

WORCESTER POLYTECHNIC INSTITUTE
April 16, 2020

To: The WPI Faculty
From: Tanja Dominko
Secretary of the Faculty

The eighth Faculty meeting of the 2019-2020 academic year will be held on **Thursday, April 16, 2020 at 3:15 pm via ZOOM.**

1. Call to Order
 - Approval of the Agenda
 - Approval of the Consent Agenda and the Minutes from 3-19-20
 - Approval of the Minutes from the Special Faculty meeting 3-27-20
2. Secretary of the Faculty Report
3. President's Report
4. Provost's Report
5. Committee Business

CTAF

- **Motion:** Extend probationary period for tenure track faculty

CAP and CGSR

- **Motion:** Course evaluations for D-term 2020

CGSR

- **Motion:** Grading policy of graduate students in D-term 2020
- **Motion:** Establish a graduate student commencement participation policy

COG and COAP

- **Motion:** That review of sabbatical leave be reviewed by department heads and the appropriate Dean prior to the request being sent to the Provost
- **Motion:** Clarify the wording in the Faculty Handbook related to years required for eligibility to take a sabbatical leave. Remove mention of one-term sabbatical leaves of absence, which are no longer available as of 2006
- **Motion:** Change the review process for requests for unpaid leaves of absence to parallel the process for requests for sabbatical leaves of absence
- **Motion:** Modify the procedure for providing feedback to faculty candidates who are denied promotion

CGSR

- **Motion:** Establish graduate program in Applied Physics
- **Motion:** Approve new courses for graduate program in Applied Physics

CAP

- **Motion:** Allow student pay during MQP/IQP projects

6. New Business
7. Closing Announcements
8. Adjournment

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WORCESTER POLYTECHNIC INSTITUTE
Faculty Meeting Minutes
March 19, 2020

Summary:

1. Call to Order
2. Approval of Consent Agenda and Minutes
3. Committee Business
4. SoF Report
5. President's Report
6. Provost's Report
7. Committee Business: COG: CAP/CAO: COG/COAP (4 motions for discussion only)
8. Adjournment

Detail:

1. Call to Order

The seventh Faculty meeting of the 2019-2020 academic year was called to order at 3:15pm via ZOOM by **Prof. Dominko (BBT)**. She reminded everyone that the meeting is being recorded for the purpose of accuracy in taking minutes.

2. Approval of Consent Agenda and Minutes of February 13, 2020

The agenda (including two additional motions) and consent agenda (including the minutes from the February 13, 2020 Faculty meeting) were approved.

3. Committee Business

COG

Prof. Gaudette (BME), for the Committee on Governance (COG), moved to allow synchronous remote voting at Faculty Meetings until the start of AY 2021. The process was explained:

- Zoom breakout rooms are used to facilitate voting
- All participants with TTT designation after their name will be “separated” from the rest to cast a vote
- Voting will be open for two minutes
- Please indicate your vote and click “submit”
- Upon completion, the outcome of the vote will be announced
- Non-TTT designated participants will rejoin the meeting

A question of anonymity in this voting process was raised and Prof. Gaudette explained that we can still do so, if needed, as is done in normal Faculty Meetings. Profs. Gaudette and Dominko stated that the start date for the new academic year referred to August 15th. **Ms. Beverage** explained that Yes/No function in Participant list would be used to express one's preference for or against the motion.

The motion passed.

COG

Prof. Gaudette (BME)c for the Committee on Governance (COG), moved that if a Faculty meeting cannot be convened in a timely manner for any reason Faculty Governance chairs, the

Secretary of the Faculty and the Committee on Governance will have the power to vote on critical issues until the start of AY 2021. The rationale was explained:

- Situations may arise where faculty approval is urgently needed, but even a “virtual” meeting cannot be convened
- A vote by a subset of faculty can provide an urgent decision
- The subset of Faculty:
 - Secretary of the Faculty
 - Faculty Governance Chairs
 - COAP, CTAF, CAO, CAP, CHB, CASL, CGSR, FAP, FRC, UOAC, CITP, FBC
 - Committee on Governance
- This endorsement expires at the start of AY 2021

Prof. Duddle (CEE) asked what constitutes a critical issue. Prof. Gaudette stated that any issues that are time sensitive may be critical. Prof. Dominko stated that these issues may include imminent decisions that would require input into an Administrative decision. She stated that it would be appropriate to have a group of 20 or so Faculty members on hand to convene, either by phone or ZOOM, to debate, discuss, and to make a decision in the best interest of the Faculty. She stated that this would only be in the case where it wouldn't be possible, physically or technologically, to convene a Faculty meeting.

Prof. Weekes (MA) made a friendly amendment that all elected members of the Faculty Governance system be allowed to participate and vote remotely and a quorum of at least 25% would need to be present. **Prof. Hanlan** (Parliamentarian) confirmed that 25% of voting faculty constitutes a quorum.

Prof. Martin (MA) made a friendly amendment that any such vote be revisited by the Faculty at the earliest possible convenience.

Prof. Billiar (BME) agrees with having a subset of Faculty available to advise the Administration but is not comfortable with them having voting privileges on behalf of the Faculty body. He stated that he is against this motion, and that it should be for advisory purposes only, not include voting privileges.

Prof. Heineman (CS) spoke in favor of the motion, being in affect from May 15 through August 15. He stated that it is hard to convene standard Faculty meetings in the summer, and that this is a good group of people, who have been elected and are willing to serve. He stated that decisions would have to be made about A term, which will be a challenge, and that we need to have something in place to allow a significant fraction of our Faculty to be involved in those discussions and to have a vote.

Prof. Spanagel (HUA) spoke in favor of the motion. He stated that if there is any way to streamline the expectations that consultation can contribute to good decision making for the college as a whole, then we should invest in those mechanisms that enable consultation to happen, rather than not happen I the concern about urgency.

A faculty member does not support the motion as written. He stated that it is challenging to narrow the criteria such that it doesn't become a default procedure for convenience. He suggested the attempt of holding a last-minute faculty meeting and using a quorum of those participating. He also suggested that the default be that Faculty get the opportunity to vote for every decision as usual, but to include a provision that if, for some reason, faculty cannot come together on short notice, that these decisions can still be made quickly.

Prof. Hansen (HUA) stated that he doesn't think this motion is time-sensitive to this meeting, that there are two more meetings before the period when this motion would take effect. He asked for consideration in tabling this motion and moving onto other motions requiring a vote today.

Prof. Hanlan (Parliamentarian) stated that the proper way to table a motion is to table to a time certain. He stated that the insidious way to kill a motion is simply to table.

A faculty member stated that nowadays it is very easy to get people together and obtain 25% (quorum) of the TT Faculty. He stated that this motion is unnecessary with current technology. Prof. Gaudette stated that the thought behind this motion was focusing on what may happen after May 1. He stated that there should be a mechanism in place now, for the Administration to go to right away. He also brought up the potential of having to call a special Faculty meeting every couple of weeks until the end of May.

Prof. Medich (PH) stated that this motion was very important and that it should be approved. He mentioned the biggest concern as having the need for meetings every couple of days, because of issues popping up on campus. He stated that it was easier to get a smaller group of people, who are elected representatives of the Faculty, and therefore incur the responsibility of doing what is best for the Faculty. He urged everyone to let them make the decision at the time of need, and then a meeting could be scheduled as soon as possible and the entire Faculty body could validate that decision later. A question was asked for an example of when this would be used. Profs. Gaudette and Dominko both shared thoughts that, if ZOOM were to suddenly go down, having a mechanism in place that could still convene a smaller group of elected faculty would be important.

Prof. Eddy (HUA) believes that it is important to pass this motion. She stated that we wouldn't want a decision to be made in an emergency with no Faculty input at all.

Prof. Bullock (HUA) agreed with Prof. Eddy. He stated that this is a unique situation and is strongly in favor of this motion.

Prof. Lou Roberts (BBT) spoke about boundary concerns of exactly when this motion could be used. He suggested calling a Faculty meeting with 24-hour notice and if there was no quorum, then put this motion into place. Prof. Gaudette stated that the concern is if there is need of a decision in less than 24 hours, and then this group would be able to accommodate the needs.

Prof. Weathers (BBT) spoke about all the juggling of technology that it takes to hold a ZOOM meeting that it is not an easy task but a monumental effort. She urged everyone to be reasonable

and practical about this, that it is a short-term emergency effort only. Also, a point was made if the internet ever went down, which she stated, with today's crisis, is a good possibility. Prof. Richman called the question. Calling the question was seconded, voted upon and passed. The amended motion passed.

4. Secretary of the Faculty Report

Prof. Dominko thanked, on behalf of Faculty Governance, all Faculty (TTT, NTT, Adjunct), along with support staff for banding together and helping each other. She stated that we are a good community, here for each other and here for students. She encouraged everyone to reach out to one another if in need.

Prof. Dominko welcomed newly elected members of Faculty Governance Committees:

- COG
 - **Len Albano** (CEE), 3-year term
- CTAF
 - **Constance Clark** (HUA), 4-year term
 - **Michael Timko** (CHE), 1-year term
- COAP
 - **Jeanine Skorinko** (SSPS) 3-year term
 - **Sarah Strauss** (IGSD) 3-year term

Professor Dominko updated everyone that the Confidentiality Policy has been modified and the reference to research data has been removed.

Prof. Dominko reported that CTAF would be working with the Provost, to forward recommendations to the President about the following issues:

- Accommodations for tenure track faculty
- Academic freedom
- Evaluation of D-term performance

She also reported that, because of this emergency situation, CAP would be working with the Provost regarding:

- Course evaluations and their use in evaluation of teaching

Prof. Dominko also highlighted the memo shared with the community by the President that prompted several questions from the community. She had forwarded questions to the President, and hopes that the President will address them in her report today.

- Campus Operations/Remote work
 - All of our employees, including our student workers, will be paid as usual for the rest of the academic year. In the unlikely event that this crisis extends far beyond

the end of the academic year we will be in touch with additional plans as they are made. Know that we are committed to doing all we can to ensure that our faculty, staff, and students come through this crisis together.

- All active academic and staff hiring will be paused with the exception of positions with offers made as of yesterday, March 17th. No further offers of employment should be made at this time.

5. President's Report

President Leshin expressed her deep appreciation for all the collaboration among faculty and staff under these most trying circumstances that we've faced in our careers. She stated that everyone is doing their very best for the institution, the students, community, employees and faculty. Everyone is working very long hours and she thanked everyone for all their hard work. She addressed some areas of yesterday's memo, with a couple of updates.

She talked about the 2 people associated with campus who were being tested for the virus, noting that one had come back with a negative finding. She was happy to let everyone know that the second person tested negative as well. She stated that as of now, we have no positive cases on campus, but that will change in the coming weeks, as more testing becomes available.

She talked about the importance of remote work, helping to stop an outbreak on campus, and minimizing that possibility to keep everyone safe. She spoke about the commitment to deliver the entire D term online. She stated that a few students remain on campus due to exceptional circumstances. She reported that campus technically remains open, with in-person services highly curtailed. There has been a strong recommendation that everyone who can work remotely does so and gets ready to do so for the long haul. We have not yet gone into an emergency posture where we say that only a very restricted number of people are allowed on campus. It is likely that we will have to go to that state at some point. This will be revisited tomorrow at the CERT meeting, and we will be in touch if that decision changes, with advance notice so individuals have time to prepare.

President Leshin wanted to assure everyone that everyone will get paid, which includes student workers, work-study students, hourly staff. She said that concerns were coming in regarding certain staff members who could not do their jobs remotely. She wants to take that worry away by letting everyone know that WPI is committed to pay everyone. The President stated that her commitment is to keep this family together, even though the long term outcome is uncertain. She assured everyone that nobody will be losing their jobs right now. WPI has closed the campus to visitors, and implemented a hiring pause. Her commitment is to this family, this team, this group of people, who WPI is currently employing, and they are trying to do everything they can to make sure we stay together as a team. One thing that we don't want to be doing is making commitments for future expenses, if we can possibly help it, until we see where this is going. She stated that, hopefully over the next weeks or months, we will be able to re-start hires, but for now the prudent thing to do is to pause them.

The President addressed the questions of revoking tenure. She stated that, that clearly was not the case at all. She reported that the Global Dean search is in fairly early stages of simply

reviewing candidates, though we will not be making a hire of that position while we are in a hiring pause. There was a question on how many new Faculty positions have been suspended. She believes there are some offers that have been made, but perhaps the Provost could answer that question. If there are any more questions about NTTs and A Term, they may need more time to work on that through Academic Affairs and she asked for a day or two and could cycle back on those details.

She emphasized that everyone should prepare themselves for a significant period of time without access to campus, so to prepare now (for lab work and teaching), though we are not in that state yet, but it could be coming within days' time.

She reported that accepted students' visit days will be virtual, so that Faculty may get a reach-out from Admissions or Marketing in the coming days or weeks asking for participation, and she urged everyone to find some time to help out with those virtual day visits. In the spirit of time for this meeting, Prof. Dominko suggested that individuals place their questions into the chat box, to be addressed at a later time by the President. In closing, President Leshin asked that everyone take care, time, and be good to themselves, and to take care of family members. She stated that she misses everyone and hopes to see all soon.

6. Provost's Report

To be able to address all the motions on today's agenda, Prof. Dominko asked the **Provost Soboyejo** to forgo his remarks and the Provost graciously agreed.

7. Committee Business

COG

Prof. Gaudette (BME) for the Committee on Governance (COG), moved for the WPI faculty to endorse the Administration's proposal to elevate the Aerospace Engineering Program to the status of an independent Aerospace Engineering department at WPI. (**Addendum #1** attached to these minutes.)

Prof. Gatsonis (ME) gave a presentation and description of the motion, reviewed the distinguished features of the proposal, administration of the Aerospace Engineering Department and External Outreach, resources that exist and have been committed, implementation and evaluation.

Prof. Wills (CS) asked about COG's thoughts on creating this department and implications for future proposals. Prof. Gaudette explained that COG evaluated the proposal received by the Provost. This proposal was evaluated independently, so as not to set any precedent in terms of how to form a department. He stated that the proposal included all information necessary (i.e. number of students, resources required, faculty involved, endorsement of the ME department).

A 15-minute extension of the meeting was moved, seconded and approved. Prof. Gaudette read a typed comment from **Prof Gennert** (CS), who stated that this proposal is a very strong case

and needs Faculty support, especially now when many universities are scrambling to survive, WPI is showing initiative.

The motion passed.

CAP/CAO

Prof. Heineman (CS), for the Committee on Academic Policy (CAP) and the Committee on Academic Operations (CAO), moved that the Undergraduate catalog section on Commencement Policy be modified. (**Addendum #2** attached to these minutes.)

Prof. Heineman gave a brief presentation on the existing policy, problems with the existing policy, and recommended changes to the policy. A question was asked about petitions to an NR grade in the course. Prof. Heineman explained that the motion states that there are no exceptions, meaning you cannot petition CAO, however a petition can always be submitted to the Dean of Undergraduate Students.

The motion passed.

COG/COAP - Discussion Only

Prof. Gaudette (BME), for the Committee on Governance (COG) introduced the motion (which will be discussed at today's meeting and voted upon at the next Faculty meeting) that review of sabbatical leave applications no longer be handled by COAP, but instead be reviewed by department heads (as currently done) and the appropriate Dean prior to the request being sent to the Provost.

Prof. Weathers (BBT), for the Committee on Appointments and Promotions (COAP), stated that COAP's major role in this process is to maintain a check list of items that are submitted with the application and then forward that list to the Provost.

Prof. Wills (CS) stated that this change makes more sense than the current process.

Prof. Aravind (PH) stated that this change was a good idea. Another comment was that this change is entirely appropriate. Another question was if anyone keeps track of the application vs. Approval statistics, and if they are made public. Prof. Weathers stated that that is not currently done, but that COAP has been discussing that in light of this potential process change.

COG/COAP - Discussion Only

Prof. Gaudette (BME), for the Committee on Governance (COG) introduced the motion (which will be discussed at today's meeting and voted upon at the next Faculty meeting) to clarify the wording in the Faculty Handbook related to years required for eligibility to take a sabbatical leave and remove mention of one-term sabbatical leaves of absence, which are no longer available as of 2006 by amending the Faculty Handbook.

Prof. Weathers (BBT), for the Committee on Appointments and Promotions (COAP), stated that the one-term sabbaticals haven't been offered since 2006 but that the Faculty Handbook just needed to be updated to reflect that. She also stated that the required years for eligibility needed to be clarified, that people could not come and go from WPI and have those years counted, unless that time is spent on regular faculty duties of spending a year as NFS, which would be acceptable.

A 10-minute extension of the meeting was moved, seconded and approved.

COG/COAP - Discussion Only

Prof. Gaudette (BME), for the Committee on Governance (COG) introduced the motion (which will be discussed at today's meeting and voted upon at the next Faculty meeting) to change the review process for requests for unpaid leaves of absence to parallel the process for requests for sabbatical leaves of absence by amending the Faculty Handbook. He stated that COAP is not currently involved in this process, and that it would take on a similar procedure to that of sabbatical leave requests.

COG/COAP - Discussion only

Prof. Gaudette (BME), for the Committee on Governance (COG), introduced the motion (which will be discussed at today's meeting and voted upon at the next Faculty meeting) that the procedures (described in the Faculty Handbook, Part Two, Section 1.D.2.5) for providing written feedback to the faculty candidates who have been denied promotion be modified so that the letter comes only from the Provost.

Prof. Gaudette explained that it was passed a few years ago that both COAP and the Provost would write and sign the letter to candidates who were denied promotion. Issues arose when COAP and the Provost disagree on the decision, so writing that letter could be difficult. Seeing the Provost has the final decision, the modification would make the letter come from the Provost only, being that the Provost is the deciding factor. Prof. Gaudette also stated that the Provost supports this change.

Prof. DeWinter (HUA) asked if this includes a letter to candidates who receive promotion, since this is a big evaluation moment. Prof. Weathers (BBT) stated that COAP writes a detailed letter to the Provost, which is co-written by the Nominator and Advocate in that promotion case. That information could be obtained from the Nominator/Advocate team, as well as from the Provost, however usually people don't ask for the commentaries in a positive decision, they are usually concerned with the negative decisions and the reasons behind it.

8. Adjournment

Meeting was adjourned at 5:00pm by **Prof. Dominko**.

Respectfully submitted,
Tanja Dominko
Secretary of the Faculty

Addenda on file with these minutes:

1. Addendum #1 COG - motion for the WPI faculty to endorse the Administration's proposal to elevate the Aerospace Engineering Program to the status of an independent Aerospace Engineering department at WPI – March 19, 2020.
2. Addendum #2 CAP/CAO - motion that the Undergraduate catalog section on Commencement Policy be modified – March 19, 2020.

WORCESTER POLYTECHNIC INSTITUTE
Special Faculty Meeting Minutes
March 27, 2020

Summary:

1. Call to Order
2. Approval of the Agenda
3. Committee Business: COG and CAP
4. New Business
5. Adjournment

Detail:

1. Call to Order

The first Special Faculty meeting of the 2019-2020 academic year was called to order at 4:00 pm via ZOOM by Prof. Dominko (BBT). She reminded everyone that the meeting is being recorded for the purpose of accuracy in taking minutes.

2. Approval of the Agenda

The agenda was approved.

3. Committee Business

Guidelines for Participation

The guidelines for participation in this meeting were reviewed by **Prof. Hanlan** (Parliamentarian). He stated that this meeting was called for by the presiding officer after consulting with CAP and COG. He also mentioned that Robert's Rules will still be followed, and everyone must be present in order to vote. The vote requires a majority to pass. Prof. Dominko added that anyone who is participating via their phone and cannot vote through the Zoom function should text their vote to Glenn Gaudette, whose number was provided.

COG and CAP

Prof. Heineman (CS) introduced the motion on behalf of CAP. The motion was to provide students with the option to receive a pass or NR grade for undergraduate course during D term.

He mentioned that CAP has received emails from multiple faculty members requesting that students be granted this grading option. This motion does not apply to IQP, PQP, MQP, or ISU students. This motion was brought together today in order to solve some issues now and allow CAP to focus on project work next week. The motion states that students will have the option until Thursday May 21st at 5:00 PM, which is after D term ends, to request that their grade be represented by traditional letter grading, or on the basis of P/NR. A grade of P, or pass, represents a letter grade of A/B/C and will count towards degree requirements. Faculty members will not have the ability to change grades from A/B/C to P or P to A/B/C; it is up to the student to request this change.

Prof. Spanagel (HUA) described a poll that he gave at the end of his lecture earlier that day. Approximately half of the students remained in the virtual classroom when the poll was given. This poll was used to gauge the opinion of students towards a pass/fail grading option for D

term. The options presented for the poll were: enthusiastically in favor of this policy, in favor of this grading option, not sure of feelings toward the grading option, have reservations about this policy, or completely against the grading policy. Out of the 25 students in the class, four were enthusiastically in favor of this policy, seven were in favor of it, five were not sure how they felt, one person had reservations about this policy, and eight students did not vote. Prof. Heineman responded to this data by providing some examples of other schools that are creating similar policies. Smith College is using a satisfactory/unsatisfactory grading policy where students can request letter grades in place of this grading method. Duke University is using a similar policy where all grades are S/U. MIT, CMU, and Lehman College are adopting similar grading policies. CMU is providing students with seven days after the semester ends to decide on a grading policy to use and Lehman College is allowing students 20 days to decide.

Prof. Dougherty (CS) mentioned that he is in favor of the motion but wanted to point out that some faculty may not have posted the grades by the May 21st deadline. Prof. Heineman mentioned that the deadline had been considered. The current May 21st deadline provides eight days from the end of the term for faculty to post grades and for students to choose their grading method. He stated that they tried to be as flexible as possible, but that the Registrar may be able to better speak on how late grades come in in D term.

Registrar Miles said that the majority of the grades do come in by the deadline, and any later grades do come in within a couple of days. She hopes that this is a good deadline, but also mentioned that students will probably have a good idea of the grade they are going to get. Registrar Miles hopes that this date holds due to the amount of processing that needs to take place after the grades come in. Faculty must submit grades by May 18th, so this deadline allows some room.

Dean McNeill (ECE) asked for clarification on the wording of the motion. The motion states that this applies to a course taken in D term, but also mentions that it applies to courses completed in D term. He was wondering what would happen if a student or Faculty member were to become ill and were not able to meet this deadline. Prof. Heineman stated that this student would receive an incomplete grade in this case. This student would still have to decide how to be graded by the deadline of May 21st and their grade would be changed after the course was completed. This hopefully would only happen in a small number of cases, if at all.

