheduled on an alternate year basis, allowing students to complete a minor or concentration, with zero to three graduating per year with these options (zero this year).

- Two of the planned classes were canceled and moved to 2021-22 due to zero enrolment (230: Electricity & Magnetism; 360: Optics).
- Enrolments in 2020-21:
 - 111: Fundamentals of Physics I: 46 (6 failing)
 - 112: Fundamentals of Physics II: 33 (number failing TBD)
 - 341: Advanced Physical Chemistry I “Quantum Chemistry,” cross-listed with chemistry: 3 chemistry majors (1 failing); lab taught by chemistry faculty online using BeyondLabz
- Courses planned for Fall 2020:
 - 111: Fundamentals of Physics I
 - 230: Electricity & Magnetism (with lab)
- Courses planned for Spring 2022:
 - 112: Fundamentals of Physics II
 - 360: Optics (with lab)
- For Physics 111/112, we used Randall D. Knight, *Physics for Scientists and Engineers: A strategic approach*, 4th edition (Pearson, 2017) via the social e-reading platform *Perusall*. Live Zoom meetings were fully interactive (polls, breakouts), with any one-way “lecture” and “demonstration” content delivered by video and quiz beforehand.
 - Labs for Physics 111 were done in live Zoom meetings using at-home materials and Excel, with breakout groups and all-class presentations and discussions, in partial collaboration with Mark Paetkau of Thompson Rivers University (abstract submitted to CAP 2021).
 - Labs for Physics 112 (waves, optics, electricity & magnetism) used PhET simulations and the other general features of the 111 labs.
- For Phys/Chem 341, we used Donald A. McQuarrie, *Quantum Chemistry*, 2nd edition (Sausalito, CA: University Science Books, 2008) via *Perusall*. This was supplemented by great lecture videos on the YouTube channel “TMP Chem” in its “Quantum Chemistry and Spectroscopy” playlist. Live Zoom meetings were fully interactive (discussion).

by Dr. Arnold Sikkema Professor of Physics
 Chair of the Mathematical Sciences Department Trinity Western University

University of British Columbia – Okanagan

Christina Haston	University of British Columbia- Okanagan	Christina.haston@ubc.ca
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OKANAGAN

The committee welcomes Christina Haston, the new Articulation representative from UBC-Okanagan

From their web page: <https://ok.ubc.ca/>

OKANAGAN CAMPUS
3333 University Way
Kelowna, BC Canada V1V 1V7
Tel 250.807.8000

UBC's Okanagan campus is situated on the territory of the Syilx Okanagan Nation

<https://cmps.ok.ubc.ca/>

Department of Computing Science, Mathematics, Physics and Statistics

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University of British Columbia – Vancouver

Tom Mattison	University of British Columbia- Vancouver	Mattison@physics.ubc.ca
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Information added at the meeting: Commenting on the last Covid-19 year teaching “it was less of a disaster than it might have been”. One thing that was surprising was how well the online labs worked. One thing to highlight is that the intention is to NOT go back to the combined lecture + lab courses. Current transfer will stay in place for the usual five years, but transfer institutions might want to take note of this new format.



UBC-Vancouver Physics & Astronomy Articulation Committee Report 2021

There are currently 116 students in Physics or Astronomy degree programs in 4th year (or above), compared to 124 (2020), 136 (2019), 125 (2018), 94 (2017), 92 (2016), 69 (2015), 93 (2014), 93 (2013), and 79 (2012). They are: 39 majors physics, 4 majors astronomy, 12 honours biophysics, 21 combined-honours physics, 12 honours physics, 12 combined-honours astronomy & physics, and 16 combined-major physics & computer science.

There are 74 students who have applied to graduate this year, compared to 84 (2020), 85 (2019), 70 (2018), 56 (2017), 59 (2016), 46 (2015), 70 (2014), 57 (2013), and 49 (2012).

We also graduate about 50 students in engineering-physics each year.

Due to Covid-19, the Faculty of Science requested that courses with combined lecture and lab components be split into separate lab and lecture courses. The lab component of PHYS 101 (for non-physics students) was removed, and the lecture-only version was re-numbered to PHYS 131. The lab component of

PHYS 107 (enriched mechanics) was removed, and the lecture-only version was re-numbered to PHYS 106.

Our intention is to not go back to the combined lecture+lab courses.

Physics and astronomy degree students are required to take the 1-credit PHYS 119 lab (which existed before Covid-19). For other students, the lab is optional. We successfully delivered an online version of the PHYS 119 in 2020-21.

Many students applying to medical or veterinary school need 2 physics lab credits. Previously they could do this with the lab component of PHYS 101, plus the PHYS 119 lab. Since this is no longer possible, we have now created a 1-credit PHYS 129 lab, which incorporates the material from the former honours lab PHYS 109 which didn't overlap with the PHYS 119 lab, plus some additional material. The PHYS 109 lab will no longer be offered.

First year physics and astronomy students take PHYS 117 (mechanics), PHYS 118 (E&M), and PHYS 119 (1-credit lab). The enriched track is PHYS 106 (mechanics), PHYS 108 (E&M lecture), and PHYS 119 (1-credit lab). Physics and astronomy degree students are encouraged but not required to take the PHYS 129 lab. Other science students usually take PHYS 131 (a range of topics). Engineering students take PHYS 157 (thermal physics and waves), PHYS 158 (E&M), PHYS 159 (1-credit lab), and PHYS 170 (engineering statics and dynamics).

All lecture courses were online-only for the 2020-21 academic year. The weight of final exams (with a variety of invigilation solutions) was reduced to either 5% or 30% of the course grade, whichever gives a student the higher grade. Students could also, after seeing their final grade, elect Credit/D/Fail grading, or Withdraw from the course.

Mechanics courses should not normally be mapped to new PHYS 131. Mechanics lecture courses with no lab component should map to PHYS 117. Mapping to PHYS 101 is deprecated, because it doesn't count toward a physics degree, and will be discontinued (although it will remain in the Calendar for a number of years). E&M lecture courses should map to PHYS 118 (and not the discontinued PHYS 102). If both terms of physics have a lab component, that should map to PHYS 119. A separate lab course should map to PHYS 119.

The physics courses for engineering students already had separate lab components, so there were no changes, and no need to change articulation.

Chemistry has created new course codes to split off lab components, but intends to go back to combined courses when that is possible. So presumably no articulation changes are required.

Tom Mattison
May 6, 2021

Erik Korolenko University Canada West erik.korolenko@ucanwest.ca

Information added at the meeting: Major news is that they have a new Vice President Academic and that there is a big expansion planned.



We acknowledge that the territories on which UCW and its campuses are situated are the traditional, ancestral and unceded territories of the xʷməθkʷəy̓əm (Musqueam), Skwxwú7mesh (Squamish) and Selílwitlh (Tseil-Waututh) Nations. We thank them for having cared for this land since time immemorial, honour their graciousness to the students who seek knowledge here, and iterate our dedication to valuing the ongoing contributions of Indigenous peoples and communities.

1. Institutional Update

- General

During COVID – 19, UCW has been experiencing a slight decrease in the student enrollment for some term but in general the total student enrollment at UCW is still climbing up gradually.

During COVID – 19, UCW transitioned to online delivery quickly with support from IT and Academic Department on the area of technology. With the establishment of Centre for Teaching Excellence, faculty are able to set up the discussion group in terms of the best practices in teaching pedagogy. Meanwhile, CTE has been continuously providing professional development training to faculty.

During 2020, UCW has been working hard on the student support program, which includes reformatting new student orientation, implementing Learning for Success Workshop, and building the micro-credential in the career development & learning success programs, etc.

At UCW, another campus – Vancouver House has now opened. Due to COVID, we have not had the opportunity to move in to our new location. The Vancouver House campus is located near the Granville Bridge and is a new feature for UCW.

- Budgets/Facilities

UCW has allocated a set up amount of budget to faculty who adopt OER textbooks for their course development. Meanwhile, there is budget allocated to faculty every year for their professional development and scholarly activities.

Vancouver House campus is now open, and we have increased the number of classrooms, dry labs and computer labs. Areas for student activities have also been increased in Vancouver House.

- Students/Enrollment

There has been a slight decrease in student enrollment associated with the conditions created by the COVID 19 pandemic. Though there has been a small decrease, the total population of students enrolled at UCW continues to increase gradually. We have also seen a slight increase in domestic students since over the last two years, since 2019.