Prof. Weathers (BBT) asked if this would show up on banner when grades are submitted or if students would choose their options after faculty have already submitted grades on banner. Prof. Heineman stated that students may elect the P/NR option early in the term. This could mean that a P grade shows up when grades are submitted, or students could wait until after grades are submitted on banner to choose the grading policy to use. Prof. Weathers also asked how this would affect graduating seniors. Prof. Heineman stated that the P grade would still count towards degree requirements. Since there are not any degree requirements that state that a specific grade need to be met, this would not impact these requirements.

Prof. Michalson (ECE) stated that he is generally in support of the motion but asked what a P meant in terms of a GPA calculated by students. Prof. Heineman emphasized that WPI does not compute GPA's, but a P grade does not have any numeric equivalents. If a student is worried about how this may look to potential employers or schools, they would most likely choose to keep the letter grades. This may be for students who do not do as well as they had hoped and end with a C or even a B in a course. He also mentioned that this semester would be very easy to

explain to employers or schools in the future if students were concerned about the appearance of a P grade.

Prof. Cowlagi (ME) explained that he is in favor of this motion and understands the rationale behind it. He asked if we should offer similar considerations to graduate students. Prof. Heineman stated that CAP focused on undergraduate students only due to the pressing nature of the issue. He stated that this would be something CGSR would deal with. Prof. Gaudette added that most of the graduate courses are semester long courses and that CGSR is considering this factor.

Prof. Billiar (BME) stated that he is in support of this motion because it looks good that we are flexible and will reduce stress for some. He mentioned that he doesn't think that the date matters, but also does not think that many biomedical engineering students will use this option because they want a grade to contribute to their GPA. The NR option is already there for them to utilize if needed. One concern that he mentioned that students have is that they are worried about getting paired with a group member that is just trying to pass and is not willing to contribute as much. He asked what would happen for MQP. In these projects, there is not only a term grade, but also a project grade. Would these students get a passing grade for the term or their entire MQP? Prof. Heineman answered by saying that CAP will be meeting on Monday to discuss project work. This motion only effects actual courses, which does include ID 2050.

Prof. Elmes (FBS) asked if the committee considered flipping this and making the default pass/fail and allowing students to opt into getting a grade. Prof. Heineman said that after speaking with Mass Academy and ROTC students, it was discovered that they would be negatively affected if the courses were considered to be pass/fail. The ROTC students specifically would be negatively affected in terms of national ranking. This is the reason why CAP decided to present the motion as opt-in rather than opt-out.

Prof. Wyglinski (ECE) stated that he is in favor of this motion but is wondering how this may impact students on financial aid and scholarships. Does this impact the future eligibility? Prof. Heineman stated that this does impact Dean's List eligibility since four A's and 2 B's are required. This also impacts those on Academic Probation. Most of these policies work over entire semesters, but the impacts of this motion will be monitored and lessened when possible.

Prof. Yagoobi (ME) asked why a student with an A would change that to a P. Prof. Heineman stated that he would remind them not to. It is up to the discretion of the student to decide if they would like to utilize this option. **Prof. Yagoobi** also asked if this motion applies to undergraduate students who are taking graduate courses. Prof. Heineman stated that this does apply since they are undergraduates that will be completing a course in D term. The graduate students do not have the same option at this time, but they also typically have different grading procedures. Graduate students are graded using A/B/C/D/F whereas undergraduate students are graded in the same class using A/B/C/NR.

Prof. Gericke (CBC) brought up that there are some chemistry students that will receive incomplete grades for their lab courses and will finish them in A term. These could be handled on a case by case basis, but this is still a potential future issue. Prof. Heineman mentioned that robotics is in a similar situation and asked that as long as the academic work was completed in D term, then the petitions should be accepted.

Prof. Ambady (BME) asked if a NR could choose a P. Prof. Heineman stated that this was not an option. A NR grade remains the same, but a grade of A/B/C would become a P.

Prof. Ault (ME) stated that she is in favor of the motion, but since she is teaching a project-based course, she is worried about the impact on team dynamics. Prof. Heineman stated that he has done project-based work in the past where students have decided to NR the course. In this case, the work can be divided differently, and adjustments can be made. This is already something that happens at WPI. There is very little that instructors can do other than be as accommodating as possible.

Prof. Fischer (ME) wanted to mention that students should be aware of the implications of doing this. There are some programs such as BS/MS programs that may require a certain grade to double count credits. This is not a reason not to pass this motion but is something that faculty members should mention to students. Prof. Heineman provided a quote from ABET, “ABET understands the need for programs to temporarily modify program delivery methods in order to safeguard the communities during this health crisis. It is not necessary to report any short-term changes to the program delivery or content to us.” It seems like ABET is trying to be very adaptable to these circumstances.

Voting occurred at this time via ZOOM

The motion passed with a vote of 125 in favor to 1 opposed.

Prof. Dominko took this time to thank everyone involved including CAP, COG, Prof. Heineman, Sarah Miles, and everyone who has raised valid questions to help both CAP and COG navigate this important issue.

Prof. Richman (ME) thanked everyone involved as well as Sarah Miles for all her help.

Prof. Dougherty (CS) asked if there was something official that will be sent out to refer students to when they have questions. **Prof. Gaudette** stated that an email will be sent out that will hopefully have all details mentioned.

Provost Soboyejo thanked the faculty for voting in favor of this motion. He stated that it has been encouraging to see how the faculty has rallied around and pulled together votes through constructive discussion and engagement to create a solution to this potential anxiety-causing problem. He also stated that a joint email will be sent out to discuss this change. This email will be sent today to not only students, but also parents. He thanked both Prof. Heinricher and Registrar Miles.

Prof. Dominko took this time to share thoughts about her classes this term. She is teaching an undergraduate course as well as a continuation of a graduate course. Prof. Dominko did not realize how complex of a situation all the students are going to potentially find themselves in. They are back with families that rely on their support. These students are taking care of grandparents, helping look after younger siblings, helping keep family businesses running, helping their parents work remotely. There have been students that have had to leave sessions due to family emergencies. These students are not in a frame of mind or physical space in which the rigor or level of success that is normally expected and received can be met. They do not have the safety of the classroom or peers. This is going to take a lot of patience as well as understanding. This is all happening while many of us are still healthy; we do not know what two

weeks from now looks like. Prof. Dominko thanked everyone for what they are doing for the students as well as each other.

Prof. Gaudette thanked Prof. Dominko for all her hard work and efforts around this motion. He asked for the email announcing the change to the grading policy to mention that all of the faculty discussed this together. He applauded everyone for not only working to get their courses online, but also for all their efforts towards donating PPE and making masks. He wants the students to understand that faculty members not only care about the students understanding of material and their grades, but also that they care about them as people and care about their safety.

4. New Business

There was no new business.

5. Adjournment

Meeting was adjourned at 4:45pm by **Prof. Dominko**.

Respectfully submitted,

Tanja Dominko
Secretary of the Faculty

Consent Agenda Motions

CAO Change distribution requirements for B.S. Degree in Civil Engineering
CAO Change the descriptions for all Air Force and Aerospace Studies Courses
CAO Add a Minor in Fire Protection Engineering

CGSR Add new Graduate Certificate in Biomanufacturing
CGSR Add CH 542: Drugs in the Brain
CGSR Add CH 546: Natural Product Isolation and Analysis
CGSR Add CH 545: Plant Natural Products
CGSR Add Annual review process for all graduate IMGD programs
CGSR Add CS 547/DS 547: Information Retrieval
CGSR Update and rename FBS Information Security Management graduate certificate
CGSR Eliminate Mathematics Requirement in CS Ph.D. Program
CGSR Systematize and streamline the double counting of BS/MS credits in the Data Science
CGSR Modify Data Science Ph.D. degree requirements
CGSR Change the course description for RBE 500: Foundations of Robotics
CGSR Revise Double-Counting of Undergraduate Courses for CHE BS/MS Program

Date: April 16, 2020

To: WPI Faculty

From: Committee on Academic Operations (Prof. Mathisen, Chair)

Re: Motion to change distribution requirements for B.S. Degree in Civil Engineering, approved by Department of Civil and Environmental Engineering on April 7, 2020

Motion: The Committee on Academic Operation recommends and I move, that the distribution requirements for the B.S. Degree in Civil Engineering be modified as described below.

Existing Distribution Requirements:

REQUIREMENTS	MINIMUM UNITS
1. Mathematics and Basic Science (Notes 1, 2).	4
2. Engineering Science and Design (including the MQP) (Note 3, 4, 5, 6).	6

NOTES:

1. Mathematics must include differential and integral calculus, differential equations, and probability and statistics.
2. Must include at least one course in physics, two courses in chemistry, and one course in an additional science area.
3. A minimum of 4 units of work must be within the Civil Engineering area. All CE courses including the MQP, ES 2503, ES 2800, and ES 3004 are acceptable within the Civil Engineering area.
4. The curriculum must include at least one engineering science course outside the major discipline area. Courses acceptable to satisfy the requirement of outside-of-discipline course are those taught in other engineering departments. The course must be 2000-level or above and cannot include ES 2501, ES 2502, ES 2503, ES 2800, and ES 3004.
5. All students are required to include an appropriate laboratory experience as part of their overall program. This experience can be met by the completion of two undergraduate CE lab courses, selected from among the following: CE 2020, CE 3024, CE 3026, CE 4054, and CE 4060. Alternately, an appropriate laboratory experience could also be accomplished by a student through careful planning of course, project and laboratory work and approval by petition through the Department Program Review Committee.
6. Must include 1/3 unit of Capstone Design Experience, and 4/3 units from the following list of Civil Engineering courses: CE 2020, CE 3010, CE 3020, CE 3041, CE 3050, CE 3059, and CE 3062.

Proposed Distribution Requirements:

(please see Rationale for description of changes – existing notes 1 and 2 are combined into proposed note 1 with one clarification; existing notes 3-6 are replaced by proposed note 2)

REQUIREMENTS	MINIMUM UNITS
1. Mathematics and Basic Science (Note 1).	4
2. Engineering Science and Design (including the MQP) (Note 2).	6

NOTES:

1. Mathematics and Basic Science
 - a. Must include differential and integral calculus, differential equations, probability, and statistics.
 - b. Must include at least 1/3 unit in physics, 2/3 unit in chemistry, and 1/3 unit in an additional science area.
2. Engineering Science and Design
 - a. 6/3 units Fundamental Engineering Science
 - i. Must include 2/3 units in solid mechanics, 1/3 unit in soil mechanics, and 1/3 unit in fluid mechanics (fulfilled by CE 2000 (or ES 2501), CE 2001 (or ES 2502), CE 3041, ES 3004).
 - ii. Must include 2/3 units of engineering science from the following list: CE 2002, ES 2001, ES 2503, ES 2800, ES 3001, ES 3002.
 - b. 12/3 units Civil Engineering
 - i. Must include 4/3 units in Core Civil Engineering, including Structural Engineering, Transportation Engineering, Project Management, and Environmental Engineering (fulfilled by CE 3010, CE 3020, CE 3050, CE 3059).
 - ii. Must include 3/3 units of civil engineering depth courses at the 3000-level or above, fulfilled by all CE courses not listed in other notes and with at least 2/3 unit from within one sub-discipline of CE.
 - iii. Must include 2/3 units of civil engineering laboratory experience fulfilled by: CE 2020, CE 3026, CE 4054, CE 4060.
 - iv. Must include 1 unit of MQP, including 1/3 unit of capstone design.

CIVIL ENGINEERING PROGRAM CHART
Course Recommendations

STUDENTS EARNING AN ABET-ACCREDITED B.S. DEGREE IN CIVIL ENGINEERING MUST COMPLETE 15 UNITS OF STUDY, DISTRIBUTED AS FOLLOWS:

UNIVERSITY REQUIREMENTS (4 units)			
Humanities and Arts	Interactive Qualifying Project	Social Sciences	Physical Education
2 units	1 unit	2/3 unit	1/3 unit
See WPI Requirements			

FREE ELECTIVES (1 unit)
Free Electives
1 unit
Students are encouraged to consider additional CE courses (e.g., CE 1030, CE 3030, CE breadth) or other engineering courses.

MATHEMATICS AND BASIC SCIENCE (4 units)							
Differential & Integral Calculus	Differential Equations	Statistics	Probability	Chemistry	Physics	Additional Science	Math/Science Elective
4/3 unit	1/3 unit	1/3 unit	1/3 unit	2/3 unit	1/3 unit	1/3 unit	1/3 unit
MA 1020/1021 MA 1120/1022 MA 1023 MA 1024	MA 2051	MA 2611	MA 2621	CH 1010 CH 1020	PH 1110/1111	GE or BB	MA, CH, PH, GE, or BB

ENGINEERING SCIENCE AND DESIGN (6 units)					
Fundamental Engineering Science		Core CE		Labs	MQP
4/3 unit		2/3 unit		2/3 unit	1 unit
CE 2000 (or ES 2501)	CE 2001 (or ES 2502)	CE 3041	ES 3004	CE 2020 CE 3026 CE 4054 CE 4060	Including 1/3 unit capstone design
CE 2002	ES 2001	CE 3020	CE 3050	CE 3059	
ES 2503	ES 2800	ES 3001	ES 3002		

CE Depth			
3/3 unit (at least 2/3 unit from one sub-discipline)			
<u>Structural and Geotechnical Engineering</u>	<u>Environmental Engineering and Water Resources</u>	<u>Transportation Engineering and Development</u>	<u>Construction Engineering and Project Management</u>
CE 3006	CE 3060	CE 3031	CE 3022
CE 3008	CE 3061	CE 3051	CE 3025
CE 3031	CE 3062	CE 3070	CE 3031
CE 3044	CE 3074	CE 3074	CE 3044
CE 4007	CE 4061	CE 4061	
CE 4017	CE/CHE 4063	CE 4071	
	CE 4600		

Note: The courses in the above chart can be replaced by other equivalent courses, with the approval of the CE program.

Rationale:

The following changes are proposed. These changes are intended to maintain flexibility in the curriculum while also providing structure to students as they plan their course selections.

Math and Basic Science

Existing notes 1-2, proposed note 1: The only change is to replace "...and probability and statistics" to "...probability, and statistics" to clarify that these are two separate topics, and thus two separate classes.

Engineering Science and Design

Existing notes 3-6, proposed note 2: The entirety of notes 3-6 is deleted and replaced with proposed note 2 as described below.

Fundamental Engineering Science:

The existing CE curriculum does not have a formal requirement for engineering science courses, and fundamental engineering science concepts are being skipped by some students. The American Society of Civil Engineering Body of Knowledge identifies mechanics, including solid and fluid mechanics, as fundamental to CE. Data from the past three years of graduates shows that over 90% of CE graduates take solid mechanics; however, only 60-75% complete fluid mechanics. Percentages less than 100% can be problematic in ABET reviews. In addition, there are other engineering science concepts that are necessary for upper level CE courses, such as soil mechanics.

Therefore, the proposed distribution requirements require 4/3 unit of solid, fluid, and soil mechanics (fulfilled by CE 2000/ES 2501, CE 2001/ES 2502, ES 3004, and CE 3041, or equivalent); and require an additional 2/3 unit of engineering science courses. This will provide students with structure for developing their sophomore schedule, and provide an increased knowledge base for upper level courses. This allocation of courses will also better prepare students for the fundamentals of engineering (FE) exam. Lastly, the department proposes to drop the requirement for an "out of department" course, which confused students as some ES courses were considered within and some outside of CE.

Core CE:

The ABET program specific criteria for CE programs includes the following: “analyze and solve problems in at least four technical areas appropriate to civil engineering...”. The existing curriculum (existing note 6) has students pick 4/3 units from a list of CE 2020, CE 3010, CE 3020, CE 3041, CE 3050, CE 3059, and CE 3062. However, this list would allow students to take a set of courses that does not meet ABET requirements. (For example, a student could take 2 environmental courses, 1 surveying lab course, and one other area.)

The proposed curriculum requires students to take courses in areas that have been identified as critical to a CE program - providing concepts in structural engineering, project management, transportation engineering, and environmental engineering. These requirements can be met by: CE 3010, CE 3020, CE 3050, and CE 3059. This meets ABET requirements and ensures that all students have completed a core set of courses.

Labs

The ABET program specific criteria for CE programs includes the following: “conduct experiments in at least two technical areas of civil engineering and analyze and interpret the resulting data; ...”. Students can satisfy the existing requirements (Note 5) with lab courses in only technical area. Note 2.b.iii. in the proposed requirements ensures that students will complete lab courses in two separate technical areas.

MQP

There is no change to the MQP requirement or capstone requirement (existing note 6 includes language on the capstone requirement and some required courses; proposed note 2f puts MQP and capstone together for clarity).

CE Depth

The existing curriculum does not have a depth requirement per se (it has a unit requirement in CE). The proposed curriculum requires 3/3 unit at the 3000+ level with at least 2/3 unit within one sub-discipline. Considering the core, depth, and laboratory requirements, students will have a minimum of 3/3 units to 4/3 units within one sub-discipline, and can have 5/3 units in one sub-area if they choose to take 3/3 unit within one sub-discipline. Alternatively, students can choose to get additional breadth.

Impact

Minor population increases are expected for the 4 required fundamental engineering science courses and the 4 core CE courses. The ES courses are taught campus wide in multiple terms, and thus no significant impact is expected. The CE core courses have had variable populations over the past decade (e.g., CE 3059 has had as few as 35 and as many as 70), and thus can accommodate a range of populations.

An example four-year plan (for a student interested in structural and geotechnical engineering) could be as follows, not including physical education and assuming no AP credit:

A Term	B Term	C Term	D Term
MA 1021 CH 1010 HUA	MA 1022 CH 1020 HUA	MA 1023 PH 1110 HUA	MA 1024 HUA SS
MA 2051 HUA CE 2000 (ES required)	MA 2611 CE 2001 (ES required) ES 3004 (ES required)	GE 2341 (Ma/Sci elective) ES Elective HUA Seminar/Practicum	MA 2621 ES Elective CE 3010 (core)
CE 3020 (core) CE 3059 (core) CE 2020 (lab)	CE 3050 (core) CE 3041 (ES required) CE 3008 (depth)	ID 2050 (SS) CE 3026 (lab) CE 3006 (depth)	IQP Off Campus IQP Off Campus IQP Off Campus
MQP BB (additional science) (free: beyond 15 units) PE: 1/12 unit)	MQP Free elective (free: beyond 15 units) (PE: 1/12 unit)	MQP (incl. capstone) Free elective (free: beyond 15 units) (PE: 1/12 unit)	CE 3044 (depth) (free: beyond 15 units) (PE: 1/12 unit)

Implementation Date: Implementation date for this action is the ~~2021-2022~~ 2020-2021 Academic year.

Date: April 16, 2020

To: WPI Faculty

From: Committee on Academic Operations (Prof. Mathisen, Chair)

Re: Motion to change the descriptions for all Air Force and Aerospace Studies Courses [AS1001, AS1002, AS1003, AS1004, AS2001, AS2002, AS2003, AS2004, AS3001, AS3002, AS3003, AS3004, AS4001, AS4002, AS4003, AS4004] approved by Lt Col Jack Skiles, Department Head, Air Force & Aerospace Studies on 3/26/20.

Motion: The Committee on Academic Operations recommends and I move, that the descriptions for all Air Force and Aerospace Studies Courses [AS1001, AS1002, AS1003, AS1004, AS2001, AS2002, AS2003, AS2004, AS3001, AS3002, AS3003, AS3004, AS4001, AS4002, AS4003, AS4004] be changed as described below.

Rationale:

The descriptions of the listed classes have been changed to accurately reflect the content of the subject matter being taught.

All the curriculum that is taught by every AFROTC detachment across the country is produced and provided by the Air University part of the Holm Center at Maxwell Air Force Base in Alabama. Air University is responsible for all of the United States Professional Military Education which includes Air Force ROTC, Officer Training School, the Air Force Academy and so on.

Every couple of years Air University, through Head Quarters AFROTC, pushes out updates to their curricula to every detachment across the country. Once we receive the updated curriculum we are directed and expected to teach that curriculum immediately. The curriculum we are asking to be updated in the course catalogue is what we just received and will be required to teach starting next year. Also, this is not unique to WPI and Detachment 340, this is an enterprise-wide issue; every university and detachment have similar discussions ongoing.

Proposed (New) course titles and descriptions:

AS 1001 - Heritage and Values I (General Military Course)

Cat. I (1/9 unit) The AS 1000 sequence of courses are survey courses designed to introduce students to the U.S. Air Force and Air Force Reserve Officer Training Corps. Featured topics include mission and organization of the Air Force, officership and professionalism, military customs and courtesies, and Air Force officer career opportunities. Leadership Laboratory is mandatory for Air Force ROTC cadets and complements this course by providing cadets with followership experiences. Leadership Laboratory is mandatory for AFROTC cadets and complements this course by providing cadets with followership experiences.

AS 1002 - Heritage and Values II (General Military Course)

Cat. I (1/9 unit) Continuation of AS1001. Topics include Air Force core values, leadership principles, group leadership dynamics, and an introduction to communication skills. Leadership Laboratory is mandatory for AFROTC cadets and complements this course by providing cadets with followership experiences.

AS 1003 - Heritage and Values III (General Military Course)

Cat. I (1/9 unit) Continuation of AS1002. Topics include Air Force core values, leadership principles, group leadership dynamics, and an introduction to communication skills. Leadership Laboratory is mandatory for AFROTC cadets and complements this course by providing cadets with followership experiences.

AS 1004 - Heritage and Values IV (General Military Course)

Cat. I (1/9 unit) Continuation of AS1003. Topics include Air Force core values, leadership principles, group leadership dynamics, and an introduction to communication skills. Leadership Laboratory is mandatory for AFROTC cadets and complements this course by providing cadets with followership experiences.

AS 2001 - Team and Leadership Fundamentals I (General Military Course)

Cat. I (1/9 unit) The AS 2000 sequence of courses are designed to provide a fundamental understanding of both leadership and team building. The lessons and course flow are designed to prepare cadets for field training and leadership positions in the detachment. In addition, the students will continue to discuss the importance of the Air Force core values through the use of operational examples and historical Air Force leaders, and will continue to develop their communication skills. Leadership Laboratory is mandatory for AFROTC cadets and complements this course by providing cadets with followership experiences.

AS2002 - Team and Leadership Fundamentals II (General Military Course)

Cat. I (1/9 unit) Continuation of AS2001. Topics include full-range leadership, problem solving, motivation, and continued development of communication skills. Leadership Laboratory is mandatory for AFROTC cadets and complements this course by providing cadets with followership experiences.

AS2003 - Team and Leadership Fundamentals III (General Military Course)

Cat. I (1/9 unit) Continuation of AS2002. Topics include team building, Human Relations, conflict management, and continued development of communication skills. Leadership Laboratory is mandatory for AFROTC cadets and complements this course by providing cadets with followership experiences.

AS2004 - Team and Leadership Fundamentals IV (General Military Course)

Cat. I (1/9 unit) Continuation of AS2003. Topics include ethical decision making, stress management, leadership capstone, and continued development of communication skills. Leadership Laboratory is mandatory for AFROTC cadets and complements this course by providing cadets with followership experiences.

AS3001 - Leading People and Effective Communication I (Professional Officer Course)

Cat. I (1/6 unit) The AS 3000 sequence of courses is a study utilizes cadet's field training experience to take a more in-depth look at leadership. Special emphasis is placed on enhancing communication skills, and why that is important as a leader. Cadets have an opportunity to try out these leadership and management techniques in a supervised environment as juniors and seniors. A mandatory Leadership Laboratory complements this course by providing advanced

leadership experience in officer-type activities, giving students the opportunity to apply the leadership and management principles of this course.

AS3002 - Leading People and Effective Communication II (Professional Officer Course)

Cat. I (1/6 unit) Continuation of AS3001. Topics include, Bias, Managing Diversity & Inclusion, Cross-Cultural Competence, Managing Competing Priorities, and continued development of communication and leadership skills. A mandatory Leadership Laboratory complements this course by providing advanced leadership experience in officer-type activities, giving students the opportunity to apply the leadership and management principles of this course.

AS3003 - Leading People and Effective Communication III (Professional Officer Course)

Cat. I (1/6 unit) Continuation of AS3002. Topics include, Leadership theory, mentoring, Professionalism is a Decision, Ethical Decision-Making: Boundaries, Self-Awareness, and continued development of communication and leadership skills. A mandatory Leadership Laboratory complements this course by providing advanced leadership experience in officer-type activities, giving students the opportunity to apply the leadership and management principles of this course.

AS3004 - Leading People and Effective Communication IV (Professional Officer Course)

Cat. I (1/6 unit) Continuation of AS3003. Topics include, Creating a Vision, Organizational Climate, Establishing Expectations, Theory and innovation, and continued development of communication and leadership skills. A mandatory Leadership Laboratory complements this course by providing advanced leadership experience in officer-type activities, giving students the opportunity to apply the leadership and management principles of this course.

AS4001 - National Security/Commissioning Preparation I (Professional Officer Course)

Cat. I (1/6 unit) The AS 4000 sequence of courses is designed for college seniors and gives them the foundation to understand their role as military officers and how they are directly tied to our National Security Strategy. It is an overview of the complex social and political issues facing the military profession and requires a measure of sophistication commensurate with the senior college level. A mandatory Leadership Laboratory complements this course by providing advanced leadership experience in officer-type activities, giving students the opportunity to apply the leadership and management principles of this course.

AS4002 - National Security/Commissioning Preparation II (Professional Officer Course)

Cat. I (1/6 unit) Continuation of AS4001. Topics include, Air Force Domains, The Total Force, Defense Support of Civil Authority, Law of War, How the Air Force Deploys, Global Hot Spots, and continued emphasis is given to the refinement of communication and leadership skills. A mandatory Leadership Laboratory complements this course by providing advanced leadership experience in officer-type activities, giving students the opportunity to apply the leadership and management principles of this course.

AS4003 - National Security/Commissioning Preparation III (Professional Officer Course)

Cat. I (1/6 unit) Continuation of AS4002. Topics include, Base Agencies, Professional/Unprofessional Relationships, Leadership Authority and Responsibility, Religious Accommodation, Suicide Prevention, Military Justice, and continued emphasis is given to the

refinement of communication and leadership skills. A mandatory Leadership Laboratory complements this course by providing advanced leadership experience in officer-type activities, giving students the opportunity to apply the leadership and management principles of this course.

AS4004 - National Security/Commissioning Preparation IV (Professional Officer Course)

Cat. I (1/6 unit) Continuation of AS4003. Topics include, Corrective Supervision and Counseling, Blended Retirement System, Enlisted and Officer Evaluation systems, Pay, Allowances and leave, Career Progression, the Oath of Office, and continued emphasis is given to the refinement of communication and leadership skills. A mandatory Leadership Laboratory complements this course by providing advanced leadership experience in officer-type activities, giving students the opportunity to apply the leadership and management principles of this course.

Current course titles and descriptions:

AS 1001. THE FOUNDATIONS OF THE UNITED STATES AIR FORCE I.

Cat. I (1/9 unit)

The AS 1000 sequence of courses are designed to introduce students to the United States Air Force and Air Force Reserve Officer Training Corps. Featured topics include mission and organization of the Air Force, officership and professionalism, Air Force officer opportunities, military customs and courtesies, and an introduction to communication skills.

The first course focuses on the foundation of officership and customs and courtesies.

The course includes one hour of class work and two hours of mandatory leadership laboratory per week. The AS 1001 Leadership Laboratory includes a study of Air Force customs and courtesies, drill and ceremonies, and military commands.

AS 1002. THE FOUNDATIONS OF THE UNITED STATES AIR FORCE II.

Cat. I (1/9 unit)

The AS 1000 sequence of courses are designed to introduce students to the United States Air Force and Air Force Reserve Officer Training Corps.

A continuation of AS 1001, the second course in this series emphasizes those communication skills needed in today's Air Force. It describes the communication systems as well as discusses common barriers and enhancements to effective communications. The course includes numerous speaking and written exercises using current Air Force topics.

The course includes one hour of class work and two hours of mandatory leadership laboratory per week. The AS 1002 Leadership Laboratory includes a study of Air Force customs and courtesies, drill and ceremonies, and military commands.

AS 1003. THE FOUNDATIONS OF THE UNITED STATES AIR FORCE III.

Cat. I (1/9 unit)

The AS 1000 sequence of courses are designed to introduce students to the United States Air Force and Air Force Reserve Officer Training Corps.

A continuation of AS 1002, the course outlines the origin of the Air Force and the organizational structure of the Air Force with a focus on the missions of select military organizations. The basic history of the United States military is studied in order to appreciate how military history impacts the Air Force today. Written and oral communication skills are practiced. The course includes one hour of class work and two hours of mandatory leadership laboratory per week. The AS

1003 Leadership Laboratory includes a study of Air Force customs and courtesies, drill and ceremonies, and military commands.

AS 1004. THE FOUNDATIONS OF THE UNITED STATES AIR FORCE IV.

Cat. I (1/9 unit)

The AS 1000 sequence of courses are designed to introduced students to the United States Air Force and Air Force Reserve Officer Training Corps. The final course in the AS 1000 sequence, it introduces students to the Air Force installation and her sister services. Written and oral communication skills are practiced. The course includes one hour of class work and two hours of mandatory leadership laboratory per week. The AS 1004 Leadership Laboratory includes a study of Air Force customs and courtesies, drill and ceremonies, and military commands.

AS 2001. THE EVOLUTION OF USAF AIR AND SPACE POWER I.

Cat. I (1/9 unit)

The AS 2000 sequence of courses are designed to examine general aspects of air and space power through a historical perspective. Utilizing this perspective, the course covers a time period from the first balloons and dirigibles to the space-age global positioning systems of the Persian Gulf War. Historical examples are provided to extrapolate the development of Air Force capabilities (competencies), and missions (functions) to demonstrate the evolution of what has become today's USAF air and space power. As a whole, the AS 2000 sequence of courses provides the student with a knowledge level understanding for the general element and employment of air and space power.

The first course covers the factors leading to the early development of air power through the use of air power during World War II. The development of oral and written communication skills is continued from the AS 1000 classes. The course includes one hour of class work and two hours of mandatory leadership laboratory per week. The AS 2001 Leadership Laboratory continues a study of Air Force customs and courtesies, drill and ceremonies, military commands, and preparation for Field Training.

AS 2002. THE EVOLUTION OF USAF AIR AND SPACE POWER II.

Cat. I (1/9 unit)

The AS 2000 sequence of courses are designed to examine general aspects of air and space power through a historical perspective. The second course in the series continues with the development of air power from World War II through the development of the Intercontinental Ballistic Missile.

The course includes one hour of class work and two hours of mandatory leadership laboratory per week. The AS 2002 Leadership Laboratory continues a study of Air Force customs and courtesies, drill and ceremonies, military commands, and preparation for field training.

AS 2003. THE EVOLUTION OF USAF AIR AND SPACE POWER III.

Cat. I (1/9 unit)

The AS 2000 sequence of courses are designed to examine general aspects of air and space power through a historical perspective. The third course in the series begins with a study of air power in the Vietnam war through the Gulf war. Oral and written communications skills will be practiced.

The course includes one hour of class work and two hours of mandatory leadership laboratory per week. The AS 2003 Leadership Laboratory continues a study of Air Force customs and courtesies, drill and ceremonies, military commands, and preparation for field training.

AS 2004. THE EVOLUTION OF USAF AIR AND SPACE POWER IV.

Cat. I (1/9 unit)

The AS 2000 sequence of courses are designed to examine general aspects of air and space power through a historical perspective. The course examines several fundamental truths associated with war in the third dimension: e.g. Principles of War and Tenets of Air and Space Power. As a whole, this course provides the students with a knowledge level understanding for the general element and employment of air and space power from an institutional, doctrinal and historical perspective. In addition, the students will continue to discuss the importance of the Air Force Core Values with the use of operational examples and historical Air Force leaders and will continue to develop their communication skills. The final course in the series explores the future of the Air Force through 2025. The course includes one hour of class work and two hours of mandatory leadership laboratory per week. The AS 2004 Leadership Laboratory continues a study of Air Force customs and courtesies, drill and ceremonies, military commands, and preparation for field training.

AS 3001. AIR FORCE LEADERSHIP STUDIES I.

Cat. I (1/6 unit)

The AS 3000 sequence of courses is a study of leadership, management fundamentals, professional knowledge, Air Force personnel and evaluation systems, leadership ethics, and communication skills required of an Air Force junior officer. Throughout the courses, case studies are used to examine Air Force leadership and management situations as a means of demonstrating and exercising practical application of concepts being studied. The first course explores different styles of leadership, followership, and management functions. The course includes three hours of class work and three hours of mandatory leadership laboratory per week. The AS 3001 Leadership Laboratory complements the classroom work by providing advanced leadership experiences in officer-type activities and giving students the opportunity to apply leadership and management principles.

AS 3002. AIR FORCE LEADERSHIP STUDIES II.

Cat. I (1/6 unit)

The AS 3000 sequence of courses is a study of leadership, management fundamentals, professional knowledge, Air Force personnel and evaluation systems, leadership ethics, and communication skills required of an Air Force junior officer. The second course studies various aspects of leadership, conflict management, counseling, and supervision. The course includes three hours of class work and three hours of mandatory leadership laboratory per week. The AS 3002 Leadership Laboratory complements the classroom work by providing advanced leadership experiences in officer-type activities and giving students the opportunity to apply leadership and management principles.

AS 3003. AIR FORCE LEADERSHIP STUDIES III.

Cat. I (1/6 unit)

The AS 3000 sequence of courses is a study of leadership, management fundamentals, professional knowledge, Air Force personnel and evaluation systems, leadership ethics, and communication skills required of an Air Force junior officer. The third course emphasizes teambuilding, process improvement, and military ethics. The course includes three hours of class work and three hours of mandatory leadership laboratory per week. The AS 3003 Leadership Laboratory complements the classroom work by providing advanced leadership experiences in officer-type activities and giving students the opportunity to apply leadership and management principles.

AS 3004. AIR FORCE LEADERSHIP STUDIES IV.

Cat. I (1/6 unit)

The AS 3000 sequence of courses is a study of leadership, management fundamentals, professional knowledge, Air Force personnel and evaluation systems, leadership ethics, and communication skills required of an Air Force junior officer. The final course explores officer professional development, and personnel and evaluation systems including practical exercises. The course includes three hours of class work and three hours of mandatory leadership laboratory per week. The AS 3004 Leadership Laboratory complements the classroom work by providing advanced leadership experiences in officer-type activities and giving students the opportunity to apply leadership and management principles.

AS 4101. NATIONAL SECURITY AFFAIRS I.

Cat. I (1/6 unit)

The AS 4000 sequence of courses examines the national security process, regional studies, advanced leadership ethics, and Air Force doctrine. Special topics of interest focus on the military as a profession, officership, military justice, civilian control of the military, preparation for active duty and current issues affecting military professionalism. Throughout the AS 4000 sequence of courses, briefing and writing exercises will be accomplished with emphasis on refining communication skills.

The first course examines in depth the national security process, principles of war and the Air Force major commands.

The course includes three hours of class work and three hours of mandatory leadership laboratory each week. The AS 4101 Leadership Laboratory complements the classroom work by providing advanced leadership experiences in officer-like activities and giving the students the opportunity to apply leadership and management principles.

AS 4102. NATIONAL SECURITY AFFAIRS II.

Cat. I (1/6 unit)

The AS 4000 sequence of courses examines the national security process, regional studies, advanced leadership ethics, and Air Force doctrine. The second course provides a detailed examination of Air Force doctrine including a study of the joint doctrine and the roles of the other military services.

The course includes three hours of class work and three hours of mandatory leadership laboratory each week. The AS 4102 Leadership Laboratory complements the classroom work by

providing advanced leadership experiences in officer-like activities and giving the students the opportunity to apply leadership and management principles.

AS 4103. NATIONAL SECURITY AFFAIRS III.

Cat. I (1/6 unit)

The AS 4000 sequence of courses examines the national security process, regional studies, advanced leadership ethics, and Air Force doctrine. The third course provides an extensive study of alliances and regional security issues, including international peacekeeping and terrorism. Continued attention is given to developing the research and communications skills necessary to be successful as junior officers.

The course includes three hours of class work and three hours of mandatory leadership laboratory each week. The AS 4103 Leadership Laboratory complements the classroom work by providing advanced leadership experiences in officer-like activities and giving the students the opportunity to apply leadership and management principles.

AS 4104. PREPARATION FOR ACTIVE DUTY.

Cat. I (1/6 unit)

The AS 4000 sequence of courses examines the national security process, regional studies, advanced leadership ethics, and Air Force doctrine. The final course in the series examines officership, the military justice system, social responsibilities, current issues affecting the military profession, and various factors that will facilitate a smooth transition from civilian to military life. The course includes three hours of class work and three hours of mandatory leadership laboratory each week. The AS 4104 Leadership Laboratory complements the classroom work by providing advanced leadership experiences in officer-like activities and giving the students the opportunity to apply leadership and management principles.

Impacts on students: There will be no necessary alterations to the distribution requirements for any majors as a result of these changes. The main impacts will be on Air Force ROTC students. These are required courses for the AFROTC cadets. All students will keep the credit they earned for the previously offered AFROTC classes and will not have to retake anything.

Resource Needs:

All resources needed to deliver the redesigned sequence are currently available, including the assigned classrooms and instructors.

Implementation Date: Implementation date for this action is the 2020-2021 academic year.

Date: April 16, 2020

To: WPI Faculty

From: Committee on Academic Operations (Prof. Mathisen, Chair)

Re: Motion to add a Minor in Fire Protection Engineering, approved by FPE on January 6, 2020.

Motion: The Committee on Academic Operations recommends and I move, that the minor in Fire Protection Engineering, described below, be added.

Catalog Description: Minor in Fire Protection Engineering

The FPE department is offering a minor for students who want to expand their engineering background by being exposed to Fire Protection Engineering at undergraduate level. The minor in Fire Protection Engineering provides an excellent opportunity to acquire a basic knowledge in Fire Protection and articulate this knowledge with their own major in an omnipresent and growing field of engineering that offers exciting careers.

Successful candidates for the FPE Minor must meet the following requirements:

1. Complete two units of work, including at least 1 unit with the prefix “FP” at the 3000-level or above.
2. The remaining courses can be chosen from the following list:
 - i. CHE 2013 – Applied Chemical Engineering Thermodynamics
 - ii. ES 3001 – Introduction to Thermodynamics
 - iii. ES 3003 – Heat Transfer
 - iv. ES 3004 – Fluid Mechanics
 - v. CE 3006 – Design of Steel Structures
 - vi. CE 3008 – Design of Reinforced Concrete Structures
 - vii. CE 3031 – Building Information Modeling: Software Tools and Principles
 - viii. CE 3010 – Structural Engineering
 - ix. AE 3602 – Incompressible Fluids
 - x. ME 442X – Radiation Heat Transfer Application and Design
 - xi. CHE 4410 – Chemical Process Safety Design

Students seeking an FPE minor should complete this form and submit it to the FPE office as early in the program of studies as possible. The department head of FPE will be responsible for review and approval of all FPE Minor requests.

WPI policy requires that no more than one unit of course work can be double counted towards other degree requirement.

*Application for
Fire Protection Engineering Minor*

Last name: _____ First Name: _____

Student Number ____ - ____ - _____ Major Department: _____

Anticipated Graduation Date: _____ Email: _____ @wpi.edu

Instructions:

- i. In the table below, list at least 3 courses satisfying requirements (1-2).
- ii. Check the right boxes if needed, to indicate which courses are being double-counted for other degree requirements. Note that WPI policy requires that no more than one unit of course work can be double counted towards other degree requirement.
- iii. Verify that you have consulted with your academic advisor regarding the FPE minor.
- iv. Obtain approval from the Department Head of FPE by contacting the FPE office.

COURSE NUMBER	COURSE TITLE	TERM	GRADE
FP			
FP			
FP			

Check if double counted

Have you discussed your application for the FPE Minor with your academic advisor?

Yes ____ No ____

FPE Department use only

Minor Approval: _____ Date: _____

FPE Department Head

Date: April 16, 2020

To: WPI Faculty

From: Committee on Graduate Studies and Research (Prof. Fischer, Chair)

Re: Proposal to offer a new Graduate Certificate in Biomanufacturing

Motion: The Committee on Graduate Studies and Research recommends, and I move that the following new graduate certificate be approved, as described below.

Plan of Study/Requirements

The **Graduate Certificate in Biomanufacturing** must be composed of 12 credits of graduate coursework chosen from a list provided in the graduate catalog and approved by the BBT graduate coordinator:

- **Three skills-based courses (9 credits).**

Courses include: BB505 Fermentation Biology, BB508 Animal Cell culture, BB509 Scaleup of Bioprocessing, BB560 Methods of Protein Purification and Downstream processing, BB581 Bioinformatics

- **One, thematically related, graduate level course (3 credits)**

Courses include: BB 551 Research Integrity in the Sciences, BB 590, Integrative in Biology and Biotechnology, BB 561 Model Systems: Experimental Approaches and Applications, BB 562 Cell Cycle Regulation, BCB 502 Biovisualization, CH 540 Regulation of Gene Expression, CHE 521 Biochemical Engineering

Background and Rationale

This new graduate certificate proposes to meet the needs of a variety of current students and working scientists who are interested in advanced coursework to deepen their understanding of bioproduction processes. We anticipate that many students will be interested in the certificate as a first step towards the skills-based MS in Biotechnology.

As WPI is well positioned to lead this area of study. This certificate will augment the skills-based MS degree program and strengthen our ability to meet the graduate education needs of the large number of biotechnology companies and employees accessible to us:

- WPI is located within a major biotechnology market – the New England area has the 2nd largest market cap after San Francisco Bay Area.
- A Voice of the Customer survey indicates that there is a healthy interest in continuing education offerings.
- Individuals with strong hands-on lab and bioproduction skills are in demand locally, and job growth is predicted to be stronger than average for the next 10 years.
- The Mass BioEducation Foundation's *2018 Job Trends Forecast* report indicates that 83% of MA biopharmaceutical employers plan to increase employment over next year, yet 65% of organizations report their average time to fill an opening was over 10 weeks, versus the national average of 30 days.
- The *2018 Job Trends Forecast* also reports that 11,976 new jobs are forecast to be created between May 2017 – May 2023
- We have seen health interest in the existing graduate certificate in Life Science Management (a mix of biology/biotechnology, chemistry/biochemistry, and management coursework); this biomanufacturing certificate would provide training for those industry employees looking to take a parallel path.

Competitive Programs

There are other universities offering graduate certificates in areas of biotechnology, including NE-area schools (Tufts, UMass Boston, UMass Lowell, Northeastern University). Many of these programs focus on providing a theoretical or analytical-based background for working in Research and Development. WPI's partnership with the Biomanufacturing Education and Training Center (BETC) provides access to state-of-the-art biomanufacturing facilities, allowing for skills-based, hands-on labs, which will be a key differentiator for this program.

Resources

These courses are all being offered as part of the MS in Biotechnology program, so the certificate does not require any additional development work. This program is intended to serve the growing needs of the biotechnology industry.

Implementation Date

The implementation date is the 2020-2021 academic year.

Date: April 16, 2020

To: WPI Faculty

From: Committee on Graduate Studies and Research (Prof. Fischer, Chair)

Re: Proposal for the addition of a new course CH542: Drugs in the Brain

Motion: The Committee on Graduate Studies and Research recommends and I move to add the class *CH542: Drugs in the Brain*.

Existing title, description, and course offering schedule:

N/A

Proposed title, description, and course offering:

CH542: Drugs in the Brain

This class will introduce the concepts of basic neuropharmacology and the action of major neurotransmitter families in the brain. The mechanisms of action of the major psychoactive drugs families including cannabis, opioids, and psychedelics will be covered. The effects of pharmaceutical treatments for anxiety and depression on brain chemistry will be discussed as well. This course will be offered in 2020-2021 and alternating years thereafter.

Recommended Background: Fundamental understanding of introductory biochemistry (CH4110, CH4120, and/or CH4130).

Explanation of Motion: This course is a new course at WPI and it will cover material not offered in any other class at WPI. It has not been taught here before. We wish to introduce it directly into the graduate book, not just offer a special topics course, because we are planning to require it as part of our graduate curriculum.

Schedule: Cat. II. C Term. R 6-8:30 pm

Rationale: The Chemistry and Biochemistry Department seeks to encourage the intellectual growth of graduate and undergraduate students by offering advanced courses designed to facilitate independent thinking and problem solving using modern topics students will find intriguing. *Drugs in the Brain* will introduce students to popular drug families and the effect of these drug families on brain neurotransmitters. It is anticipated that student interest in the course may reach beyond chemistry and biochemistry. For instance, students in neurobiology, biology, biomechanical engineering, and others disciplines may find the course both useful and interesting.

Impacts on students: A positive impact on both graduate and undergraduate students is expected as the course is a new addition to the curriculum and covers information that is not currently offered in any other course.

Resource Needs: A classroom for ~20 people will be needed. Prof. Carissa Olsen will teach this class as part of her standard teaching load.

Implementation Date: Implementation date for this action is the 2020-2021 academic year.

Date: April 16, 2020

To: WPI Faculty

From: Committee on Graduate Studies and Research (Prof. Fischer, Chair)

Re: Proposal for the addition of a new course CH546: Natural Product Isolation and Analysis, approved on Jan 21, 2020 by the CBC faculty.

Motion: The Committee on Graduate Studies and Research recommends and I move to add the class *CH546: Natural Product Isolation and Analysis*.