Year	2019	2020	2021
Domestic	2.60%	2.74%	3.33%
International	97.40%	97.26%	96.67%

Physics classes enrollment:

Term	Summer 2020	Fall 2020	Winter 2021	Spring 2021
Enrollment	34	20	18	15

- Staffing

Dr. Cyndi Banks has been starting her position as the VPA at UCW since Feb 2020.

Dr. Aigerim Shilibekova has been appointed to the Manager of Online Learning since April 2020 to April 2021 and return to a FT faculty position at UCW.

Seyed-Reza Hosseinifar has been appointed to Director of CTE as of March 2021.

Meghan Barclay has been appointed as the Manager, Learning Success since January 2021.

Amy Hua has been promoted to the Director of Strategic Academic Planning since December 2020.

Christine Chan has been appointed as the Director of Student Affairs since March 2021.

- Instruction/Open Education Resources

Instruction of UCW courses have shifted to a blended online learning model necessitated by the COVID-19 pandemic. Personnel across departments have supported students and faculty make this change from a physical classroom, to a virtual one. We look forward to returning to campus when it is deemed safe to do so.

As mentioned above, UCW has been supporting faculty to transition to OER to students by providing faculty a stipend for the work associated with changing the main course texts. We have a committee under our Library department who are spearheading this initiative to incorporate OER in our courses.

2. Program/Course Update

- Curriculum Developments

For teaching Physics 101 at UCW, we have adopted an OER textbook: OpenStax College Physics, by P.P.Urone, R.Hinrichs, K.Dirks and M.Sharma. Jan. 25, 2021, downloadable for free at <https://openstax.org/details/books/College-Physics>

- Transfer Credit Applications or Alterations

No changes

- Issues

Laboratory work under pandemic has been limited to computer simulations. Students like the interactivity of the model simulations and the ability to try out various scenarios / sets of model parameters.

On January 12, 2021, Physics online simulations based on Adobe Flash were discontinued due to EOL of Adobe Flash Player <https://www.adobe.com/ca/products/flashplayer/end-of-life.html>. Online simulations carried out without Adobe Flash were unaffected.

- Research/Projects

We are developing laboratory experiments that use smartphone sensors (Physics Toolbox Suite) to collect real-time data on acceleration, sound pressure & frequency. These data are useful in experiments on harmonic pendulum, motion on an inclined plane, sound interference and beat tone generation.

We have used videos captured by smartphone to detect the moving pendulum in front of static background, extract the pendulum motion dynamics and create charts of pendulum acceleration, speed and position vs time.

3. Other Items of Interest

UCW is providing tutors to support students in Physics, Algebra and technical writing.

From the web page <https://www.ucanwest.ca/about/mission-goals>

University of the Fraser Valley

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Information added at the meeting: All the labs last year were face-to-face. Norm Taylor and Tim Cooper are retiring. They will be missed after many decades of service. There is a limited time appointment to replace them.



2021 Engineering & Physics/Astronomy Articulation Report

News:

- 1st calculus-based engineering & physics stream courses (PHYS 111/112) enrolments were down. A lot (from 311 to 243 on an annual basis). Which of course means that our calculus-based enrolments are now far below our historical high of around 400.
- Our algebra-based service course enrollments (ASTR 101/103/104, PHYS 100/101/105) were stable (247 to 235), which is good considering that we did not offer as many of them because running the labs was too onerous (extra set-up, extra cleaning, smaller lab sizes). The deferred courses were ASTR 103 & 104 and PHYS 100.
- 2nd year numbers were actually up quite a bit, from 60 to 80, but higher-level course numbers (3rd year and up) were down. A LOT. They went from 178 to 126. Online learning has clearly induced students to wait

until they can come back for F2F instruction. We just hope that they DO come back.

- Engineering Transfer enrolments are also down (from 94 to 75). Our Engineering Physics-Mechatronics Diploma enrolments also went 'way down (from 57 to 24). Our numbers were so low we changed many of our regularly-offered courses into directed study ones.
- We have a total of 10 graduates so far this year (down from 16), all but one a Majors degree.
- We have four (down from 17!) Engineering Physics/Mechatronics Diploma graduates.
- Still not much progress on our Engineering program proposal. Our Dean was supposed to prepare a report on the way forward before he retired. No sign of it yet. We did manage to update our Engineering Transfer Program (ETP) offerings along the approved provincial guidelines. They will be in place for this Fall – expect many articulation requests soon (if not in the system already).
- No change in regards to OpenStax texts - all of our first-year service courses still use them, but not our mainstream calculus-based courses. The user-friendly nature of Mastering Physics is very attractive to faculty, and (more importantly) student performance is adversely affected with an online text.
- Our administration has given us some guidance that we should try to have as much face-to-face (F2F) instruction as possible in the 1st and 2nd year courses as we try to build back those social networks. They would also like around 30% of UFV courses to be online. We don't plan on adding much to that total.

Other Notes:

- Our “lab-less” astronomy course (Astr 101) was a godsend in this pandemic, since we did not offer any other Astronomy courses (those with labs) at all.
- Learning outcomes relevant to indigenous people will be even more important going forward.
- Any changes as a result of COVID-19 are covered below.
 - o Courses with labs required complicated lab equipment, and so could not be done at home. We either cancelled these courses, or had MUCH smaller lab sections to accommodate social distancing, and had students working on their own, each in their own plastic bubble (see picture below). The labs were also generally shorter,

for data-taking only (and then doing the analysis at home and handing them in on Blackboard). The labs were cleaned between each class.

- We noticed that while the labs were shorter, the marking took much longer.
- Our first-year E&M course retained full-length 3-hour labs – we thought it would be just too difficult for students to learn how to set up circuits and use a DSO in a shorter length of time working on their own. We feel we were correct.
- We almost got to have some F2F final exams this semester, but then the third wave hit so we went back to online exams.
- We predict 2-3 years of remedial work to bring our students back to same pre-pandemic skill level.



University of Northern British Columbia

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Information added at the meeting: When classes resume face-to-face online labs will continue in some force. The videos that were made explaining how to do some problems will also continue to be used. There was evidence of a lot of online cheating.



University of Northern British Columbia Physics Department 2021

UNBC offers a full physics program, and no major curriculum changes were made during 2020 - 2021.

Program required changes in Engineering resulted in a substantial drop in enrolment in the second semester of calculus-based first-year physics in 2020 – 2021.

Lectures in all first-year courses were delivered asynchronously using pre-recorded videos. Scheduled lecture times were used for office hours and assignment solutions, Online labs were built around PhET, Simbucket, and Physics Aviary simulations and videos. Astronomy lectures were delivered synchronously using slides.

Upper-level labs, which were dropped more than ten years ago when the faculty was downsized, will be introduced in 2021 – 2022.

Also in 2021 – 2022, OpenStax texts will be used for calculus-based first-year physics.

Enrolment	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	% change
Physics 115 (physics 12)	68	74	71	59	63	+7
Physics 110/111 (calculus-based)	131	134	122	141	111	-21
Physics 100/101 (algebra-based)	172	200	189	172	165	-4
ASTR 120/121 (Astronomy)	39	37	57	43		
Physics 150 (Physics for Future Leaders)	10	10	not offered	12		
Second-Year (four-course total)	32	30	40	15		+140

Textbooks	2018-2019	2019-2020	2020-2021
Physics 115 (Physics 12)	<i>Physics</i> , Cutnell and Johnson	<i>Physics</i> , Cutnell and Johnson	<i>Physics</i> , Cutnell and Johnson
Physics 110/111 (calculus-based)	<i>Physics for Scientists and Engineers</i> , Serway and Jewett	<i>Physics for Scientists and Engineers</i> , Serway and Jewett	<i>Physics for Scientists and Engineers</i> , Serway and Jewett
Physics 100/101 (algebra-based)	<i>College Physics</i> , Serway and Vuille	<i>College Physics</i> , Serway and Vuille	<i>College Physics</i> , Serway and Vuille
ASTR 120/121 (Astronomy)	<i>Astronomy Today</i> , Chaisson and McMillan	<i>21st Century Astronomy</i> , Kay, Palen, and Blumenthal	<i>21st Century Astronomy</i> , Kay, Palen, and Blumenthal
Physics 150 (Physics for Future Leaders)	not offered	An Introduction to Physical Science, Shipman, Wilson, Higgins, Torre	not offered

George Jones

University of Victoria

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Information added at the meeting: They dove in and started using WeBWork for a homework system. Made all their own questions. There was a steep learning curve but what they made was much better than any commercial product out there and it was free to the students. The plan for when back face-to-face is that there will be one section of first year physics that is online but there will be a common face-to-face final exam.