Existing title, description, and course offering schedule:

N/A

Proposed title, description, and course offering:

CH546: Natural Product Isolation and Analysis

In this laboratory class, students will learn strategies to isolate and characterize natural products. Techniques used during this course may include solvent extraction, supercritical fluid extraction, NMR spectroscopy, IR spectroscopy, mass spectrometry, gas chromatography, and liquid chromatography. This class will be offered in 2021-2022 and alternating years thereafter.

Recommended background: Introductory chemistry laboratory experience.

Explanation of Motion: This course is a new course at WPI and it will cover material not offered in any other class at WPI. It has not been taught here before. We wish to introduce it directly into the graduate book, not just offer a special topics course, because we are planning to include it as part of our graduate curriculum. Notably, the CBC department is advancing a more accessible masters chemistry/biochemistry degree for the local workforce that will have a large online presence.

Schedule: Cat. II. D Term. R 6-9 pm or on weekends (depending on the student population. If there are a lot of part-time masters students, we may do the laboratory work on weekends to accommodate working people schedules.)

Rationale: The Chemistry and Biochemistry Department seeks to directly prepare undergraduate, master, and PhD level students for employment for many chemical industries that are reliant on natural products (e.g., cosmetics, essential oil, medicinal chemistry). *Natural Product Isolation and Analysis* will introduce students to techniques used to isolate, purify, and study natural products with commercial value. This course will combine theory with hands-on practice to give students the skills they need to hit the ground running when they enter the workforce.

Impacts on students: A positive impact on both graduate and undergraduate students is expected as the course is a new addition to the curriculum and covers information that is not currently offered in any other course.

Resource Needs: A laboratory classroom for ~15 people will be needed. This class will be team taught by 7 chemistry and biochemistry professors (each one taking a turn each week). Prof. Arne Gericke will be the main instructor for the course and will take the lead for organizing the guest instructors for each topic.

Implementation Date: Implementation date for this action is the 2021-2022 academic year.

Date: April 16, 2020

To: WPI Faculty

From: Committee on Graduate Studies and Research (Prof. Fischer, Chair)

Re: Proposal for the addition of a new course CH545: Plant Natural Products, approved by the CBC faculty on January 21, 2020.

Motion: The Committee on Graduate Studies and Research recommends and I move to add the class *CH545: Plant Natural Products*.

Existing title, description, and course offering schedule:

N/A

Proposed title, description, and course offering:

CH545: Plant Natural Products

This class will cover the chemistry of a number of families of plant-derived natural products, including, terpenoids, phenolic compounds, and alkaloids. The coverage of aspects of the chemistry involving these natural products may include biosynthesis, chemical synthesis, and medicinal chemistry applications. The historical and current roles of select natural products, such as tetrahydrocannabinol, taxol, heroin, and quinine, in society may also be discussed. This class will be offered in 2020-2021 and alternating years thereafter.

Recommended background: A fundamental understanding of organic chemistry, such as that obtained in an introductory organic chemistry sequence (CH2310, CH2320, and CH2330).

Explanation of Motion: This course is a new course at WPI that has not been offered before even in an experimental or special topics format. It will cover material not offered in any other class at WPI. We wish to introduce it directly into the graduate book, not just offer a special topics course, because we are planning to include it as part of our graduate curriculum. Notably, the CBC department is advancing a more accessible masters chemistry/biochemistry degree for the local workforce that will have a large online presence.

Schedule: Cat. II. D Term. R 6-8:30 pm

Rationale: The Chemistry and Biochemistry Department seeks to encourage the intellectual growth of graduate and undergraduate students by offering advanced courses designed to facilitate independent thinking and problem solving using modern topics students will find intriguing. *Plant Natural Products* will introduce students to families of bioactive natural products derived from plants that are of current interest in several industries (e.g., cosmetics, essential oil, medicinal chemistry). It is anticipated that this course will help to prepare students at the undergraduate, master, and PhD levels for employment for many chemical industries.

Impacts on students: A positive impact on both graduate and undergraduate students is expected as the course is a new addition to the curriculum and covers information that is not currently offered in any other course.

Resource Needs: A classroom for ~20 people will be needed. Prof. Anita Mattson or Prof. Patricia Musacchio will teach this class as part of their standard teaching loads.

Implementation Date: Implementation date for this action is the 2020-2021 academic year.

Date: April 16, 2020

To: WPI Faculty

From: Committee on Graduate Studies and Research (Prof. Fischer, Chair)

Re: Motion to institute annual graduate student review milestone and add description of this milestone to the graduate catalog

Motion: The Committee on Graduate Studies and Research recommends and I move that the following changes be made to the graduate catalog for IMGD, in which we institute an annual review process for all graduate students across all degree programs within IMGD:

Proposed Modifications to Graduate Catalog:

We propose adding the following text to the IMGD section of the graduate catalog, prior to descriptions of specific degree requirements, as this review process is for all students regardless of degree sought:

Annual Progress Review Milestone

In addition to the milestones specific to each degree, all IMGD graduate students must participate in an annual progress review conducted by the program. Students submit a report describing the work they have completed that year and reflection on their progress. A faculty committee reviews each report, discusses student progress, and makes a decision about student continuation in the program. There are three potential recommendation outcomes from this review milestone: a) satisfactory progress, b) program warning, and c) program dismissal. If a student receives a warning, then they will receive constructive feedback on how to improve their performance. If the committee recommends the student for dismissal, they enter WPI's academic dismissal process as described in the "Academic Standards" section of this catalog.

Proposed Internal Implementation:

We intend to implement this review process at the beginning of D-term. The faculty committee that reviews and votes upon student progress will be constituted as follows: all IMGD faculty who are currently advising or serving as a committee member or thesis/project reader for IMGD students, all faculty who are serving on the IMGD graduate committee, and the IMGD director. Each student will submit an approximately one-page reflection on their progress in the degree thus far, which comments on their performance in their coursework and project work, what they have learned over the course of the year, any challenges they feel they have faced, and how they intend to improve in the following academic year. If the student is funded as a research assistant, they must reflect on their progress on research. If the student is funded as a teaching assistant, they must discuss their teaching activities.

The graduate committee will assemble the following information related to each student:

- A list of coursework taken and grades earned in each of those courses
- Feedback from the student's advisor regarding progress on project/thesis work and/or funded research
- Feedback from faculty for whom the student has been a TA, if relevant

The committee will meet to discuss each student in the program and review the material compiled for and submitted by each student. Students do not attend this review meeting.

The student's advisor leads discussion for their student; if the advisor cannot attend, they nominate another faculty member to lead discussion in their place. An outcome for the student is proposed by the advisor or their proxy. A majority vote is required for warning or dismissal. At the time of the vote for a particular student, the student's advisor and committee members must be either present, or have declared that their vote be held in proxy by another committee member.

- a) Satisfactory progress: the committee determines that the student is performing satisfactorily and may continue in the degree program next year; optionally, the faculty will provide feedback on how to improve in the following year or address specific concerns the student raises.
- b) Program warning: the committee wishes to warn the student that their performance is subpar, and will provide constructive feedback on how to improve in the following year; this does not trigger a WPI-level academic warning.
- c) Program dismissal: the committee feels that the student's progress is unsatisfactory and that the student should be dismissed from the program; this triggers the WPI academic dismissal process.

Rationale:

Until now, IMGD has relied primarily upon WPI's graduate academic warning/probation system for both monitoring student progress and instituting penalties for failing to meet expectations. IMGD students are assigned advisors upon entry to the program who can offer support, and then have a project/thesis advisor who mentor students through independent work. If an advisor is concerned about their student's progress, they typically meet with the IMGD director and/or graduate coordinator to discuss potential solutions. The advisor or IMGD director may strongly recommend that the student take a leave of absence or leave the program, but this decision has historically been left up to the student.

This informal review system has never been ideal, and is especially strained as the IMGD graduate program grows both in terms of number of enrolled students and number of degrees offered. In particular, there are several challenges we aim to address with this milestone, including:

- a) IMGD students must meet several degree milestones that sit outside of their formal coursework in order to graduate. Some, but not all, of these milestones are integrated into independent study/independent thesis credit. We have recommendations for when these milestones should be achieved, but there will always be some students who take additional time. Sometimes the additional time is justified and understandable; other times, it can be an indicator that the student is struggling through the program and needs additional support. In the case of part-time students, it is hard to establish firm guidelines for when exactly these milestones should be met. Thus, whether or not a student meets a milestone "on time" is not a reliable indicator of student progress.
- b) IMGD has occasionally had students who have lingered in the degree program for several semesters, or even years, beyond the intended length of the degree, typically either taking additional thesis credits in an effort to complete unfinished work, or continuing to take coursework in an effort to raise their GPA above the requirement for graduation.
- c) As an interdisciplinary program, our students frequently take courses outside of IMGD (most frequently in CS, PSY, MIS, and SD). Those courses, understandably, are designed primarily for students within their particular discipline, and IMGD students are expected to apply what

they learn in these courses in an IMGD context. It is impossible to tell from GPA alone whether the student is able to do this.

Thus, we propose instituting a formal, annual review process for all graduate students in IMGD. The goal with this review process is threefold: a) to provide holistic, individualized feedback to the student on how they are progressing through their degree and offer advice for how to meet challenges they identify, b) identify students who are struggling early and give them the opportunity to course-correct before they fail, and c) provide a mechanism for us to dismiss students who are failing to meet expectations.

Since this is a recurring milestone that spans the degrees, we request that a description of the milestone be included in the graduate catalog so that students are aware of this expectation and potential consequences that arise from it. We do not wish the internal implementation details of the review process to be included in the catalog, in order to provide flexibility in how we implement this each year. The internal process will be documented and maintained by the IMGD graduate committee, and any changes to this process must be approved by the IMGD faculty.

Impact on Degree Requirements: This does not alter the course, project, or thesis requirements for students in any of our degrees. It adds a new degree milestone that each student must meet every year, which requires a small amount of effort (expected one hour per year, maximum, to write and submit their progress report). This is intended to be implemented in accordance with the WPI policy on “academic standards” as stated on p13 of the 2019-20 graduate catalog: *“If a student is in otherwise good standing but fails to meet specified degree milestones, they may be dismissed from the program by the department graduate committee”*.

Resources and Anticipated Instructors: No additional resources are required for this change.

Implementation Date: Implementation date for this action is the 2020-2021 academic year.

Date: April 16, 2020

To: WPI Faculty

From: Committee on Graduate Studies and Research (Prof. Fischer, Chair)

Re: Motion to approve a new graduate course CS 547/DS 547 “Information Retrieval”, which is approved by the Data Science Program on Dec 3rd, 2019 and was approved by the Computer Science Department on February 11th, 2020.

Motion: The Committee on Graduate Studies and Research recommends and I move that the following new graduate course be added to the WPI Graduate Catalog, as described below.

Proposed Course/Catalog Description:

CS 547/DS 547 “Information Retrieval”

3 credits

This course introduces the theory, design, and implementation of text-based and Web-based information retrieval systems. Students learn the key concepts and models relevant to information retrieval and natural language processing on large-scale corpus such as the Web and social systems. Topics include vector space model, crawling, indexing, web search, ranking, recommender systems, embedding and language model.

Prerequisites: statistical learning at the level of DS 502/MA 543 and programming skills at the level of CS 5007.

Rationale: The purpose of this course is to help students to (1) understand the key concepts and models relevant to information retrieval and natural language processing in the Web; (2) design, implement, and evaluate the core algorithms underlying a fully functional information retrieval system; and (3) identify the salient features and apply recent research results in information retrieval.

This course was offered twice as a special topic CS 525/DS 595: “Information Retrieval & Social Web” in Spring 2018 and 2019. It will be offered again in Spring 2020 as a special topic. The following table shows the enrollment, and the average course report ratings students gave on Question #1 (overall course rating), Question #2 (instructor rating), and Question #7 (The amount I learned from the course) on a five point scale for each class session offered in the previous two years (1 represents “Very Poor” and 5 represents “Excellent”).

Year	Term	Course	Course Title	Class Size	Q#1	Q#2	Q#7
2018	Spring	CS525/DS595	Information Retrieval and Social Web	36	4.4	4.7	4.3
2019	Spring	CS525/DS595	Information Retrieval and Social Web	35	4.7	4.8	4.4

This table shows that although it was a special topic course, 35~36 students registered the course, indicating the popularity and the need of offering the course.

Impact on Degree Requirements: The course will be offered as an elective course in the Data Science program. It will be offered in the Computer Science graduate program’s “Applications of Computer Science” breadth bin.

Resources and Anticipated Instructors:

Assistant Professor Kyumin Lee — he taught this course as a special topic in Spring 2018 and 2019 (CS 525/DS 595), and taught Machine Learning (CS539).

Assistant Professor Xiangnan Kong — he has taught Introduction to Data Science (DS501) and Machine Learning (CS539).

- Classroom large enough to hold **50 students**, including a lecture with standard power and projector connections.
- Student access to the current ACE computing cluster, including GPU machines.

Implementation Date: The 2020-2021 academic year.

Assessment: The course will be assessed based on student course evaluations (including the outcomes of questions 1, 2, and 7) and instructors’ feedback and reflections on whether the course met the course’s learning objectives.

Date: April 16, 2020

To: WPI Faculty

From: Committee on Graduate Studies and Research (Prof. Fischer, Chair)

Re: Motions to update FBS Information Security Management graduate certificate to reflect recent FBS course changes and to rename the certificate “Cybersecurity Management”, approved by FBS faculty on February 12, 2020.

Motion 1: The Committee on Graduate Studies and Research recommends and I move that the Information Security Management graduate certificate be updated as follows to reflect recent FBS course changes and curriculum updates.

Current Information Security Management graduate certificate structure:

The graduate certificate in Information Security Management requires completion of four courses: two required courses for a total of six credits; and two, three-credit elective courses.

Two Required Courses (6 credits)

- MIS 578: Telecommunications Management
- MIS 582: Information Security Management

Two Electives

- MIS 500: Innovating with Information Systems
- MIS 571: Database Applications Development
- MIS 581: Information Technology Policy and Strategy
- MIS 584: Business Intelligence
- OIE 542: Risk Management and Decision Analysis

Proposed updated Information Security Management graduate certificate structure:

The graduate certificate in Information Security Management requires completion of four courses: two required courses for a total of six credits; and two, three-credit elective courses.

Two Required Courses (6 credits)

- MIS 582: Information Security Management
- OIE 542: Risk Management and Decision Analysis

Two Electives

- MIS 500: Innovating with Information Systems
- MIS 571: Database Applications Development
- MIS 581: Information Technology Policy and Strategy
- MIS 584: Business Intelligence
- MKT 568 Data Mining Business Applications
- DS 501 Introduction to Data Science

Rationale:

MIS578 *Telecommunications Management* was offered in fall 2019 for the final time. We propose making OIE542 *Risk Management and Decision Analysis* a required course within the certificate. OIE542 has previously been taught with cybersecurity risk as an explicit focus for the power industry. We have also expanded the certificate’s elective options to include MKT568

and DS501, providing more room for student customization. The change has been discussed with the Data Science Program Director, who is fine with the change.

Additional Resources:

None

Implementation Date:

This change will take effect as soon as approved by CGSR and full WPI faculty. Will be updated on website as soon as approved and in WPI graduate catalogue in next iteration post-approval.

Motion 2: SPCC moves that the Information Security Management graduate certificate be renamed the Cybersecurity Management graduate certificate to better resonate in the marketplace.

Rationale:

Management capabilities to understand cybersecurity threats and plan programs to prevent, respond and recover from those threats have continued to increase. Enemies have grown to include well-funded nation states with sophisticated hacking capabilities. The scale and scope of cybersecurity attacks require business managers who are able to understand both the technical nature of those attacks and how to develop affordable cybersecurity plans. Senior management and boards of directors are increasingly aware of cyber threats due to media reports and they have raised their expectations for information security programs to integrate cybersecurity resiliency.

WPI has provided a Computer Science graduate certificate in Cybersecurity for several years (<https://www.wpi.edu/academics/online/study/computer-science-online-certificates>). This six course certificate has always included OIE 542 *Risk Management and Decision Analysis* to address the behavioral aspects of cybersecurity. The CS certificate was developed with the help of CPE at the request of power industry organizations to whom WPI has delivered graduate Power Systems programs. The CS graduate certificate in Cybersecurity has additionally attracted interest from working professionals from the financial industry.

Enrollment in the CS Cybersecurity graduate certificate has been steady at about 75 to 100 credit hours per year. However, CPE reports that WPI has to turn away approximately half of the people who express interest in the certificate because they lack the programming and other computer science foundational education required in the CS certificate. A re-branded FBS Cybersecurity Management graduate certificate would be a perfect fit for these prospective students. WPI has not gotten any traction with the Information Security Management graduate certificate; a re-branded Cybersecurity Management certificate should better resonate in the marketplace.

Cybersecurity is a growing challenge for companies and a source of career opportunities for individuals. With an updated and re-branded Cybersecurity Management graduate certificate, WPI can better help companies meet this challenge while helping individuals develop their capabilities and advance their careers. The name change has been discussed with the Cybersecurity program; the change is fine.

Additional Resources:

Marketing resources to promote updated certificate.

Implementation Date:

This change will take effect as soon as approved by CGSR and full WPI faculty. Will be updated on website as soon as approved and in WPI graduate catalogue in next iteration post-approval.

Date: April 16, 2020

To: WPI Faculty

From: Committee on Graduate Studies and Research (Prof. Fischer, Chair)

Re: Motion to Eliminate Mathematics Requirement in CS Ph.D. Program

Motion: The Committee on Graduate Studies and Research recommends and I move that the program requirements for the Ph.D. in Computer Science be adjusted as described below.

Description of changes to the WPI Graduate Catalog:

On page 78 of the Graduate Catalog, the requirements for the Ph.D. degree are listed. This motion would alter the requirements as follows. Additions are indicated in *underlined italics* (with deleted text indicated by ~~strikethroughs~~).

The Ph.D. degree requirements consist of a coursework component and a research component, which together must total at least 60 credit hours beyond the master's degree requirement for Ph.D. students who earned a MS degree in a program other than CS at WPI. The coursework and research component must total at least 57 credit hours for students who earn both a master's degree and Ph.D. degree in CS at WPI. The coursework component must include 1) the completion of the student's Ph.D. Breadth Requirements, ~~2) 3 credits of graduate-level mathematics,~~ and 3) 15 graduate credits in Computer Science courses, independent studies, or directed research (these 15 credits may include credits earned as part of completing the Ph.D. Breadth Requirements). Coursework credits taken outside Computer Science must be approved by the student's advisor.

Rationale:

The current mathematics requirement is not serving some of the Computer Science Ph.D. students well. The lack of specificity in graduate-level mathematics classes is resulting in our Ph.D. students taking research-oriented mathematics courses for which they are unqualified and fail to complete successfully. This is leading students to repeat mathematics classes or seeking petitions to substitute classes from other programs, such as DS or ECE, to meet the requirement.

In exploring the topic further, the CS department's Graduate Committee was unable to find evidence that the mathematics requirement as written is in the best interest of our students. The goals of the requirement are unclear and it is not obvious why mathematics in particular should be singled out in the CS program requirements. The committee noted that Ph.D. advisors already can authorize students to take courses outside of the department and can encourage them to take appropriately rigorous mathematics courses where appropriate. The department believes this advisor consultation is the more appropriate tool for student learning.

The CS Faculty voted to approve this motion at their February 11, 2020 department meeting.

Resource Impact: Resources required for graduate-level mathematics classes would decrease slightly and the resources required for CS graduate level classes or research credits/independent study would increase slightly. Assuming each PhD student take at least 4 years to complete the

degree, based on the current 45 PhD students in CS, this would affect an average of 11 students (or 33 credits) across all graduate level mathematics classes annually.

Implementation Date: The proposed policy would go into effect for the 2020-2021 academic year.

Date: April 16, 2020

To: WPI Faculty

From: Committee on Graduate Studies and Research (Prof. Fischer, Chair)

Re: Motion to systematize and streamline the double counting of BS/MS credits in the Data Science program. The proposed changes have been approved by the program on March 3rd 2020.

Motion: The Committee on Graduate Studies and Research recommends and I move that the double counting of credits for the BS/MS degree in Data Science be modified as follows.

Old Description in the Graduate Catalog:

Double Counting Credits From 4000-Level Courses

~~The credits from the following list of 4000-level courses can count towards the Data Science M.S. degree:~~

Courses from Computer Science
CS 4120 Analysis of Algorithms
CS 4341 Introduction to Artificial Intelligence
CS 4432 Database Systems II
CS 4445 Data Mining and Knowledge Discovery
CS 4531 Machine Learning
CS 4802 BioVisualization
CS 4803 Biological and Biomedical Database Mining

Courses from Mathematical Sciences
MA 4235 Mathematical Optimization
MA 4603 Statistical Methods in Genetics and Bioinformatics
MA 4631 Probability and Mathematical Statistics I
MA 4632 Probability and Mathematical Statistics II
MA 4635 Data Analytics and Statistical Learning

Other 4000-level courses not listed above, including 4000-level independent study courses, require a petition and approval from the Data Science Graduate Committee before they can double-count for the B.S./M.S. degree.

New Description in the Graduate Catalog:

Double Counting Credits From 4000-Level Courses

For the following 4000-Level courses, two graduate credits will be earned towards the B.S./M.S. degree if the student achieves grade B or higher, or otherwise with the instructor's approval. In addition, faculty may offer, at their discretion, an additional 1/6 undergraduate unit, or equivalently a 1 graduate credit, for completing additional work in the course. To obtain this additional credit, the student must register for 1/6 undergraduate unit of independent study at the 4000-level or a 1 graduate credit independent study at the 500-level, with permission from the instructor.

Courses from Computer Science
CS 4120 Analysis of Algorithms
CS 4341 Introduction to Artificial Intelligence
CS 4432 Database Systems II
CS 4445 Data Mining and Knowledge Discovery
CS 4531 Machine Learning
CS 4802 BioVisualization
CS 4803 Biological and Biomedical Database Mining
Courses from Mathematical Sciences
MA 4235 Mathematical Optimization
MA 4603 Statistical Methods in Genetics and Bioinformatics
MA 4631 Probability and Mathematical Statistics I
MA 4632 Probability and Mathematical Statistics II
MA 4635 Data Analytics and Statistical Learning

Other 4000-level courses not listed above, including 4000-level independent study courses, require a petition and approval from the Data Science Graduate Committee before they can double-count for the B.S./M.S. degree.

Rationale:

The goal of this motion is to standardize the process of earning graduate credits in the BS/MS Data Science program, and reducing the administrative work that needs to be done by both the faculty to approve the credits and the students to submit petitions. The proposed changes are already the common practice followed by the Data Science faculty. Hence, the motion does not introduce core changes, but rather simplifies the process.

Graduate Catalog Additions:

If approved, the graduate catalogs (online and next print) shall be modified to reflect the proposed changes.

Implementation Date

Fall 2020

Date: April 16, 2020

To: WPI Faculty

From: Committee on Graduate Studies and Research (Prof. Fischer, Chair)

Re: Motion to revise the number of credits from 60 to 57 as part of the Ph.D. degree requirements in Data Science for MS students who earned their degree in the Data Science program at WPI. The changes have been approved by the program on March 3rd 2020.

Motion: The Committee on Graduate Studies and Research recommends and I move that the Data Science Ph.D. degree requirements to be modified in the Graduate Catalog as follows:

Old Description in the Graduate Catalog:

The Ph.D. degree requirements consist of a coursework component and a research component, which together ~~must total at least 60 credit hours beyond the master's degree requirement.~~ The coursework component consists of at least 30 coursework credits, as specified on the Data Science program website <http://wpi.edu/academics/datascience/graduate-program.html>.

New Description in the Graduate Catalog:

The Ph.D. degree requirements consist of a coursework component and a research component, which together must total at least 60 credit hours beyond the master's degree requirement for Ph.D. students who earned their MS degree in a program other than Data Science at WPI. The coursework and research component must total at least 57 credit hours for students who earn both a master's degree and Ph.D. degree in Data Science at WPI. The coursework component consists of at least 30 coursework credits, as specified on the Data Science program website <http://wpi.edu/academics/datascience/graduate-program.html>.

Rationale:

Students who are granted a master's degree in Data Science from WPI have already earned 33 credits, and thus the number of credits to reach the PhD credit requirements, which is 90 credits, is 57 credits. Traditionally, students in such situation had to submit petition to waive the extra un-needed 3 credits. This motion is to eliminate this inconsistency and overhead.

Graduate Catalog Additions:

If approved, the graduate catalogs (online and next print) shall be modified to reflect the proposed changes to this certificate.

Implementation Date: Fall 2020

Date: April 16, 2020

To: WPI Faculty

From: Committee on Graduate Studies and Research (Prof. Fischer, Chair)

Re: Motion to change the course description for RBE 500 Foundations of Robotics, as previously approved by the Robotics Engineering Program on March 27, 2020

Motion: The Committee on Graduate Studies and Research recommends and I move that the following catalog changes for the course description of RBE 500 be approved.

Current description

RBE 500. Foundations of Robotics

Mathematical foundations and principles of processing sensor information in robotic systems. Topics include an introduction to probabilistic concepts related to sensors, sensor signal processing, multi-sensor control systems and optimal estimation. The material presented will focus on the types of control problems encountered when a robot must operate in an environment where sensor noise and/or tracking errors are significant. Techniques for assessing the stability, controllability and expected accuracy of multi-sensor control and tracking systems will be presented. Lab projects will involve processing live and synthetic data, robot simulation, and projects involving the control of robot platforms. (Prerequisites: Differential Equations (MA 2051 or equivalent), Linear Algebra (MA 2071 or equivalent) and the ability to program in a high-level language.)

Revised description

RBE 500. Foundations of Robotics

Fundamentals of robotics engineering. Topics include forward and inverse kinematics, velocity kinematics, introduction to dynamics and control theory, sensors, actuators, basic probabilistic robotics concepts, fundamentals of computer vision, and robot ethics. In addition, modular robot programming will be covered, and the concepts learned will be applied using realistic simulators. (Prerequisites: Differential Equations (MA 2051 or equivalent), Linear Algebra (MA 2071 or equivalent) and the ability to program in a high-level language.)

Rationale:

RBE 500 is the first of a sequence of three foundational graduate courses in robotics – the other two courses in the sequence are RBE 501 Robot Dynamics and RBE 502 Robot Control.

Originally developed to focus on sensors and sensor technology, the curriculum of RBE 500 has been recently redesigned with the goal of transforming this course into an onramp class for RBE 501/502. More specifically, the redesign aimed to:

- Identify and eliminate duplicate topics between RBE 500 and RBE 501/502
- Introduce new fundamental topics in robot control that are currently not covered anywhere else in the RBE graduate curriculum and that will better prepare students for RBE 502

The proposed new description reflects the recent redesign of RBE 500.

Impact on Degree Requirements: None.

Resources and Anticipated Instructors: No additional resources are required.

Implementation Date: Implementation date for this action is the 2020-2021 academic year.

Date: April 16, 2020

To: WPI Faculty

From: Committee on Graduate Studies and Research (Prof. Fischer, Chair)

Re: Motion to Revise Double-Counting of Undergraduate Courses for Chemical Engineering BS/MS Program

Motion: The Committee on Graduate Studies and Research recommends and I move that the description of double-counting courses in the B.S.-M.S. program for the department of chemical engineering be updated as follows.

Proposed Addition to the Graduate Catalog:

“Double Counting. B.S.-M.S. students may double-count up to 12 credits from undergraduate or graduate courses. A maximum of four undergraduate courses may be double-counted. The undergraduate courses allowed to double-count are listed below. Students may also petition the graduate committee for other 4000-level courses to double-count. A minimum grade of “B” is required for the course to be double-counted. In order for a course to be double-counted, students must also complete an extra assignment for each course demonstrating graduate-level competence. This extra assignment may be for instance a project or a literature review. The instructor for each course should advise the student what this assignment would be after being notified that the student is double counting the course towards the B.S.-M.S. degree. Students must be accepted into the B.S.-M.S. program before courses are allowed to double-count.

Allowed Undergraduate Courses (Four Maximum Allowed to Double-Count)

- CHE 3501 Applied Mathematics in Chemical Engineering
- CHE 4405 Chemical Process Dynamics and Control Laboratory
- MQP Major Qualifying Project (1/3 unit maximum)
- An Independent Study in Chemical Engineering at the 4000 level (1/3 unit maximum)

Only One of the Following May Count:

- CHE 4401 Unit Operations of Chemical Engineering I
- CHE 4402 Unit Operations of Chemical Engineering II

Only One of the Following May Count:

- CHE 4404 Chemical Plant Design Project
- CHE 4410 Chemical Process Safety Design”

Rationale: We have updated our B.S./M.S. requirements to enable more student participation in the program. Previously only one undergraduate course, CHE3501, was allowed to double-count. This was excessively restrictive, and few students pursued the B.S./M.S. option. The new rules allow several more possible undergraduate courses that students in the B.S.-M.S. program can take.

Impact on Degree Requirements: Previously students in our department’s BS/MS program were only allowed to double-count one undergraduate course, CHE3501. The new requirements will expand the number of courses students may take and double-count.

Resources and Anticipated Instructors: No new resources are needed. The listed courses are already being taught within our department.

Implementation Date: Implementation date for this action is the 2020-2021 academic year.

Committee Business

Date: April 16, 2020

To: The WPI Faculty

From: Committee on Tenure and Academic Freedom (Prof. Deskins, Chair)

Re: Motion to stop the Tenure Clock for Tenure-Track Faculty due to the COVID-19 pandemic

Motion:

The Committee on Tenure and Academic Freedom recommends and I move that current Tenure-Track Faculty have their probationary period extended by one year due to hardships associated with COVID-19, with the right to opt out of this provision.

Description of the proposed motion:

Current Tenure-Track Faculty (those starting AY19/20 or earlier) will be given an additional year to their Tenure Clock, similar to what is currently allowed for a new child or unpaid leaves. Faculty who do not wish to stop their Tenure Clock must provide written notification to the Provost, the appropriate Dean and Department head by the end of D term 2021 (May 4, 2021). Those faculty who would submit their tenure case this year may request not to stop their Tenure Clock by submitting written notification by the end of D term 2020 (May 13, 2020).

Rationale:

The COVID-19 pandemic has disrupted scholarship, teaching, and many faculty activities. Tenure-Track Faculty have had research efforts come to a halt, and many faculty are teaching in unfamiliar online environments. Faculty have not been able to put forth their best efforts due to current stresses. After the COVID-19 pandemic ends, faculty will require time to rebuild research programs and adjust to new norms. The current motion will allow Tenure-Track Faculty time to better prepare their tenure cases. Many universities have adopted similar practices, in that they allow Tenure-Track Faculty the opportunity to stop their tenure clocks for one year. Indeed the AAUP recommends that Tenure-Track Faculty members be given the option to stop the Tenure Clock due to COVID-19 disruptions (<https://www.aaup.org/news/aft-and-aaup-principles-higher-education-response-covid-19#.Xn89LpNJFhE>).

The Faculty Handbook allows Tenure-Track Faculty to stop the Tenure Clock under two circumstances: (1) the New Child Provision and (2) Unpaid Leaves and Part-Time Employment. The current unprecedented situation does not fit either of these two circumstances, and faculty are currently unable to stop their Tenure Clock due to COVID-19 hardships. This motion will provide a one-time opportunity for Tenure-Track Faculty to stop their tenure clock, should they wish to do so.

Date: April 16, 2020

To: WPI Faculty

From: Committee on Academic Policy (Prof. Heineman, Chair) and Committee on Graduate Studies & Research (Prof. Fischer, Chair)

Re: Motion to adjust process for online course reports of undergraduate and graduate classes for D-2020 term, and graduate classes for the Spring 2020 semester.

Motion: The Committee on Academic Policy and the Committee on Graduate Studies & Research recommend and I move to change the policy regarding the automatic sharing of the results of online course reports of undergraduate and graduate classes for D-2020 term, and graduate classes for the Spring 2020 semester with the WPI community and administration.

Due to the unprecedented situation from the potential health risks of Coronavirus, all undergraduate and graduate courses for D-term 2020 have been forced to be taught online. With very little preparation and training, WPI instructors have adjusted all course delivery to be remote. CAP and CGSR are concerned about the impact this rapid online conversion will have on the course reports collected at the end of this term. These student course reports are used by department heads, the Provost's office, and tenure and promotion committees as one element in the evaluation of teaching.

CAP and CGSR recommend that the course report surveys be distributed to students to collect data using the current online system but the results of these surveys be returned to the instructor only; this applies to tenured and tenure-track faculty, non-tenured faculty and adjunct faculty. Instructors will not be required to submit their course report results for any administrative purpose, such as tenure/promotion or annual reviews.

Rationale

The WPI faculty handbook mentions course reports as being used for two purposes:

- to evaluate course instruction (i.e., "course evaluation")
- as a means for evaluating instructors (i.e., "personnel evaluation")

The relevant sections of the faculty handbook include:

1. Criteria for Tenure (Page 2-2)
2. Evaluation for continuing non-tenure track faculty (Page 2-86/87)
3. Promotion for continuing non-tenure track faculty (Page 2-86/87)
4. Criteria for promotion to Associate/Full Teaching Professor (Page 2-89)

WPI – like many other colleges and universities around the country – is embarking on an unprecedented experiment in delivering remotely, for the rest of this academic year, all remaining academic undergraduate and graduate courses, including projects, practicums and inquiry seminars. During this time, CAP and CGSR appreciate that some faculty do not believe it would be worthwhile to collect course reports.

In the current situation, this D-term poses an incredible challenge to our faculty, many of whom have never taught an online course before. The focus should be to deliver class content as best as we are able, and no faculty member should be penalized (even in an unintended way) by course

report results. While faculty are expected to continue to do their best in teaching their courses, we feel that it is important to let the instructor decide whether to share their course reports. There is precedent for adjusting the visibility of the student course reports. In May of 2003, CAP brought a motion to the faculty for a two-year pilot program for IDEA Student ratings of instruction. During this pilot program, IDEA Report results were returned to the instructor only and faculty were not required to submit results during the pilot for administrative purposes such as tenure/promotion or annual reviews.

There are some other alternatives to the current proposal, but none of them offer the same assurances.

- Allow faculty members to OPT-OUT of course reports for their affected courses – We feel this option might penalize those faculty members who choose to opt out.
- Give faculty members a chance to OPT-IN for their courses – Again, this option appears to penalize those faculty members who choose to opt out.
- Eliminate all course reports entirely for affected courses – We felt that many faculty members might be interested in receiving feedback from students on this remote course delivery option.

Implementation Plan

The course report system would continue as planned for D-term 2020, which would include all undergraduate and graduate courses. The results of these course reports will be delivered via email (in a PDF form, as is usual) to the instructor only.

The results will not be made available to the WPI community using the <http://oscar.wpi.edu> Online Student Course Report system.

The Dean of Undergraduate Studies typically prepares a report for Department Heads, Deans, and the Provost using course report data; however, for this D-term, these reports will not be created or shared with administration.

Instructors retain the right to use the data from their courses and may include this information in annual reports or the development of their dossiers for promotion or tenure.

Date: April 16, 2020

To: The WPI Faculty

From: Committee on Governance (Prof. Gaudette, Chair) & Committee on Graduate Studies and Research (Prof. Fischer, Chair)

Re: Motion to provide students with the option to receive Pass/NC grades for graduate courses during D-term 2020

Motion: The Committee on Governance (COG) and the Committee on Graduate Studies and Research (CGSR) recommend and I move to give graduate students the option to receive a Pass/NC grade for any course taken in D-term 2020, as described below.

Description of the proposed modifications:

This motion ONLY applies to graduate students completing a course in D-term 2020 (including term-long courses in D-term and semester-long courses in the Spring semester).

1. Students will have the option until Thursday May 21st 5:00 EDT to request that their grade for an individual course would be either P (Pass) or NC (No Credit). This means grades of A/B/C would become P. Courses assigned a P grade will count towards degree requirements, unless specifically prohibited by individual program requirements.
2. The current “Grade/Change” process/paperwork shall disallow any attempt to have a faculty member change for D-term or Spring Semester of 2020 an existing grade to a P or to change a P grade to an A/B/C grade.
3. Amnesty will be granted to graduate students on Academic Warning or Academic Probation, meaning that the “one semester of course work to raise their cumulative overall GPA” will be extended an additional semester.

Rationale:

All courses during D-term 2020 are offered in distance learning format as a result of the COVID-19 pandemic. While all faculty members are committed to offering high quality remote courses, most have not received the extensive training usually associated with offering remote courses. Students, however, did not choose to take their courses remotely. Most have been displaced from their WPI residence (whether on or off campus), and most will not have the same learning environment they have grown accustomed to at WPI. Furthermore, as the COVID-19 pandemic continues, students are more likely to become sick or have family members or friends stricken with this disease. In consideration of these changes, students should be provided with options allowing them to continue to learn without having to worry about their grade.

WPI has already approved a similar motion for undergraduate students. Other colleges around the country are devising different strategies to address the concerns of students forced into an academic class conducted using online course delivery, as detailed in the motion to establish P/NR grading for undergraduates.

We have tried to craft a student-centered policy that adopts the following principles:

- The student has the right to choose whether to be graded as “Pass/NC” or “A/B/C/D/F” for any graduate course.
- Faculty will continue to grade graduate students using A/B/C/D/F grading scale. Faculty may still use the “I” grade as always for incomplete if the student and faculty member so choose to complete the work for credit at a later date on the A/B/C/D/F scale noting that

the grade will automatically become an F if not completed within one year (and not be able to be changed to Pass/NC after the deadline of May 21st 2020).

- The P grade has no numeric equivalence. It means the student received at least a C grade. The student will receive credit, but the grade will not be counted in GPA calculations.
- A grade of NC was chosen rather than F given the unprecedented challenges potentially faced by our students. While an NC grade is not currently used for graduate courses, the grade already exists in the graduate catalog (listed as an option for thesis work) and therefore would be extended to coursework as part of this motion. The NC grade will appear on the transcript, but will not count as earned credit, and will not count in the GPA.
- Amnesty for those on Academic Warning or Academic Probation is important because our most at-risk students would otherwise be precluded from taking advantage of this option since a Pass does not count towards the GPA, and thus would not be able to help elevate their GPA to get out of the Warning or Probation state.

Students that elect the Pass/NC option cannot receive an Incomplete grade, and the grade may not be changed at a later time to a traditional A/B/C/D/F.

Students that elect to continue with a letter grade may still receive an Incomplete grade at the discretion of the instructor, provided a realistic plan to complete the course is developed. If an Incomplete grade is assigned by the instructor, the student will have 12 months to complete the course requirements, as is the current policy.

There are potentially significant implications for students to elect to take a course Pass/NC. Students choosing to be graded as Pass/NC are responsible for understanding the implications of a non-letter grade on meeting graduate program requirements and other potential implications. These implications may include, but are not limited to: fellowship requirements, teaching assistantship or research assistantship eligibility, employer tuition benefits, VISA requirements, GPA calculations, academic standing considerations, and financial aid.

The registrar's office will set up a system for students to record their intentions and will announce to the campus when the system is ready to be used. This motion ONLY applies to graduate students completing a course in D-term 2020.

Date: April 16, 2020
To: The WPI Faculty
From: Committee on Graduate Studies and Research (Prof. Fischer, Chair)
Re: Motion to create Commencement participation policy for graduate students.

Motion: On behalf of Committee on Graduate Studies and Research I move that a policy for the participation of graduate students in Commencement who will not complete degree requirements by the ceremony date be added to the Graduate Catalog.

Current:

None. Students must complete all requirements before participating in May commencement. Eligible students have completed requirements and earned degrees in September, December, or May of the current academic year. Students have been petitioning CGSR individually.

Proposed:

Commencement Participation Policy

Master's degree graduate students who are planning to complete their final courses (maximum 6 credits) in the summer term and graduate in September are eligible to participate in the previous May Commencement ceremony. Students who have thesis requirements remaining are not eligible. Students must be registered for all remaining requirements in the summer term by April 1 of the year they will be participating in order to be approved. Students may only participate in one ceremony per degree level. Students approved to walk will not receive their diploma, nor will the degree be conferred, at the May ceremony. They will also not be listed in the Commencement program. PhD students must complete all requirements before participating in a Commencement ceremony and are not eligible to participate in an earlier ceremony. No exceptions will be made to this policy.

Rationale:

Graduate students are petitioning CGSR on an individual basis, and there are no guidelines in place for evaluating such requests. A policy would allow the Registrar's Office to evaluate the student against the rules and act accordingly, eliminating the need for petitions. There is a policy at the undergraduate level and, as many of our undergraduates go on to be graduate students, there is an expectation that some method for participating without completing requirements exist. On average, petitions that have been approved have been within 6 credits of graduation. Additionally, some corporate programs complete in the summer semester by design, with the last one or two courses ending in June or August. This gives them no choice but to petition or wait until the following May (most simply never participate, since we do not widely advertise the petition option). There are approximately 30 students in this situation each year.

Date: April 16, 2020
To: The WPI Faculty
From: COG (Prof. Gaudette, Chair) and COAP (Prof. Weathers, Chair)
Re: Update to Sabbatical Leave Process

Motion: The COG and COAP recommend, and we move that review of sabbatical leave applications no longer be handled by COAP, but instead be reviewed by department heads (as is currently done) and the appropriate Dean prior to the request being sent to the Provost by amending the Faculty Handbook as follows:

Rationale: COAP currently reviews all sabbatical leave application requests by tenure track faculty. The process is described in the Faculty Handbook:

1. Faculty member requests their Department Head review their plans for sabbatical leave.
2. Department Head verifies with the Provost that “all administrative requirements have been cleared”.
3. Department Head writes Letter of Support.
4. Faculty member submits application for sabbatical leave, including Department Head Letter of Support, to COAP.
5. COAP reviews application and make recommendation to the Provost.
6. Provost makes the final determination to approve or decline the sabbatical leave.

This process was instituted long before WPI had Deans, and has not been updated to reflect the Deans’ roles. Furthermore, COAP’s role is perfunctory in that the committee reviews the application package for completeness before sending it to the Provost, after the Department Head and Provost have already reviewed the application. It is COAP’s determination that its role is superfluous. COAP recommends that the sabbatical approval process follow the organizational structure from Department Head to Dean to Provost.

Updates to Faculty Handbook:

Pg. 1-12:

Current wording:

COAP makes recommendations to the Provost regarding recipients of sabbatical leaves, and represents the Faculty to the President and Provost on appointment, reappointment, and performance evaluation of academic Department Heads.

Change to read:

~~COAP makes recommendations to the Provost regarding recipients of sabbatical leaves, and represents the Faculty to the President and Provost on appointment, reappointment, and performance evaluation of academic Department Heads.~~

Pg. 2-41:

Current wording:

a. Faculty members should submit requests for sabbatical leaves to the Committee on Appointments and Promotions on or before the following dates:

Change to read:

a. Faculty members should submit requests for sabbatical leaves to ~~the Committee on Appointments and Promotions~~ *their Dean on* or before the following dates:

Pg. 2-42:

Current wording:

b. The application should be accompanied by supporting documentation from the faculty member's department head. This documentation should include a review of the faculty member's proposed sabbatical program with regard to its appropriateness; the impact of the sabbatical on department operations; a statement that all administrative requirements have been cleared with the Provost; and the department recommendation on the proposed sabbatical. In the case of an application for a sabbatical leave by a department head, this additional documentation will be supplied by the Provost.

c. The Committee on Appointments and Promotions reviews all application materials and supporting documentation, and forwards its recommendation to the Provost.

d. The Provost reviews all leave applications, together with recommendations from the Committee on Appointments and Promotions, and makes the final determination of the request.

Change to read:

b. The application should be accompanied by supporting documentation from the faculty member's department head. This documentation should include a review of the faculty member's proposed sabbatical program with regard to its appropriateness; the impact of the sabbatical on department operations; ~~a statement that all administrative requirements have been cleared with the Provost;~~ and the department recommendation on the proposed sabbatical. In the case of an application for a sabbatical leave by a department head, this additional documentation will be supplied by the ~~Provost~~ *appropriate Dean*.

c. The ~~Committee on Appointments and Promotions~~ *appropriate Dean* reviews all application materials and supporting documentation, and forwards ~~its~~ *their* recommendation to the Provost *with copies of the sabbatical checklist and the recommendation to the Committee on Appointments and Promotions. The Committee on Appointments and Promotion will maintain record-keeping and monitoring role.*

d. The Provost reviews all leave applications, together with recommendations from the ~~Committee on Appointments and Promotions~~ *Deans*, makes the final determination of the requests, *and sends copies of the decision letters to the Committee on Appointments and Promotions. The Committee on Appointments and Promotion will maintain record-keeping and monitoring role.*

Date: April 16, 2020
To: The WPI Faculty
From: COG (Prof. Gaudette, Chair) and COAP (Prof. Weathers, Chair)
Re: Update to Faculty Handbook regarding eligibility to take sabbatical leave and removal of one-term sabbatical leaves

Motion: The COG and COAP recommend, and we move to clarify the wording in the Faculty Handbook related to years required for eligibility to take a sabbatical leave and remove mention of one-term sabbatical leaves of absence, which are no longer available as of 2006, by amending the Faculty Handbook as documented below.