UVic 1st and 2nd year PHYS and ASTR articulation report, May 2021

1st year PHYS:

There were no significant changes in our offerings this past year other than the pandemic-driven “fully online” move. We had many different models for lab delivery in first-year labs including having the students purchase kits, re-working the experimental program to be done with household equipment, and videotaping labs and providing the data. We’re reviewing which was most effective.

Our overall enrolment was up in the algebra-based stream and only slightly soft in the calculus-based streams. We had an exceptionally high drop rate in the calculus-based stream but ended up having about the same number of A & B students as usual going through the two-term sequence.

We are undertaking a comprehensive curriculum review. This review has been delayed by the pandemic. First-year offerings are not explicitly part of the review but our experience this past year means the idea of separating out a lab course is on the table. No changes for the upcoming year, but “watch this space”.

Courses offered:

PHYS 102A (first term) and 102B (second term) – An algebra-based survey of physics.

Normally offered Sept-April. *Formerly a two-term course PHYS 102.*

Primary Audience: Biology students

Text: Serway (algebra based, latest edition)

Enrolment: Initially around 500.

Final enrolment PHYS 102A:

Fall 2020: 563 ('19: 510'18: 519, '17: 473)

Final enrolment PHYS 102B:

Spring 2021: 465 ('20: 403, '19: 377, '18: 330)

Topics: Mechanics and energetics, oscillatory and wave motion, fluids, thermodynamics, electricity and magnetism, optics, modern physics

PHYS 110 (first term) and 111 (second term) – A calculus-based survey of physics

PHYS 110 offered Fall (Sept) and Spring (Jan)

PHYS 111 offered Spring (Jan) and Summer (May)

Primary Audience: Natural Science and Engineering students

Text: UVic locally-written text and supplements.

Enrolment: Initial (fall) enrolment peaks at 750-800

Final enrolment PHYS 110:

Fall 2020: 438 (19: 493, 18: 498, 17: 556, 16: 599, 15: 606, 14: 609, 13: 566)

Spring 2021: 196 (20: 144, 19: 144, 18: 156, 17: 162, 16: 154, 15: 159, 14:

134)

Summer 2021: 98 (unusual offering)

Final enrolment PHYS 111:

Spring 2021: 297 (20: 406, 19: 420, 18: 490, 17: 448, 16: 460, 15: 473, 14:

435)

Summer 2021: 129 (20: 68, 19: 61, '18: 77, '17: 71, '16: 84, '15: 87, '14: 73)

Fall 2021: (potential unusual offering)

Topics: As for 102, with limited content on fluids and electromagnetism

110 – Mechanics, conservation laws, electric and magnetic forces

111 – Thermodynamics, oscillatory and wave motion, optics, modern physics

PHYS 120 (first term) and 130 (second term) – Physics for Physicists and Astronomers

Normally offered Fall (120) and Spring (130)

Primary Audience: Prospective major/honours students

Text: Young and Freedman – University Physics with Modern Physics (latest edition)

Enrollment: Used to peak near 100

Final enrolment 120: 76 (19: 67, 18: 62, 17: 57, 16: 74, 15: 88, 14: 104, 13: 106, 12: 116)

Final enrolment 130: 57 (20: 57, 19: 48, 18: 42, 17: 49, 16: 58, 15: 68, 14: 72, 13: 66)

Topics: As for 102 omitting Electricity and Magnetism and Thermodynamics

120 – mechanics and special relativity

130 – rotational motion, oscillatory motion, waves, modern physics

2nd year PHYS:

The University of Victoria offers a number of second year Physics courses, four of which are common to all our undergraduate programs. Enrollment have been relatively stable for the past years.

We are currently piloting two courses at the second-year level

- Introduction to Medical Physics (2nd year offering)
- Introduction to Quantum Computing (1st year offering)

The change in instruction method in March means that it's hard to draw lessons about their success.

Courses offered:

PHYS 210 (also EOS 210) – Geophysics

Normally offered in the fall.

Primary Audience: PHYS/EOS combined program students

Text: Selections from several books, including Lillie – Whole Earth Geophysics

Enrolment: About 60 (20 as PHYS, 40 as EOS).

Enrolment: 2020: 47 (19: 65, 18: 56, 17: 62, 16: 32, 15: 51, 14: 54)

PHYS 215 – Introductory Quantum Physics

Normally offered in the spring.

Primary Audience: PHYS and ASTR major and honours students

Text: Varies depending on instructor, usually Thornton and Rex

Enrolment 2021:65 (20: 52, 19: 57, 18: 49, 17: 42, 16: 46, 15: 35, 14: 32)

PHYS 216 – Introductory Electricity and Magnetism

Normally offered in the fall – offered again this summer in compressed form.

Primary Audience: PHYS and ASTR major and honours students, and Engineers

Text: Excerpts from Young and Freedman – we are looking for a better text.

Enrolment 2020:58 (19: 57, 18: 75, 17: 72, 16: 64, 15: 67, 14: 53, 13: 54)

PHYS 248 – Computer Programming in Math and Physics

Normally offered in the spring.

Required in MATH effective 2016/17 year.

Required in PHYS effective 2017/18 year.

Primary Audience: PHYS, ASTR, and MATH major and honours students

Text: None standardized

This past year the course was offered twice, fall and spring. There are ongoing challenges associated with the cross-listing, and preliminary discussions of removing the cross-list.

Enrolment Term

PHYS

MATH

S2021	48	42
F2020	n/a	48
S2020	43	13
F2019	16	26
S2019	57	38
S2018	32	24
S2017	5	22
S2016	10	n/a
S2015	7	n/a

1st year ASTR:

The University of Victoria offers three 1st year Astronomy courses, two intended for non-majors and one that is the first course in our ASTR progression.

The number of sections of ASTR 101 and 102 offered has changed in response to the 2017 retirement of a long-serving staff member.

Courses offered:

ASTR 101 and 102 – Astronomy for non-specialists (101-Solar System, 102-Cosmology/Stars)

Primary Audience: General interest

Text: Varies depending on instructor

Enrolment: About 150-180/term in ASTR 101; About 100-120/term in ASTR 102. Summer offering about 60-80.

ASTR 150 – Concepts in Astronomy

Primary Audience: Astronomy major/honours students

Text: Varies depending on instructor

Normally offered in the spring.

Enrollment 2020: 60

(2020: 57, 19: 62, 18: 50, 17: 61, 16: 72, 15: 83, 14: 67)

2nd year ASTR:

The University of Victoria offers three second-year Astronomy courses, one intended for general interest, and two that form part of our ASTR program. ASTR 201 is a recently developed course.

Courses offered:

ASTR 201 – Search for Life in the Universe

Primary Audience: General interest

Text: Readings

Enrolment: 50-70.

Normally offered in the fall.

ASTR 250 – Introductory Astrophysics

Primary Audience: ASTR major/honours students

Text: Freedman and Kaufman - Universe

Enrolment: 2020: 25

(2019: 28, 18: 30, 17: 27, 16: 24, 15: 33, 14: 24, 13: 30)

Normally offered in the fall.

ASTR 255 – Planetary Science

Primary Audience: ASTR major/honours students

Text: Varies depending on instructor

Enrollment: 2021: 22

(2019: 13, 19: 18, 18: 9, 17: 15, 16: 11, 15: 10, 14: 11)

Normally offered in the spring.

This course is now being taught by a new faculty member specializing in exoplanets; there may be changes to this course reflecting his research interest.

Vancouver Community College

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Information provided at the meeting: Grades were about 20% higher than normal last year. Using Mastering Physics. Labs were a combination of videos and ioLabs.



Report to UT Physics and Astronomy Articulation 2021

We ran one section of the first half of our calculus-based 1st year physics (PHYS 1100) in fall 2020 which had 14 students. In winter 2020 we ran one section of the second half (PHYS 1200) with 17 students.

As mentioned back in 2017, Mechanics 1 (PHYS 1170) has been added to the engineering certificate at VCC. This course transfers to UBC as PHYS 170. This course was run with 9 students.