Rationale: Current wording allows faculty who have departed WPI, given up their tenured or tenure-track position, taken jobs elsewhere, and then returned to WPI to abuse the sabbatical leave privilege by counting time at WPI and elsewhere toward sabbatical leave. Sabbatical leaves are an earned privilege, representing an investment by the university in faculty professional development and renewal following full-time activity. COAP contends that faculty should count their 6 or 3 years of full-time activity since their most recent hiring at WPI in order to be eligible for sabbatical leave. Also, single-term sabbaticals have not been allowed since January 2006. The current motion updates the Faculty Handbook to reflect this practice.

Updates to Faculty Handbook:

Current language in the Faculty Handbook (~~deleted~~, **proposed**)

Pg. 2-41; C. Policy on Sabbatical Leaves; 1. Basic Objectives; paragraph 3:

Current wording:

Sabbatical leaves may be taken for a full academic year, a half-year, or one term. All full-time tenured and tenure-track faculty are eligible to apply for a full-year or half-year sabbatical leave after 6 years of full-time service since their initial hiring at WPI or since their previous sabbatical, or for a one-term sabbatical leave after 3 years of full-time service since their initial hiring at WPI or since their previous sabbatical.

Change to read:

*Sabbatical leaves may be taken for a full academic year **or a half academic year**, ~~a half year, or one term~~. All full-time tenured and tenure-track faculty are eligible to apply for a full-year or half-year sabbatical leave after 6 years of full-time service since their ~~initial~~ **most recent** hiring at WPI or since their previous sabbatical, ~~or for a one-term sabbatical leave after 3 years of full-time service since their initial hiring at WPI or since their previous sabbatical~~. **Time spent on unpaid leave or less than half-time activity, although considered continuous service, do not count as full-time service toward sabbatical leave.***

Pg. 2-41; C. Policy on Sabbatical Leaves; 2. Financial Arrangements:

Current wording:

2. Financial Arrangements

a. A full year sabbatical leave is taken at one-half of the faculty member's academic year salary. Half-year and one-term leaves are taken at full salary. If the faculty member obtains salary support from outside sources, WPI's contribution will not exceed that

required to maintain the faculty member's normal salary. Exceptions to this policy must be negotiated before the leave starts.

Change to read:

2. Financial Arrangements

a. A full year sabbatical leave is taken at one-half of the faculty member's academic year salary. Half-year ~~and one-term~~ leaves are taken at full salary. If the faculty member obtains salary support from outside sources, WPI's contribution will not exceed that required to maintain the faculty member's normal salary. Exceptions to this policy must be negotiated before the leave starts.

Pg. 2-41; C. Policy on Sabbatical Leaves; 3. Procedures for Review and Award:

Current wording:

a. Faculty members should submit requests for sabbatical leaves to the Committee on Appointments and Promotions on or before the following dates:

Full year and half-year sabbaticals:

December 15 for proposed leaves in the following academic year.

One-term sabbaticals:

October 1 for proposed leaves in following C term or later

November 15 for proposed leaves in following D term or later

February 1 for proposed leaves in following A term or later

April 1 for proposed leaves in following B term or later

...

e. For full-year and half-year sabbatical leaves, notification of the award will be made no later than the time of issuance of appointment letters. For one-term sabbatical leaves, notification of the award will be made no later than the end of the term in which the application is submitted.

Change to read:

*a. Faculty members should submit requests for sabbatical leaves to the ~~Committee on Appointments and Promotions~~ Dean on or before **December 15 for proposed leaves in the following academic year** ~~the following dates:~~*

~~Full year and half-year sabbaticals:~~

~~December 15 for proposed leaves in the following academic year.~~

~~One-term sabbaticals:~~

~~October 1 for proposed leaves in following C term or later~~

~~November 15 for proposed leaves in following D term or later~~

~~February 1 for proposed leaves in following A term or later~~

~~April 1 for proposed leaves in following B term or later~~

...

e. For full-year and half-year sabbatical leaves, ~~n~~Notification of the award will be made no later than the time of issuance of appointment letters. For ~~one-term~~ sabbatical leaves, ~~notification of the award will be made no later than the end of the term in which the application is submitted.~~

Date: April 16, 2020
To: The WPI Faculty
From: COG (Prof. Gaudette, Chair) and COAP (Prof. Weathers, Chair)
Re: Update Unpaid Leaves of Absence process to parallel Sabbatical Leave Process

Motion: The Committee on Governance recommends, and I move to change the review process for requests for unpaid leaves of absence to parallel the process for requests for sabbatical leaves of absence by amending the Faculty Handbook as described below.

Rationale: The process for approving requests for unpaid leaves of absence should parallel the process for sabbatical leaves, following the organizational structure from Department Head to Dean to Provost.

Pg. 2-43:

Current wording:

On occasion, faculty members may wish to pursue a professional opportunity off-campus and request a leave of absence without salary and fringe benefits. WPI expects the host institution to assume the institutional costs of benefits. These leaves can be for periods of time that fit in with the academic program, up to a maximum of 2 years, and should involve experience in government, industry, or academia that contributes to the professional development of the faculty member. This type of leave requires the approval of the appropriate department head and the Provost.

Change to read:

*On occasion, faculty members may wish to pursue a professional opportunity off-campus and request a leave of absence without salary and fringe benefits. WPI expects the host institution to assume the institutional costs of benefits. These leaves can be for periods of time that fit in with the academic program, up to a maximum of 2 years, and should involve experience in government, industry, or academia that contributes to the professional development of the faculty member. This type of leave requires the approval of the appropriate department head, **Dean**, and the Provost.*

Pg. 2-44:

Current wording:

Although unpaid leave requests are not reviewed by the Committee on Appointments and Promotions it is desirable that such requests take the form of sabbatical leave requests and are accompanied by documentation from the department head.

Change to read:

*~~Although unpaid leave requests are not reviewed by the Committee on Appointments and Promotions it is desirable that such requests~~ **Unpaid leave requests should** take the form of sabbatical leave requests, **which** ~~and~~ are accompanied by documentation from the department head.*

Date: April 16, 2020
To: The WPI Faculty
From: COG (Prof. Gaudette, Chair) and COAP (Prof. Weathers, Chair)
Re: Motion to modify the procedure for providing feedback to faculty candidates who are denied promotion

Motion: COG and COAP recommend and we move that the procedures (described in the Faculty Handbook, Part Two, Section 1.D.2.5) for providing written feedback to faculty candidates who have been denied promotion be modified so that the letter comes only from the Dean and the Provost as described below.

Background: On May 8, 2018, COAP brought to the Faculty a motion to revise the feedback procedure in the case of a negative promotion decision. Following discussion by the Faculty, the motion was returned to COAP for reconsideration. This is COAP's revised motion, which addresses the three goals set forth in Rationale 1, below.

Rationale:

1. The proposed policy has three goals: 1) To enhance the clarity of the promotion process, 2) To maintain the confidentiality of candidates who have been denied promotion, and 3) To ensure a complete feedback in the case of a negative promotion decision so that the candidate may appropriately address any shortcomings for future promotion evaluations.
2. The same procedure for providing feedback from a negative or a positive decision must be used regardless of whether COAP and the Provost agree or disagree.
3. In case of a disagreement between COAP and the Provost on a given case, the Provost's decision is the final one, and it is then difficult to write a joint letter from COAP and the Provost. Furthermore, it would be inappropriate for COAP members to sign a letter that runs counter to its unitary recommendation.
4. The Joint Promotion Committee's recommendation letter may contain confidential information, such as names of references, or may allow the inference of confidential information. Thus, it is imperative that the candidate not see this letter.

Although it is not stated in the motion, it is understood from the context of the Faculty Handbook that this policy only applies to academic promotions from Assistant to Associate Professor that occur prior to the scheduled tenure review year and academic promotions from Associate Professor to Professor.

There are no corresponding procedures for Continuing Non-Tenure Track Faculty promotions in the Faculty Handbook. Nonetheless, it is recommended that the same procedure be followed to provide feedback in the event of a negative decision.

Description of the proposed modifications: (with deleted text ~~struck through~~ and added text in red):

1. POLICIES REGARDING THE STATUS OF FACULTY

D. Promotion*

D.2. Procedures for Promotion Nomination and Review

D.2.5. Review by the Joint Promotion Committee, Dean, and Provost

The Joint Promotion Committee reviews a nomination for promotion in order to make a recommendation to the appropriate Dean and the Provost.

In Term A and Term B of the academic year of the promotion review, the Joint Promotion Committee meets to consider the merits of the nomination for promotion. The Joint Committee reviews the complete promotion dossier (described in section D.1.3) including the letters of appraisal from Professional Associates and External Reviewers. The welfare of the candidate must be protected by all members of the Joint Committee by observing strict rules of confidentiality during all phases of the promotion review. When all the members of the Joint Promotion Committee agree that there has been sufficient discussion, a vote is taken by the six voting members of the Joint Committee for or against promotion (no abstentions) by means of a secret ballot, with the majority ruling. By the end of Term B, the Joint Committee forwards to the Dean and the Provost a letter conveying the result of its vote as a unitary recommendation for or against promotion and summarizing the salient reasons for its recommendation.

The Provost reviews each case and consults with the Dean and the President. Subsequently, the Provost may ask to meet with the Joint Committee to discuss any of its recommendations and must meet with the Joint Committee in the case of potential disagreement. Lastly, the Provost sends to the Board of Trustees the names of candidates for whom promotion is recommended. ***At no time shall the identity of any faculty member who was not recommended for promotion be disclosed to the members of the Board of trustees.*** The Provost will inform the candidate of the Board's decision.

In the event of a negative decision on promotion, a ~~joint~~ letter to the candidate discussing the strengths and weaknesses of the case for promotion will be written by ~~the Joint Promotion Committee~~, the Dean, and the Provost. The purpose of this letter is to provide constructive advice to the candidate so that they may address any deficiencies and resubmit the case for promotion consideration in the future. The candidate may meet with the Provost, Dean, or the Nominator to discuss ~~this letter~~ reasons for the promotion decision.

If a candidate for promotion wishes to appeal a negative decision, faculty grievance procedures are available to the extent provided by a Faculty Review Committee (Bylaw One, IX).

Date: April 16, 2020

To: WPI Faculty

From: Committee on Graduate Studies and Research (Prof. Fischer, Chair)

Re: Motion to establish a new Applied Physics M.S. and Ph.D. graduate program.

Motion: The Committee on Graduate Studies and Research recommends and move that an Applied Physics Graduate Program, as described below, be established at WPI.

1 Proposal for a New M.S. and Ph.D. Applied Physics Program

Program goals

The goal of our proposed Applied Physics graduate program is to provide graduate students with a flexible set of interdisciplinary skills that will prepare them for careers at national and international laboratories, industry, education, and academia. Our program combines a core physics curriculum with cross-cutting course-work and research in areas at interface of physics and other scientific disciplines. For this program, students will select an approved applied physics concentration. Each concentration will have a multidisciplinary theme and a corresponding set of thematically related courses.

For our Applied Physics Program, we propose the creation of five concentrations based on the current core research strength of our faculty. These concentrations are: Biophysics and Soft Condensed Matter Physics, Medical Physics, Nanoscience and Technology, Photonics, and Radiological Sciences.

Program Justification

This proposed program will apply physics concepts and practices to interdisciplinary technical areas to prepare students for a variety of careers in industry, health care, and government as well as in traditional academic settings.

Biophysics and soft condensed matter physics is an interdisciplinary research area comprising the fields of physics, chemistry, and biology that focuses on the study of static and dynamic properties of biological materials, liquids, polymers, gels, and other complex materials. This research field is interesting for its potential applications in technology, medicine, and biology. In this area, Dr. Wu's group studies self-organization of active matter and its applications in fluidic device industry and emergent energy applications. Dr. Wen's and Dr. Liu's groups study cell mechanics and its applications in cancer diagnosis and therapy. Dr. Iannacchione and Dr. Stroe study physical properties of proteins and other biomaterials

Concentrations in Medical Physics and Radiological Sciences address the strong demand for Medical Physicists and Radiological Scientists in the United States and New England. New England's many hospitals, for example, employ numerous Health and Medical Physicists, its industry employs many nuclear scientists and engineers, and its local nuclear power plants employ nuclear engineers and health physicists. Yet there is a strong demand for a well-prepared and educated workforce, only one school in New England offers a doctoral degree in this field (UMass Lowell); one other school offers a Medical Physics master's degree (University of Rhode Island). WPI therefore is well-situated to fill the need for qualified applied physicists for nuclear science, medical and health physics jobs. In addition to Dr. Medich, who works in fields

of medical and health physics, ~~Dr. Blake Carrier performs radiation dosimetry research using MCNP and performs neutron shielding development, Dr. Izabela Stroe performs research in radiation biological effects and actinoid radionuclide transport, Dr. Germano Iannacchione is developing techniques for absolute radiation dosimetry measurements~~ Dr. Blake Carrier teaches graduate courses in reactor design, nuclear materials, and introduction to nuclear science and engineering, Dr. Izabela Stroe teaches nuclear instrumentation and nuclear physics, and Dr. Snehalata Kadam teaches radiation biology, and Snehalata Kadam lends teaching support. The Nuclear Science and Engineering program also has the following affiliated faculty members: Dr. Michael King (UMMS, Worcester MA), Dr. Andrew Karellas (UMMS/Arizona State), Dr. David DeSantis (UMMS, Saint Elizabeth's Hospital), Dr. Don Soo Kim (Children's Hospital, Boston MA), Dr. Gene Cardarelli (Hartford Hospital, Ct.), and Dr. Mi-Ae Park (Brigham and Women's Hospital, Boston MA).

The concentrations in Nanoscience and Technology and in Photonics lastly addresses the need for highly qualified work force in fields of optics and photonics, quantum sensing, communication, nanotechnology, optoelectronic devices, renewable energy, and other rapidly emerging industries in Massachusetts as well as across the nation via our engagement in Manufacturing USA Institutes, such as AIM Photonics. Students choosing one of these concentrations will work with Dr. Petkie, Dr. Titova, Dr. Burnham, Dr. Quimby, Dr. Zekavat, Dr. Liu, and Dr. Furlong.

Resources Required:

This new Applied Physics Graduate Program will not require any significantly new resources. We also will be using the current administrative structure of our Physics Graduate Program to administer this Applied Physics program. Because the Concentrations presented for this program focus on current faculty research strengths, no additional faculty will be required to promote and administer this program. For this program to be effective, we will be requesting (in a separate motion) to create seven new graduate courses. Of these seven courses, five already are being taught as Physics Special Topics (PH 597). These courses are: PH 563, NSE 515, NSE 560, NSE 570, and NSE 580. Therefore, the inclusion of these courses will not require additional faculty resources. The 1 credit ethics course, required for graduate programs in Medical Physics, is expected to be an online course although any of the identified Medical Physics faculty above can teach or oversee this course.

Program Expertise:

Members of our department have a proven history of advising graduate students interested in pursuing interdisciplinary (applied) physics research. As an example: we graduated two Interdisciplinary doctoral students, one in 2018 and one in 2019 and two Interdisciplinary M.S. students in 2019. This year, we will be graduating two physics doctoral students who will be working in the Health Physics field. We also expect to one interdisciplinary Ph.D. in 2021 (Medical Physics) and one physics student (Medical Physics) who is currently supported by Phillips Healthcare.

Impact and Comparison to Other Programs at WPI

We designed this program to complement our department faculty and resources and specifically set out to ensure that our programs will not negatively-impact other WPI graduate programs. To

that end, this proposal was submitted to Drs. Kris Billiar, Joseph Duffy, Arne Gericke, and Jamal Yagoobi prior to its presentation at this faculty [senate](#) meeting.

Implementation Plan

Pending agreement with the Registrar and approval of the faculty [senate](#), we will begin accepting applicants into this program starting in the 2020/2021 academic year.

NOTE: THE FOLLOWING TEXT WILL REPLACE the text currently in the WPI Graduate Catalog [BEGIN Proposed Graduate Handbook Entry]

Programs of Study

The Department of Physics offers programs leading to the M.S. and Ph.D. degrees in Physics and M.S. and Ph.D. degrees in Applied Physics with concentrations in Biophysics and Soft Condensed Matter, Medical Physics, Nanoscience and Technology, Photonics, and Radiological Sciences. The Department of Physics also offers a Master of Science program in Physics for Educators (MPED) and a Graduate Certificate in Nuclear Science and Engineering (NSE) and an accelerated B.S./M.S. program.

Research opportunities are available in experimental, theoretical, and computational studies of biophysics and soft condensed matter physics, materials science, medical physics, nanoscience, optics, photonics, atomic physics, and radiological sciences. In addition to coursework and research opportunities, professional development opportunities also exist for students interested in a career pathway in academia, industry, federal laboratories, and education. The Physics program reserves its financial aid for graduate students in the Ph.D. program.

The Physics Ph.D. and M.S. Programs

WPI Physics graduate program provides students with a broad background in the core areas of fundamental physical sciences and prepares students for careers in research in an academic, industry, or national laboratory setting. In addition to core courses, students are encouraged to acquire breadth by choosing special topics courses to complement their studies. Students carry out rigorous research in theoretical and experimental physics areas including: biophysics, condensed matter physics, optics, quantum physics, atomic, and nuclear physics. The M.S. program provides a suitable foundation for the pursuit of a Ph.D. degree in physics, or a related field, or for a career in industry immediately after graduation.

The Applied Physics Ph.D. and M.S. Programs

The Applied Physics program provides a flexible set of interdisciplinary skills to prepare students for careers at national and international laboratories, industry, education, and academia. It combines a core physics curriculum with cross-cutting research in areas at the interface of physics and other scientific disciplines. Applied Physics Ph.D. and M.S. students are required to select a research concentration and a corresponding set of thematically related courses from the following five options: Biophysics and Soft Condensed Matter Physics, Medical Physics, Nanoscience and Technology, Photonics, and Radiological Sciences.

The Master of Science in Physics for Educators (MPED)

The Master of Science in Physics for Educators is designed specifically for middle school, high school, and community college in-service educators. The emphasis of the program is put on physics courses designed for educators and is combined with courses in assessment and evaluation theory and a participant-designed project. The physics content courses are intended to give educators a deep but applicable understanding of physics that makes advanced physics topics easily accessible to educators and the students they teach. Topics covered will include modern physics, methods in physics and physics for citizens and leaders. Support for degree candidates extends beyond the specific coursework and projects as participants will become part of a network of physicists which ranges from local individuals to a much broader community. The program may be used to help middle and high school educators move from Initial to Professional Licensure in Massachusetts. For information about admissions and requirements, see the listing under STEM for Educators.

The Graduate Certificate in Nuclear Science and Engineering (NSE)

The Graduate Certificate in Nuclear Science & Engineering requires the successful completion of 12-18 graduate credit-hours) with an overall GPA of 3.0. Credits are chosen from the NSE 510-50 course listing or by approval of the NSE Program Committee. Courses cover such topics as nuclear power, radioactivity, chain reaction physics, nuclear reactor safety, power plant design and operation, and case studies of nuclear accidents. These courses are offered on campus, and online through Corporate and Professional Education. The faculty in the certificate program hold a full-time position in a WPI academic department or are affiliated faculty approved by an academic department and NSE program review committee.

The Combined B.S./M.S. Program

The Department of Physics offers a combined B.S./M.S. degree option in Physics and Applied Physics for undergraduate students currently enrolled at WPI. The university rules for B.S./M.S. programs are described in the undergraduate catalog and graduate catalog. It is recommended that the M.S. application be submitted at the beginning of the student's junior year of undergraduate study at WPI.

Admission Requirements

M.S. and Ph.D. Program in Physics

Entrance into the M.S. or Ph.D. Physics Program requires a B.S. in Physics, Applied Physics or the equivalent. Candidates not meeting this entrance requirement may be required to take additional undergraduate courses that will not count towards coursework to satisfy graduate degree requirements.

Well-qualified Ph.D. candidates entering with an M.S. degree in Physics, Applied Physics or its equivalent will be considered by the Physics Department Graduate Committee (PDGC) for admission with Ph.D. 60 status, as described in Degree Requirements section under General Requirements for the Doctorate.

All applications to the M.S. or Ph.D. Physics program must include a Statement of Purpose describing the motivation for pursuing a graduate degree in Physics and should identify one or more faculty members as potential research advisors. Applicants are strongly encouraged contact

faculty directly to learn about their research. Transcripts from every previously attended college or university, a CV, and three letters of reference are also required.

M.S. and Ph.D. Program in Applied Physics

Entrance into the M.S. or Ph.D. Applied Physics Program requires a B.S. degree in physics, applied physics, engineering, materials science, or other natural sciences. Candidates not meeting this entrance requirement may be required to take additional undergraduate courses, which do not count towards coursework to satisfy graduate degree requirements.

Well-qualified Ph.D. candidates entering with an M.S. degree in Physics, Applied Physics or its equivalent will be considered by the Physics Department Graduate Committee (PDGC) for admission with Ph.D. 60 status, as described in Degree Requirements section under General Requirements for the Doctorate.

The application to both the M.S. and Ph.D. Applied Physics Program must include a Statement of Purpose identifying the concentration(s) that the student is interested in and must also describe the motivation for pursuing a graduate degree in Applied Physics. This statement also should identify one or more faculty members as potential research advisors. Applicants are highly encouraged to directly contact potential research advising faculty to learn about their research. Transcripts from every previously attended college or university, a CV, and three letters of reference also are required.

MPED and NSE Programs Entrance into the MPED or NSE programs prefers that the applicant have a B.S. in Physics. However, applicants with comparable backgrounds also will be considered.

Information on the Physics M.S. and Ph.D. Programs

Degree Requirements for the Physics M.S. Program

The M.S. degree in Physics requires completing 30 graduate credit-hours of course and research work. All full-time students also are required to register for the zero-credit graduate seminar (PH 580) each term. Options are available to pursue a Thesis or Non-Thesis option for the Physics M.S. degree. Each option requires completion of 15 credit-hours of core coursework as described below. The Non-Thesis option requires an additional 9 credit hours of physics electives or other courses approved by the PDGC and 6 hours of directed research (PH 598). The Thesis option requires a minimum of 6 hours of thesis research (PH 599) and the completion, presentation, and defense of an M.S. thesis. The thesis option will require that a thesis committee be formed one year prior to the student's expected graduation date. This committee will be formed by the student and his/her research advisor and will consist of three faculty members (including the advisor, who will be responsible for providing mentoring to the student and for overseeing the progress of the student towards a successful completion of their degree). The research advisor may not be the chair of this committee.

Degree Requirements for the Physics Ph.D. Program.

Students in the Physics Ph.D. Program are required to complete 90 graduate credit hours of coursework, a minimum of 30 credits of dissertation research (PH 699), and must complete and

defend their Ph.D. dissertation. Courses taken to satisfy M.S. degree requirements will be counted toward the Ph.D. credit requirements, but completion of an M.S. degree is not required. Additional course credits applied toward the Ph.D. degree requirements can be physics electives, directed research (PH 598), or other approved courses by the PDGC. All full-time students are required to register for the zero-credit graduate seminar (PH 580) each term.

Students entering the Ph.D. Physics Program and who already have been granted an M.S. degree in Physics, Applied Physics, or Engineering Physics may be promoted to Ph.D. 60 status based on PDGC evaluation of their M.S. Degree. Ph.D. 60 students are required to complete 60 graduate credit hours, including a minimum of 30 credits of research (Directed Research, PH 598 or Ph.D. Dissertation, PH 699). Coursework requirements for the students in Ph.D. 60 status may include some or all of the core courses as part of their total 60 credits requirement and will be determined by the PDGC upon review of student's previous graduate coursework.

The PDGC reviews each student's academic work on an annual basis, and the committee and the academic or research advisor may require additional coursework to address specific deficiencies in the student's background. Students must maintain a minimum of a 3.0 GPA to be in good standing. One year of residency in the program is required.

Summary of Physics M.S. and Ph.D. credit requirements:

	M.S. Non-Thesis	M.S. Thesis	Ph.D.
Physics Core Courses: PH 511 Classical Mechanics PH 514 Quantum mechanics I PH 515 Quantum mechanics II PH 522 Statistical Mechanics PH 533 Advanced Electrodynamics	15	15	15
PH 580 Graduate Seminar	Continuous enrollment in zero credit-hour course ⁺		
PH 599 Thesis Research	-	6-15	*#
PH 598 Directed Research	6	-	*
PH Electives (or approved courses by PDGC)	9	0-9	*
PH 585 Scientific Writing and Proposal Development	-	-	1
PH 798 Comprehensive Written Exam	-	-	%
PH 799 Ph.D. Qualifying Exam	-	-	%
PH 699 Ph.D. Dissertation	-	-	30

* For the Ph.D. Program, physics electives, directed or thesis research, and other approved courses by the PDGC count toward the completion of the required number of credit hours for the degree.

Only for the Ph.D. 90 status when completing a thesis.

⁺ Only for full-time students.

% Degree requirement tracking course (zero credit hours)

The Ph.D. Physics Program also has the following requirements:

Ph.D. Qualifying Examination

Students enrolled in the Physics or Applied Physics Ph.D. program are required to register and pass, no later than the end of the third year after formal admittance to the Ph.D. program, the *Ph.D. Qualifying Exam* (PH 799). Here, the student is required to write and defend an original research proposal before a committee representative of the area of their specialization, approved and appointed by the PDGC. The students are allowed only two attempts to pass this exam. The examination is used to evaluate the ability of the student to pose meaningful scientific questions, to propose experimental or theoretical methods for answering those questions, and to interpret the validity and significance of probable outcomes of these theoretical conjectures, models or experiments. The committee will consist of a minimum of three physics faculty members including the advisor, and at least one faculty member from outside the department, and will administer and evaluate the exam. The research advisor may not be the chair of this committee. The students are also required to take and pass a one-credit scientific writing course (PH 585) prior to their first attempt at taking the Ph.D. Qualifying Exam.

Ph.D. Dissertation

To fulfill the final Ph.D. degree requirement, the candidate must submit and defend a satisfactory dissertation to the dissertation committee formed in consultation with the research advisor and approved by the PDGC. This committee will consist of a minimum of three physics faculty members including the advisor, and at least one faculty member from outside the department. The research advisor may not be the chair of this committee.

Information on the Applied Physics M.S. and Ph.D. Programs

Degree Requirements for the Applied Physics M.S. Program

The M.S. degree in Applied Physics requires completing a minimum of 30 graduate credit-hours of course and research work. All full-time students also are required to register for the zero-credit graduate seminar (PH 580) each term. Options are available to pursue a Thesis or Non-Thesis option for the Physics M.S. degree with course distribution requirements for each concentration provided in the tables that follow. The thesis option requires a minimum of 6 hours of thesis research (PH 599) and the completion, presentation, and defense of an M.S. thesis. The thesis option will require that a thesis committee be formed one year prior to the student's expected graduation date. This committee will be formed by the student and his/her research advisor and will consist of three faculty members (including the advisor, who will be responsible for providing mentoring to the student and for overseeing the progress of the student towards a successful completion of their degree). The research advisor may not be the chair of this committee.

Petitioning to Changing an M.S. Option: Students may petition the PDGC to switch from a non-thesis to a thesis option, a thesis to non-thesis option, or to switch between the Applied Physics and Physics programs. Petitions must include a justification for the switch and a letter of support from a potential M.S. thesis advisor. Petitions will be reviewed in consultation with student's advisor, when appropriate.

Degree Requirements for the Ph.D. in Physics and Applied Physics

Students in the Physics or Applied Physics Ph.D. program are required to complete 90 graduate credit hours of coursework and a minimum of 30 credits of dissertation research (PH 699). These

students also must complete and defend their Ph.D. dissertation. Courses taken to satisfy M.S. degree requirements will be counted toward the Ph.D. credit requirements, but completion of an M.S. degree is not required. Additional course credits applied toward the Ph.D. degree requirements can be physics electives, directed research (PH 598), or other approved courses by the PDGC. All full-time students are required to register for the zero-credit graduate seminar (PH 580) each term.

Students entering the Physics or Applied Physics Ph.D. program who already have been granted an M.S. degree in Physics, Applied Physics, or Engineering Physics may be promoted to Ph.D. 60 status based on PDGC evaluation of their M.S. Degree. Ph.D. 60 students are required to complete 60 graduate credit hours, including a minimum of 30 credits of dissertation research (PH 699). Coursework requirements for the students in Ph.D. 60 status may include some or all of the core courses as part of their total 60 credits requirement and will be determined by the PDGC upon review of student’s previous graduate coursework.

The PDGC reviews each student’s academic work on an annual basis, and the committee and the academic or research advisor may require additional coursework to address specific deficiencies in the student’s background. Students must maintain a minimum of a 3.0 GPA to be in good standing. One year of residency in the program is required.

Basic Course Requirements for the Applied Physics M.S. and Ph.D. Programs

Students in the Applied Physics Program must select a Concentration from the following list

1. Biophysics and Soft Condensed Matter Concentration
2. Medical Physics Concentration
3. Nanoscience and Technology Concentration
4. Photonics Concentration
5. Radiological Sciences Concentration

The basic course requirements of each concentration are as follows:

Basic Course Requirements for Both the M.S. and Ph.D. Applied Physics: Biophysics and Soft Matter Concentration			
	M.S. Non- Thesis	M.S. Thesis	Ph.D.
Physics Core Courses: PH 511 Classical Mechanics PH 522 Statistical Mechanics	6	6	6
PH 562 Introduction to Biophysics	3	3	3
Approved Concentration Electives*	15	6	15
PH 580 Graduate Seminar	Continuous enrollment in zero credit-hour course ⁺		
PH 599 Thesis Research	-	6-15	**#
PH 598 Directed Research	6	-	**
PH Electives (or approved courses by PDGC)	-	-	**
PH 585 Scientific Writing and Proposal Development	-	-	1

PH 798 Comprehensive Written Exam	-	-	%
PH 799 Ph.D. Qualifying Exam	-	-	%
PH 699 Ph.D. Dissertation	-	-	30

*NOTE: The student may select electives from the following list of preapproved courses: PH 563, PH 533, PH 514, PH 541, PH 554, PH 561, PH 571, BME 555, BME 564, BME 583, CHE 541. Other courses may be used towards the elective requirement based on prior approval by the Physics Department Graduate Committee (PDGC).

** For the Ph.D. Program, physics electives, directed research, and other approved courses by the PDGC count toward the completion of the required number of credit hours for the degree.

Only for the Ph.D. 90 status when completing a thesis.

+ Only for full-time students.

% Degree requirement tracking course (zero credit hours)

Basic Course Requirements for Both the M.S. and Ph.D. Applied Physics: Medical Physics Concentration			
	M.S. Non- Thesis	M.S. Thesis	Ph.D.
Physics Core Courses*	6	6	6
NSE 515: Radiation Biology	3	3	3
NSE 530: Health Physics	3	3	3
NSE 560: Nuclear Instrumentation	3	3	3
NSE 570: Diagnostic Medical Physics	3	3	3
NSE 580: Radiation Therapy Physics	3	3	3
An Anatomy and Physiology course (undergraduate or graduate)	3	3	3
A Medical Ethics Course	1	1	1
PH 580 Graduate Seminar	Continuous enrollment in zero credit-hour course ⁺		
PH 599 Thesis Research	-	6	**#
PH 598 Directed Research	6	-	**
PH Electives (or approved courses by PDGC)	-	-	**
PH 585 Scientific Writing and Proposal Development	-	-	1
PH 798 Comprehensive Written Exam	-	-	%
PH 799 Ph.D. Qualifying Exam	-	-	%
PH 699 Ph.D. Dissertation	-	-	30

*NOTE: The student must take two core physics courses from the following list: PH 511, PH 514, PH 515, PH 522, and PH 533.

Only for the Ph.D. 90 status when completing a thesis.

+ Only for full-time students.

% Degree requirement tracking course (zero credit hours)

Basic Course Requirements for Both the M.S. and Ph.D. Applied Physics: Nanoscience and Technology Concentration			
	M.S. Non- Thesis	M.S. Thesis	Ph.D.
PH 514: Quantum Mechanics I	3	3	3
PH 511: Classical Mechanics or PH 533: Advanced Electrodynamics	3	3	3
Approved Concentration Electives*	18	9	18
PH 580 Graduate Seminar	Continuous enrollment in zero credit-hour course ⁺		
PH 599 Thesis Research	-	6-15	**#
PH 598 Directed Research	6	-	**
PH Electives (or approved courses by PDGC)	-	-	**
PH 585 Scientific Writing and Proposal Development	-	-	1
PH 798 Comprehensive Written Exam	-	-	%
PH 799 Ph.D. Qualifying Exam	-	-	%
PH 699 Ph.D. Dissertation	-	-	30

*NOTE: The student may select electives from the following list of preapproved courses: PH 511 or PH 533, PH 515, PH 522, PH 541, PH 554, PH 561, MTE 575, MTE 509, MTE 532, CH 516, CH 554. Other courses may be used towards the elective requirement based on prior approval by the Physics Department Graduate Committee (PDGC).

** For the Ph.D. Program, physics electives, directed research, and other approved courses by the PDGC count toward the completion of the required number of credit hours for the degree.

Only for the Ph.D. 90 status when completing a thesis.

⁺ Only for full-time students.

% Degree requirement tracking course (zero credit hours)

Basic Course Requirements for Both the M.S. and Ph.D. Applied Physics: Photonics Concentration			
	M.S. Non- Thesis	M.S. Thesis	Ph.D.
PH 514: Quantum Mechanics I	3	3	3
PH 533: Advanced Electrodynamics	3	3	3
PH 544: Fundamentals of Photonics	3	3	3
Approved Concentration Electives*	15	6	15
PH 580 Graduate Seminar	Continuous enrollment in zero credit-hour course ⁺		
PH 599 Thesis Research	-	6-15	**#
PH 598 Directed Research	6	-	**

PH Electives (or approved courses by PDGC)	-	-	**
PH 585 Scientific Writing and Proposal Development	-	-	1
PH 798 Comprehensive Written Exam	-	-	%
PH 799 Ph.D. Qualifying Exam	-	-	%
PH 699 Ph.D. Dissertation	-	-	30

*NOTE: The student may select electives from the following list of preapproved courses: PH 511, PH 515, PH 541, PH 548, PH 554, PH 561, PH 571, ME 5225, ME 5301, BME 583. Other courses may be used towards the elective requirement based on prior approval by the Physics Department Graduate Committee (PDGC).

** For the Ph.D. Program, physics electives, directed research, and other approved courses by the PDGC count toward the completion of the required number of credit hours for the degree.

Only for the Ph.D. 90 status when completing a thesis.

+ Only for full-time students.

% Degree requirement tracking course (zero credit hours)

Basic Course Requirements for Both the M.S. and Ph.D. Applied Physics: Radiological Sciences Concentration			
	M.S. Non- Thesis	M.S. Thesis	Ph.D.
Physics Core Courses*	6	6	6
NSE 515: Radiation Biology	3	3	3
NSE 530: Health Physics	3	3	3
NSE 560: Nuclear Instrumentation	3	3	3
Approved Concentration Electives*	9	6	9
PH 580 Graduate Seminar	Continuous enrollment in zero credit-hour course ⁺		
PH 599 Thesis Research	-	9	**#
PH 598 Directed Research	6	-	**
PH Electives (or approved courses by PDGC)	-	-	**
PH 585 Scientific Writing and Proposal Development	-	-	1
PH 798 Comprehensive Written Exam	-	-	%
PH 799 Ph.D. Qualifying Exam	-	-	%
PH 699 Ph.D. Dissertation	-	-	30

**NOTE: The student must take two core physics courses from the following list: PH 511, PH 514, PH 515, PH 522, and PH 533. Elective Courses may be selected from the PH or NSE course offerings. Other courses may be used towards the elective requirement based on prior approval by the Physics Department Graduate Committee (PDGC).

** For the Ph.D. Program, physics electives, directed research, and other approved courses by the PDGC count toward the completion of the required number of credit hours for the degree.

Only for the Ph.D. 90 status when completing a thesis.

+ Only for full-time students.

% Degree requirement tracking course (zero credit hours)

In addition, the following also are required for the Ph.D. Applied Physics Degree.

Comprehensive Written Examination

Students entering the Ph.D. program in Applied Physics are required register for and pass the *Comprehensive Written Examination* (PH 798) no later than the end of their second year. No more than 3 attempts to pass this exam are allowed. This exam is offered twice a year during Fall and Spring semesters and will consists of four important courses that are central to the student's career goals:

Comprehensive Written Exam Topics: Biophysics and Soft Matter Concentration
Course
PH 511: Classical Mechanics
PH 522: Thermodynamics and Statistical Mechanics
PH 562: Fundamentals of Biological Physics
And a Core/Elective topic chosen in consultation with the student's Thesis Committee

Comprehensive Written Exam Topics: Medical Physics Concentration
Course
NSE 515: Radiation Biology
NSE 530: Health Physics
NSE 570: Diagnostic Medical Physics
NSE 580: Radiation Therapy Physics

Comprehensive Written Exam Topics: Nanoscience and Technology Concentration
Course
PH 514: Quantum Mechanics
EITHER: PH 511: Classical Mechanics OR PH 533: Advanced Electrodynamics
Core/Elective area chosen in consultation with the student's Thesis Committee
Core/Elective topic chosen in consultation with the student's Thesis Committee

Comprehensive Written Exam Topics: Photonics Concentration
Course
PH 514: Quantum Mechanics
PH 533: Advanced Electrodynamics
PH 544: Fundamentals of Photonics

And a Core/Elective topic chosen in consultation with the student's Thesis Committee
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Comprehensive Written Exam Topics: Radiological Sciences Concentration
Course
NSE 515: Radiation Biology
NSE 530: Health Physics
NSE 560: Nuclear Instrumentation
And a Core/Elective topic chosen in consultation with the student's Thesis Committee

Ph.D. Qualifying Examination

Students enrolled in the Physics or Applied Physics Ph.D. program are required to register and pass, no later than the end of the third year after formal admittance to the Ph.D. program, the *Ph.D. Qualifying Exam* (PH 799). Here, the student is required to write and defend an original research proposal before a committee representative of the area of their specialization, approved and appointed by the PDGC. The students are allowed only two attempts to pass this exam. The examination is used to evaluate the ability of the student to pose meaningful scientific questions, to propose experimental or theoretical methods for answering those questions, and to interpret the validity and significance of probable outcomes of these theoretical conjectures, models or experiments. The committee will consist of a minimum of three physics faculty members including the advisor, and at least one faculty member from outside the department, and will administer and evaluate the exam. The research advisor may not be the chair of this committee. The students are also required to take and pass a one-credit scientific writing course (PH 585) prior to their first attempt at taking the Ph.D. Qualifying Exam.

Ph.D. Dissertation

To fulfill the final Ph.D. degree requirement, the candidate must submit and defend a satisfactory dissertation to the dissertation committee formed in consultation with the research advisor and approved by the PDGC. This committee will consist of a minimum of three physics faculty members including the advisor, and at least one faculty member from outside the department. The research advisor may not be the chair of this committee.

Transferring between Ph.D. program options: students may petition the PDGC to switch between a Physics and Applied Physics programs, or to change their concentration. Such petition must include justification and a letter of support from student's advisor.

Note: Students must maintain a minimum of a 3.0 GPA to be in good standing.

Department Course Descriptions

Department graduate courses in this list are worth 3 credits unless otherwise noted.

PH 500. Independent Study (ISG)

(credits are arranged: 1-3)

Various specialized topics and/or research areas from one to two graduate students. Arranged individually with the faculty.

PH 511. Classical Mechanics I

Lagrangian formulation Kinematics and dynamics of rigid bodies. Small oscillations. Motion in non-inertial frames, Hamiltonian mechanics. Canonical transformations. Hamilton-Jacobi theory.

PH 514. Quantum Mechanics I

Schrodinger equation, potential wells and barriers, Hilbert space formulation of quantum mechanics and applications, Central potentials, hydrogen atom, isotropic oscillator, angular momentum and spin.

PH 515. Quantum Mechanics II

Time independent perturbation theory, variational method and WKB method, time-dependent perturbation theory, partial wave theory of scattering, integral approach to scattering theory and Born approximation.

PH 522. Thermodynamics and Statistical Mechanics

The laws of thermodynamics. Elements of kinetic theory. Ensemble theory: canonical, microcanonical, and grand canonical ensembles. Quantum statistical mechanics, Bose-Einstein and Fermi-Dirac statistics. Special topics in statistical mechanics.

PH 533. Advanced Electromagnetic Theory

Classical electrodynamics including boundary-value problems using Green's functions, Maxwell's equations, electromagnetic properties of matter, wave propagation and radiation theory.

PH 541. Mathematical Methods in Physics. The emphasis of the course is on mathematical techniques needed by physicists. The course covers functions of complex variable, special functions, Fourier and Laplace transforms, linear algebra and tensor analysis.

PH 544. Fundamentals of Photonics

Wave optics, Gaussian beams, photon optics, guided-wave optics, semiconductor optics (sources and detectors), interaction of photons with atoms.

PH 548. Fundamentals of Sensors

The course offers an overview of basic sensor physics and technologies to provide practical working knowledge of sensors. The course will include basic sensor operating principles, the physics of sensors, electrical interfacing to sensors, measurement principles, and applications. A wide range of sensors could be covered, such as temperature, photonic, acoustic, chemical, biological, electromagnetic, pressure, position and motion sensors. There will also be a laboratory component to the course.

PH 554. Solid State Physics

Phonons and specific heat of solids; electronic conductivity and band theory of solids; Fermi and Bose gases, Optical properties of materials. Magnetic interactions.

PH 561 Atomic Force Microscopy

Atomic force microscopes (AFMs) are instruments that allow three-dimensional imaging of surfaces with nanometer resolution and are important enabling tools for nanoscience and technology. The student who successfully completes this course will understand the functional principles of AFMs, be able to run one, and interpret the data that are collected. The recommended background for this course is a bachelor's degree in science or engineering. Students who have successfully completed PH 2510, the undergraduate version of this course, may not earn credit for PH 561.

PH 562. Fundamentals of Biological Physics

The course will cover the fundamental concepts of biological physics. The main objective is to learn how to apply the principles of physics, methods of mathematical analysis and computational modeling to complex biological systems and develop a better understanding. The approach will be truly interdisciplinary, bringing concepts from statistical physics, classical mechanics, cell biology, chemistry and biochemistry. Topics covered include: biology by the numbers: time and length scales, mechanical and chemical equilibrium in the living cell, entropy in biology, two-state systems and cooperative binding, random walks and the structure of macromolecules, architecture of the cytoskeleton, biological membranes, modeling of fluids, statistical view of biological dynamics, life in crowded environments, rate equations and dynamics in the cell, dynamics of molecular motors.

PH 563. Introduction to experimental methods in biophysics

The course will overview the biophysical experimental techniques which are used in the study of the structure and function of biological systems at the cellular and molecular level. The main objectives are to understand the principles of most common biophysical techniques and to learn essential skills to perform lab research in biophysics. Topics covered include: light microscopy, super-resolution microscopy, image processing, electron microscopy, x-ray diffraction and protein structure determination, NMR, spectroscopy, calcium measurements, resonance energy transfer, patch-clamp, optical tweezers, rheological characterization of soft materials, molecular force measurements, proportional-integral-derivative automation, protein expression, and design of DNA plasmid. Students will gain hands-on experience on cutting-edge biophysical techniques and will receive training on data collection, data analysis, and scientific report writing.

PH 571. Biophysics / Soft Condensed Matter Journal Club

(1 credit)

Students interested in Biophysics / Soft Condensed Matter read journal articles, prepare presentations and give short talks, engage in critical discussion, and provide feedback to fellow students. The objectives of the course are for students to learn about current topics in the broad area Biophysics / Soft Condensed Matter and biotechnology and to improve their professional skills. Recommended background: A bachelor's degree in science, technology, engineering, or mathematics.

PH 572. Nanoscience Journal Club

(1 credit)

Students interested in nanoscience read journal articles, write abstracts, give short talks, engage in critical discussion, and provide feedback to fellow students. The objectives of the course are for

students to learn about current topics in nanoscience and nanotechnology and to improve their professional skills.

PH 580. Graduate Seminar

(0 credits)

Students attend Physics Colloquia by WPI faculty and invited scientists on current research topics in different areas of physics. They discuss results and ideas presented in those talks. In addition, students give presentations on their research or on problems of current interest to physics community. The course therefore will provide opportunities for students to develop their presentation skills, broaden their perspectives and provide networking opportunities. All full-time physics graduate students are required to register and attend.

PH 585. Scientific Writing and Proposal Development

(1 credit)

This course will cover key elements of writing successful grant or fellowship proposals, as well as manuscripts. The topics that will be covered will include project development, identification of funding agencies or journals, proposal and manuscript writing and editing, as well as aspects of the submission and review process. Students will be expected to develop a proposal, and participate in reviews. Students are expected to complete this course prior to taking the Ph.D. Qualifying Exam in Physics. Recommended background: A bachelor's degree in science, technology, engineering, or mathematics.

PH 597. Special Topics

(1-3 credits)

Arranged by physics faculty for individual or groups of students, these offerings cover topics that are not covered by the regular Physics course offerings. Exact course descriptions are posted by the faculty in advance of the offering.

PH 598. Directed Research

(credit varies)

A directed and coherent program of research that, in most cases, will eventually lead to thesis or dissertation research. This is also used for Directed Research Rotation (for 3 credit hours) for first year students who have not yet taken the Qualifying Examination in order to explore the available research opportunities.