Vancouver Island University

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VANCOUVER ISLAND
U N I V E R S I T Y

Vancouver Island University Report 2021

General enrolment trends

Course	2020/21	2019/20	2018/19
PHYS 111	76	75	83
PHYS 112	61	50	51
PHYS 121	57	47	57
PHYS 122	45	24	43
ASTR 111/112/311/312	130	115	126

- The Life Science stream (PHYS 111/112) has been relatively steady
- The Calculus-based stream (PHYS 121/122) saw a rise in enrolment (returning to a more typical enrolment pattern)
- Both streams have improved retention from Fall to Spring than in previous years (it is unclear why at this point – assessments within the Physics courses have a consistent average grade to previous offerings). Further study is to be undertaken.
- Astronomy continues to offer two 1st year (solar system, stars & galaxies) & two 3rd year (cosmology, history). All four courses are well subscribed. As with last year, formal astronomical viewing sessions did not take place due to the pandemic.

Impact of the Pandemic

- SCIE 350 (Technologies for the Developing World) was not offered this past year due to the pandemic, and will be discontinued as the lead instructor is retiring at the end of this year. It will be replaced by SCIE 312 (Concepts of Relativity and Quantum Physics), which has been shown to have interdisciplinary interest.

- All courses within the Physics and Astronomy curriculum were offered synchronously and remotely.
- For the PHYS 111/112/121/121 labs, videos of the measurements were provided to students, from which they were required to conduct an analyze, make conclusions, and provide a report. Lab sessions were continued during their schedule time slots; instructors typically provided an introduction at the start of each session, and were available to answer any questions by students.
- Positive take-aways: Online submission of assignments and labs was received well by both instructors and students. This practice will likely continue beyond the pandemic. Students also appeared to be better aware of upcoming deadlines. It was also felt that the resources created will serve to complement activities when we return face-to-face, particularly for those students who are unable to attend class due to illness or other reasons.
- Negative: Many first-year students did not appear disciplined enough to watch and learn from videos. Demos were not nearly as effective as in person, and good test questions did not work as well with open book exams. A larger challenge was the general lack of engagement that some found within their classes, particularly as the term progressed. Most students had their screens off, and were largely passive. It also appeared that Zoom fatigue set in as the term progressed, and attendance within some classes dropped off.
- VIU is currently planning to be fully face-to-face with respect to its first-year Physics curriculum for the coming academic year. Astronomy courses will continue to be offered remotely in the Fall, with the possibility for face-to-face activities in the Spring.
- At the moment, we are not aware of specific budgetary impact on our offerings due to the pandemic. VIU's revenue is down approximately 8% in revenue, primary due to the loss of International tuition. Physics and Astronomy generally has not had high international student numbers, and so enrolment was not significantly impact; however, as international revenue tends to be broadly distributed, and it remains to be seen what the impact might be on non-core activities. As a department, we have been advised to be constrained over the next few years, and all departments in our Faculty have seen their supply budgets reduced by 25% for next year (excluding Engineering). New hires are not being excluded but their need has had increased scrutiny.
- It is expected that we will be using remote instruction for the Fall term, with the hope that we are back in-person by Spring. Various scheduling scenarios are being considered to mitigate that impact. Adaption of lab/project/team work to a remote instruction environment is being undertaken, such that this

work may be applied as additive to an in-person experience as much as possible.

Other activities

- The Extreme science show, offered annually to local K12 schools, is continuing this year in a modified form (<https://news.viu.ca/viu-faculty-take-popularextreme-science-show-online>) with the support of local engineering firms, and Engineers and Geoscientists of BC. Videos were created providing a series of demonstrations to students (with prizes); around 4700 students within the VIU's four feeder districts have been engaged.
- A Lightboard was built to allow for more interactive lecture sessions (<https://news.viu.ca/community-classroom/community-classroom-blog/brightidea-boosting-student-engagement>).
- Department / Program website has been re-vamped

Yukon University

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Information added at the meeting



Yukon College Articulation Report May 2021

From their webpage: <https://www.yukonu.ca/>

Acknowledging that we live and work in the traditional territory of the Kwanlin Dün First Nation and the Ta'an Kwäch'än Council.

<https://www.yukoncollege.yk.ca/>

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