PH 599. M.S. Thesis Research

(credit varies)

Each student will work under the supervision of a member of the department on the thesis research for their Master of Science in Physics degree. (Prerequisite: Consent of advisor)

PH 699. Ph.D. Dissertation

(credit varies, no more than 30 credits)

Can be taken any time after passing the Physics Qualifying Examination but required in the last semester for the writing and defending of the Ph.D. dissertation. (Prerequisite: Consent of advisor)

PH 798. Comprehensive Written Examination

(0 credit)

Comprehensive Written Examination prepared, administered and evaluated by the Physics Department Graduate Committee (PDGC). Recommended background: Student should be enrolled in the Physics or Applied Physics Ph.D. program.

PH 799. Ph.D. Qualifying Examination

(0 credit)

Students are required to write and defend an original research proposal before a committee representative of the area of their specialization, approved and appointed by the Physics Department Graduate Committee (PDGC). Recommended background: Student should be enrolled in the Physics Graduate program, seeking a Ph.D. degree.

MPE 510. Classical Mechanics

(2 credits)

Broad coverage emphasizing interconnections of a mechanical description of the universe utilizing both algebraic and calculus language at a level appropriate for secondary school educators. Topics include: vectors and vector manipulation to describe motion, Newton's laws of motion; work and energy concepts; energy and momentum conservation laws; models of forces and interactions; generalized coordinates and momentum; overview of Lagrangian and Hamiltonian formulations.

MPE 520. Electrodynamics

(2 credits)

Broad coverage at the appropriate level emphasizing interconnections of the electromagnetic interactions in the universe utilizing both algebraic and calculus language at a level appropriate for secondary school educators. Topics include: electro and magnetostatics and dynamics, boundary-value problems; Maxwell's equations; overview of electromagnetic properties of matter and wave propagation (radiation).

MPE 530. Modern Physics

(2 credits)

Broad coverage of the three central areas of modern physics that emphasize the wonder and interconnections at the conceptual level appropriate for secondary school educators. Topics include: Quantum Physics (postulates, Schrödinger and Dirac formalisms, implications and interpretations), Special and Introduction to General Relativity (the four-vector, space-time, invariants, time dilation and length contraction), and Thermo/Statistical Physics (macroscopic variables, equation of state, state functions, response functions, microscopic variables, statistical approach, ensembles, the partition function).

MPE 540. Differential Equations in Nature

(2 credits)

Emphasizes connections and interconnections with the mechanical, electromagnetic, and modern areas as well as mathematical areas of oscillations, waves, and optics utilizing differential

equations at a level appropriate for secondary school educators. Topics include: Free, damped, and driven-damped oscillations, waves, Doppler Effect, optics, interference and diffraction. Examples are drawn from a wide range of physical phenomena to illustrate each concept. To develop this content, homogeneous and non-homogeneous differential equations of the first and second order will be employed. Thick contextual meaning will be drawn to support mathematical foundation and vice versa to allow for deeper “authentic” learning.

MPE 550. Computational Methods in Physics

(2 credits)

Topics are chosen to illustrate various numerical techniques useful for educators and students to illustrate physics concepts and develop a sense of physical intuition through simulations and modeling. It is not intended to be a course on numerical methods; rather it will be aimed at the application of numerical methods to physical models. Various programming languages/platforms are utilized in each example to highlight the general nature and to provide choices matching students programming backgrounds.

MPE 560. Experimental Methods in Physics

(2 credits)

Hands-on methods of physically testing concepts and models of the universe. Technology is utilized but general methods accessible to barely outfitted lab environments are stressed. Topics covered are in a series of subject units, the physical principles underlying the phenomena to be observed and the basis for the measurement techniques employed is reviewed. Principles and uses of standard laboratory instruments (oscilloscopes, meters for frequency, time, electrical and other quantities, lock-in amplifiers, etc.) are stressed. In addition to systematic measurement procedures and data recording, strong emphasis is placed on processing of the data, preparation and interpretation of graphical presentations, and analysis of precision and accuracy, including determination and interpretation of best value, measures of error and uncertainty, linear best fit to data, and identification of systematic and random errors. Preparation of high-quality experiment reports is also emphasized. Representative experiment subjects are: mechanical motions and vibrations; free and driven electrical oscillations; electric fields and potential; magnetic materials and fields; electron beam dynamics; optics; diffraction-grating spectroscopy; radioactive decay and nuclear energy measurements.

MPE 572. Physics Research Experience for Teachers

Provides educators with hands-on research experience either in the research programs in Physics at WPI or other venues but under the oversight of the physics faculty. The goal is to support the active involvement of educators in research in order to translate their research experience into new classroom activities and build long term collaborative relationships between the researcher(s), educator(s), and potentially the educator(s)’ students. Research activities can range from experimental to theoretical to computational and can involve multiple educators and/or their students with some expectation that the activity may lead to a publication.

MPE 574. Physics for Citizens and Leaders

Emphasizes physics concepts and connections to society. Educators will explore and understand the important connections between society and the relevant physics concepts and their context. The goal is for the educator to be able to apply critical thinking of the application of physics to

important societal issues. Topics can range from energy options, climate change, technology assessment and risk, ethical use of science.

MPE 576. Physics in Popular Culture

Covers myths and misconceptions of physics in popular culture (i.e., movies, books, TV, web, etc.). The goal of this independent study is for the educator to be able to identify how the representation of physics in popular media perpetuates important myths and misconceptions that impact reasoning and critical thinking, sometimes in a profoundly negative way. Emphasis is placed on utilizing these representations as teaching/learning moments for the specific relevant physical concepts.

NSE 510. Introduction to Nuclear Science and Engineering

This introductory course provides an overview of the field of nuclear science and engineering as it relates to nuclear power and nuclear technologies. Fundamental concepts relevant to nuclear systems are introduced, including radioactivity, radiation interaction phenomena, chain reaction physics, and transport in engineering materials. Nuclear reactor physics and design concepts are introduced with focus on light water fission reactors. A survey of advanced nuclear technologies and applications is provided. Prerequisites: graduate or senior standing or consent of the instructor.

NSE 515: Radiation Biology

This course will introduce the student to fundamental concepts in radiation biology. Initially, theories will be developed concerning the effects of radiation exposure on basic biological systems, such as a virus or a cell. These theories will be based on our knowledge of radiation interaction mechanisms at the atomic/molecular level coupled with our knowledge of cell biology. Once developed, these theories will be compared against experimental observations and expanded to include cellular kinetic responses to radiation. Focus will then shift from the simple cell to more complex biological organisms. Ultimately, the student will be expected to appreciate the practical aspects and consequences of human radiation exposure and to properly apply this information in a radiation safety or medical physics environment.

NSE 520. Applied Nuclear Physics

This course introduces engineering and science students to the fundamental topics of nuclear physics for applications, basic properties of the nucleus, nuclear radiations, and radiation interactions with matter. The course is divided into four main sections: (1) introduction to elementary quantum mechanics, (2) nuclear and atomic structure, (3) nuclear decays and radiation, and (4) nuclear matter interactions and nuclear reactions. Prerequisites: Physics of mechanics and electrodynamics (PH1110/11 and PH1120/21) and mathematical techniques up to and including ordinary differential equations (MA2051)

NSE 530. Health Physics

This course builds on fundamental concepts introduced in NSE510 and applies them to key topics in health physics and radiation protection. Health physics topics include man-made and natural sources of radiation, dose, radiation biology, radiation measurement, and radiation safeguards. Radiation protection concepts are explored as they apply to existing and advanced nuclear power generators, including reactor safety, nuclear waste and byproducts, regulatory constraints, and accident case studies. Prerequisites: graduate standing or consent of the instructor

NSE 540. Nuclear Materials

This course applies fundamental materials science concepts to effects on materials in harsh nuclear environments. An overview is provided on environments, special nuclear materials, and constraints in materials selection. Relationships are developed between nuclear effects on crystal structure, microstructure, degraded material performance, and bulk properties of engineering and electronic materials. Case studies provide examples of enhancements induced by multiple harsh environments and mitigation through material design hardening. Prerequisites: ES2001 or equivalent.

NSE 550. Reactor Design, Operations, and Safety

This course provides a systems engineering view of commercial nuclear power plant technology. Power plant designs and their evolutions are studied, ranging from early to modern generation light water reactors, as well as advanced design families, such as alternate moderator and breeder reactors. Critical aspects of conventional power reactor designs are explored in detail, including steam supply, reactor core, control, and protection systems. Plant operational characteristics are studied, including reactor dynamics, control, feedback, and fuel cycle management. Critical power plant safety aspects of the design and operations are explored and reinforced with lessons learned from major power generator accident scenarios (including Three Mile Island, Chernobyl, and Fukushima Daiichi). Prerequisites: graduate standing or consent of the instructor

NSE 560: Nuclear Instrumentation

This course provides the operating principles and applications of nuclear radiation detection systems, including detector theory, electronic signal processing, and measurement and data reduction techniques. Students will learn to use ion chambers, proportional counters, Geiger Mueller counters, scintillators, and high-purity germanium detectors to detect alpha, beta, gamma, x-ray, and neutron radiation.

NSE 570: Diagnostic Medical Physics

Students will be introduced to the fields of diagnostic medical imaging with a focus on the fundamental imaging physics. Basic concepts, including: matter and energy, x-ray production, and photon interactions, will lead to topics in x-ray generation, nuclear magnetic resonance, and sound-wave propagation. The course will then focus on the different diagnostic imaging modalities including X-ray radiography, Computed Tomography, Nuclear Magnetic Resonance, Gamma Scintillation, and ultrasound imaging.

NSE 580: Radiation Therapy Physics

Students will learn the theory, practice, and application of radiation oncology and therapy. Using the basic concepts of matter and energy, the production of x-rays, and photon interactions in tissue, the student will be introduced to linear accelerator (LINAC) physics, radiation treatment planning, and photon and electron dosimetry. In addition, this course will cover topics of current interest in radiation therapy such as: intensity-modulated radiation therapy, calibration of electron and photon beams, brachytherapy, hyper-fractionation therapy, and charged particle therapy.

NSE 585: Medical Ethics and Responsible Conduct

(1 credit):

This material is intended to cover ethical issues in clinical medicine, scientific research, and in the professional conduct of the medical physicist. The term “ethics” is used here in the sense of a permissible standard of conduct for members involved with the medical and research fields.

NSE 595. Special Topics

(1-3 credits)

Arranged by faculty affiliate to the Nuclear Science and Engineering program for individual or groups of students, these courses survey areas that are not covered by the regular NSE course offerings. (Prerequisite: Consent of instructor.)

[END Proposed Graduate Handbook Entry]

Date: April 16, 2020

To: WPI Faculty

From: Committee on Graduate Studies and Research (Prof. Fischer, Chair)

Re: Motion to establish new Applied Physics lecture courses to support the new Applied Physics graduate program.

Motion: The Committee on Graduate Studies and Research recommends and move that the following new Applied Physics graduate courses be established to support the new graduate program in Applied Physics.

1. Proposal for new Applied Physics courses

Rationale:

To implement this new Applied Physics degree program and ensure its success, we propose to create seven (7) new 3-credit lecture courses, one (1) medical physics 1-credit ethics course, and one (1) Nuclear Science and Engineering (NSE) Special Topics course. Of these seven (7) proposed 3-credit lecture courses, four of them, NSE 515, NSE 560, NSE 570, and NSE 580 already are being taught as a PH 597 Special Topics and have a history of student success. In addition, these NSE courses were selected to meet the course recommendations of the American Association of Physicists in Medicine (AAPM) and the Health Physics Society.

Proposed New Courses:

Below is a list of new courses proposed to support the proposed Applied Physics Program. Please note that each course includes the number of credits it is worth, the expected frequency that the course will be offered, an indication of if this course currently is being offered as an experimental course, and the professors who will or can teach this course.

PH 563. Introduction to experimental methods in biophysics (3 credits, expected to be offered biennially) This course has been taught as a special topics course by Dr. Qi Wen and also may be taught by Dr. Kun-Ta Wu

PH 544. Fundamentals of Photonics (3 credits, expected to be offered biennially) to be taught by Lyubov Titova or Rick Quimby

PH 548. Fundamentals of Sensors (3 credits, expected to be offered biennially) to be taught by Seyed Zekavat or Doug Petkie

NSE 515 Radiation Biology (3 credits, expected to be offered annually). This course is currently taught as PH 597RB: Radiation Biology by Dr. Kadam or Dr. Medich.

NSE 560 Nuclear Instrumentation (3 credits, expected to be offered annually). This course is currently taught as PH 597NI: Nuclear Instrumentation by Dr. Stroe, Dr. Currier, or Dr. Medich.

NSE 570 Diagnostic Medical Physics (3 credits, expected to be offered biennially). This course is currently taught as PH 597DM: Diagnostic Medical Physics by Dr. Medich.

NSE 580 Radiation Therapy Physics (3 credits, expected to be offered biennially). This course is currently taught as PH 597RT: Radiation Therapy Physics by Dr. Medich.

NSE 589: Medical Professionalism and Ethics (1 credit, offered biennially). NOTE: *This course is expected to be an online course with content based on that recommended by the American Association of Medical Physicists (AAPM, Task Group 159, Med. Phys. 37 (8) August 2010) and the Commission on Accreditation of Medical Physics Programs (CAMPEP).*

Resources Required: The four new three credit courses: NSE515, NSE560, NSE570, and NSE580 currently are being taught by WPI TTT and NTT faculty as Physics special Topics (PH 597) courses. Therefore, the inclusion of these courses will not require additional faculty resources. The 1 credit ethics course is expected to be an online course although any of the identified Medical Physics faculty above can teach or oversee this course.

Implementation Plan:

These new courses will be scheduled in the next academic year after passage by the faculty. Once approved by the Faculty [Senate](#), the Department Chair, Associate Chair, and the faculty targeted to teach these new courses will meet to select the appropriate semesters to offer PH 563, PH 544, and PH 548. Courses with an established teaching schedule (NSE 515, NSE 560, NSE 570, NSE 580) will continue to be offered at the same semester, time, and classroom as their PH 597 counterpart. The Physics Chair and Associate Chair also will decide on how to best implement NSE 589 (ethics). It is envisioned that this course will be offered online.

These new courses are proposed to appear in the Graduate School Handbook as presented below:

[BEGIN Proposed Graduate Handbook Entries]

Course Descriptions: Unless otherwise noted, each course is worth 3 credits

PH 563. Introduction to experimental methods in biophysics

The course will overview the biophysical experimental techniques which are used in the study of the structure and function of biological systems at the cellular and molecular level. The main objectives are to understand the principles of most common biophysical techniques and to learn essential skills to perform lab research in biophysics. Topics covered include: light microscopy, super-resolution microscopy, image processing, electron microscopy, x-ray diffraction and protein structure determination, NMR, spectroscopy, calcium measurements, resonance energy transfer, patch-clamp, optical tweezers, rheological characterization of soft materials, molecular force measurements, proportional-integral-derivative automation, protein expression, and design of DNA plasmid. Students will gain hands-on experience on cutting-edge biophysical techniques and will receive training on data collection, data analyzation, and scientific report writing.

PH 544. Fundamentals of Photonics

Wave optics, Gaussian beams, photon optics, guided-wave optics, semiconductor optics (sources and detectors), interaction of photons with atoms.

PH 548. Fundamentals of Sensors

The course offers an overview of basic sensor physics and technologies to provide practical working knowledge of sensors. The course will include basic sensor operating principles, the physics of sensors, electrical interfacing to sensors, measurement principles, and applications. A wide range of sensors could be covered, such as temperature, photonic, acoustic, chemical, biological, electromagnetic, pressure, position and motion sensors. There will also be a laboratory component to the course.

NSE 515: Radiation Biology

This course will introduce the student to fundamental concepts in radiation biology. Initially, theories will be developed concerning the effects of radiation exposure on basic biological systems, such as a virus or a cell. These theories will be based on our knowledge of radiation interaction mechanisms at the atomic/molecular level coupled with our knowledge of cell biology. Once developed, these theories will be compared against experimental observations and expanded to include cellular kinetic responses to radiation. Focus will then shift from the simple cell to more complex biological organisms. Ultimately, the student will be expected to appreciate the practical aspects and consequences of human radiation exposure and to properly apply this information in a radiation safety or medical physics environment.

NSE 560: Nuclear Instrumentation

This course provides the operating principles and applications of nuclear radiation detection systems, including detector theory, electronic signal processing, and measurement and data reduction techniques. Students will learn to use ion chambers, proportional counters, Geiger Mueller counters, scintillators, and high-purity germanium detectors to detect alpha, beta, gamma, x-ray, and other radiations.

NSE 570: Diagnostic Medical Physics

Students will be introduced to the fields of diagnostic medical imaging with a focus on the fundamental imaging physics. Basic concepts including: matter and energy, x-ray production, and photon interactions, will lead to topics in x-ray generation, nuclear magnetic resonance, and sound-wave propagation. The course will then focus on the different diagnostic imaging modalities including X-ray radiography, Computed Tomography, Nuclear Magnetic Resonance, Gamma Scintillation, and ultrasound imaging.

NSE 580: Radiation Therapy Physics

Students will learn the theory, practice, and application of radiation oncology and therapy. Using the basic concepts of matter and energy, the production of x-rays, and photon interactions in tissue, the student will be introduced to linear accelerator (LINAC) physics, radiation treatment planning, and photon and electron dosimetry. In addition, this course will cover topics of current interest in radiation therapy such as: intensity modulated radiation therapy, calibration of electron and photon beams, brachytherapy, hyper-fractionation therapy, and charged particle therapy.

NSE 589: Medical Professionalism and Ethics (*1 credit*)

This material is intended to cover ethical issues in clinical medicine, scientific research, and in the professional conduct of the medical physicist. The term “ethics” is used here in the sense of a permissible standard of conduct for members involved with the medical and research fields.

[END Proposed Graduate Handbook Entry]

Date: April 16, 2020

To: The WPI Faculty

From: Committee on Academic Policy (Prof. Heineman, Chair)

Re: Motion to allow students to be paid for credit-bearing work on sponsored projects

Motion: The Committee on Academic Policy recommends, and I move that the current trial policy allowing students to be paid by sponsors for credit-bearing work on MQPs and IQPs be made permanent. The policy should be updated to emphasize the central role of WPI's academic mission in all student project work and emphasize the primary authority and responsibility of the faculty advisor(s) in all decisions related to the project work.

Changes to the Catalog:

The following language appears in the AY 2020-2021 Undergraduate Catalog (in the **Projects and Research** pages of Section 1: The WPI Plan in the undergraduate catalog):

PAY AND CREDIT (for students working on sponsored projects)

A student may receive pay for work associated with a registered project under the following conditions:

1. The work done for pay is clearly distinguished from the work defined for academic credit for the project. This distinction must be clearly articulated in a conflict of interest statement signed by all participating parties before the project begins.
2. Results obtained from paid or unpaid work performed while students are not registered for project credit at WPI may be used in projects only after consultation with the project advisor. When possible, such consultation should take place before work begins.

This language appears in two places. First, on page 16 of the catalog where the structure and requirements of the MQP are discussed. Second, the language is repeated on page 217 under the Registrar's policies regarding project registration.

This language will be replaced with the following language:

PAY AND CREDIT (for students working on sponsored projects)

Many WPI projects, including both the IQP and the MQP, are completed with an external partner or sponsor. It is important to emphasize that WPI project work is different from traditional internships or co-op experiences in two important ways. First, the primary purpose of the project work is always student learning, as defined by the learning outcomes associated with each project. Second, there must be a WPI faculty member advising the project who has primary responsibility for guiding the student work, for setting the goals of the work, and ensuring that the focus of the project remains student learning.

There do arise situations in projects sponsored by an external organization, usually a company or government agency, when the sponsoring organization requires that the students are

classified as employees or interns and receive pay in order to work on the project. In these situations, approval from the Office of Undergraduate Studies is required.

WPI students may receive pay for work on an externally sponsored IQP or MQP when all of the following three conditions are met:

1. There is documentation, shared with the students, sponsors, and the faculty advisor(s), stating that the primary purpose of the project work is student learning.
2. WPI faculty advisor(s) have a central role in the project and have the responsibility and authority to guide and evaluate student work done on the project. The sponsor does not assign grades or evaluate student learning.
3. The Sponsored Project Agreement and the Scope of Work document is reviewed and approved/denied by the Office of Undergraduate Studies before project work begins. Proposals for pay and credit projects must be submitted for approval/denial by the Office of Undergraduate Studies before the fifth day of the academic year term (A, B, C, or D) or summer term (E1 or E2) preceding the term when project work will begin.

Note that, in order to receive academic credit, students must be registered for the project during the terms in which project work is being done. Work performed with an external sponsor prior to registration – and outside the three conditions described above – will not receive academic credit.

To avoid redundancy in the catalog, existing language on page 217 of the 2020-2021 undergraduate catalog will be removed and replaced with a reference to the earlier material in section “Projects and Research” included above.

PAY AND CREDIT (for students working on sponsored projects)

The “Projects and Research” part of this catalog (page 16) describe the conditions under which a student may receive pay for work associated with a registered project. ~~A student may receive pay for work associated with a registered project under the following conditions:~~

- ~~1. The work done for pay is clearly distinguished from the work defined for academic credit for the project. This distinction must be clearly articulated in a conflict of interest statement signed by all participating parties before the project begins.~~
- ~~2. Results obtained from paid or unpaid work performed while students are not registered for project credit at WPI may be used in projects only after consultation with the project advisor. When possible, such consultation should take place before work begins.~~

Rationale:

In AY 2015-2016, a CAP motion led to a three-year trial period to allow students to be paid while completing IQP or MQP sponsored projects. A task force was formed, and it should have submitted a report by January 2019 to determine whether to revert to the original policy (of disallowing payment to students) or move forward with the new policy. Since no report was submitted, we are

completing this effort. During these three years (Sep 2016 through May 2019), CAP was only able to identify 8 students that were paid.

At this point, although still not a common occurrence, we leave open the possibility that students can get paid by a project sponsor while at the same time receiving academic credit and we articulate this in the Pay and Credit Policy. It must be fully accepted that WPI's academic mission is at the center of all student project work and that the responsibility and authority for managing, supervising, and evaluating project work lies with the faculty advisor(s). Furthermore, approval for student pay while doing a project is done only with prior review and approval by the Office of Undergraduate Studies.

After next year, for the subsequent three years (2021-2022, 2022-2023, and 2023-2024), at the start of the academic year, the Office of Undergraduate Studies shall report to CAP:

- In the previous academic year, the number of requested proposals, the number of students and the sponsoring companies/agencies involved.
- The number of projects (and # of students) that received approval with supporting documentation explaining why approved.
- The number of projects (and # of students) that were denied with supporting documentation explaining why denied.