

# Premium Tuition MS Program Proposal

*Submitted by the*

Department of Chemical & Biomolecular Engineering

NC State University

August, 2016

Degree Program CIPS

14.0701 123 000 A MS Chemical Engineering

Level:

Master's

Degree Types:

See above, includes MS Option B, MS Distance Education, MS Thesis

Proposed Date of Implementation:

Fall 2017

## **Introduction**

The Chemical and Biomolecular Engineering Department is one of the top graduate and research-intensive programs on campus, with a strong focus on on-campus doctoral and Distance Education MS students. Despite such a reputation, a change in chemical engineering industrial demand for MS degrees, together with constraints on resources to expand our on-campus MS program and sustain our Distance Education MS, necessitates a direly needed tuition increase. A proposed tuition increase of \$2400/semester (or \$800/course) will have a significant effect on student training and program quality, will result in a higher return on student investment, and will keep our program competitive with peer and other institutions who are already establishing such programs, without any detrimental effect on graduate recruiting (based on tuition analysis).

There are several factors driving the need for premium tuition in the MS program, related to the constraints in budgetary resources and improving the quality of the program. First, there is a change in market demography, and we are observing a significant increase in applications from well-qualified students who want to complete an MS degree. Last year alone we received 126 applications for our on-campus MS program. However, we are unable currently to admit them because of limited resources (e.g., TAs). Second, as our Distance Education Master's program grows and reaches steady state in terms of student enrollment, we are not able to offer the quality program that we would like. The inability to sustain a quality program occurs in two fronts—creating new courses and providing adequate TA support. Third, many peer and non-peer institutions (e.g., Delaware, Carnegie Mellon, and Cornell) that we compete with have realized the need to create self-funded MS programs because of the changing industrial demography. We need to be competitive with them. Finally, this program would be a conduit to identify outstanding candidates for our doctoral program, as we will have the opportunity to evaluate them during their MS studies. We know other schools are using this avenue to recruit outstanding doctoral students, which leaves us at a competitive disadvantage.

The premium tuition generated (~\$168k/year, as explained later in Section G) will make substantial improvements to our program and offer multiple benefits. First, it will help us create needed new TA positions. One of the reasons we are unable to admit a reasonable number of on-campus MS students is because we do not have TA support or faculty resources to create multiple class sections of graduate courses. Our graduate program structure requires doctoral students to be Teaching Assistants for two semesters; most often, because of limited resources and a large enrollment of students in the chemical engineering BS program, they end up as a TA in our undergrad curriculum. Providing TA supplements (to on-campus doctoral students to serve as Teaching Assistants) would enable us to get more TAs for the Distance Ed MS courses that are needed. In addition, with an anticipated 20 new on-campus MS students coming in every year under the present proposal, we will definitely need TA resources and/or we will have to create an additional section. Second, we need to create more electives for both the MS and general grad programs. A portion of the additional resources from the Premium Tuition program will be used to hire well-qualified adjuncts to teach select undergraduate courses. This would free up our faculty to create new graduate elective courses based on their areas of expertise. Third, we would eventually like to create tracks for our MS program, for example, Soft Matter (polymers, colloids) and Biotechnology. The additional resources would enable us to provide support to faculty to create and teach such curricula. Finally, we would like to create some supplementary fellowship/financial assistance slots. A few entering students whose expenses are not reimbursed by companies (in the case of Distance Ed students) or who have a financial burden will need support; we would like to help them with partial or full tuition remission. Special emphasis will be given to underrepresented groups. In this regard, we may utilize some of the resources to recruit them from schools such as NCA&T, NCCU and Howard by offering supplementary fellowships.

We anticipate that students in the program will garner return on investment on several fronts, from quality of education to better job opportunities. First, we would offer a quality of education that rivals our PhD program. Unlike many schools in which a student in an MS program does not take the core doctoral courses, we require our MS students to take them all. With the added resources we would be able to provide additional TAs and/or class sections, as needed, to ensure they get a quality program. Second, a student would see an average increase in their salary of ~\$14K/year (more details presented in Section D). Thus, they would be able to recoup the additional cost in tuition in about a year. Third, there would be more job opportunities for MS graduates. About a third of our Distance Ed students are non-Chemical Engineers. For them the additional job prospects and salary increase would be substantial. As an example, a student just recently told us that because of his MS degree from NC State, he was promoted to Research Manager. Obtaining a Research Manager position, which opens up many doors, would have never happened with only a BS degree.

Perhaps what is significant is we can offer this enriched program with the premium tuition (a) without putting unnecessary financial burden on our students, and, (b) maintaining or increasing the number of Masters students. A survey of tuition of various schools (Tables 1 and 2, discussed later), including our peers, shows that our tuition is one of the lowest. For example, of the tuition of the 17 official NC State peer institutions (including NC State), our current in- and out-of-state graduate tuitions are both in the bottom quartile. What is most important is that even with premium tuition, NC State's tuition will be right around the mid-point of the 17 schools. In

addition, several private institutions have embarked on the Master's program; their tuition is substantially higher than ours.

In terms of student enrollment, we anticipate an increase with the introduction of the premium tuition MS program because of the following reasons. First, our current focus has been on PhD recruiting only; as such our on-campus MS enrollment typically hover around one. With our new effort to admit MS students, this number will rise significantly. Second, most of our Distance Education Master's students get tuition reimbursement from the respective companies they work for. With the improved quality of the MS program using premium tuition (as described in the next section), we anticipate the enrollment will grow. Finally, we are creating a two-semester sequence 'bridging courses' for non-chemical engineering background students. There is a strong interest from this cohort to pursue a Chemical Engineering MS, and these unique 500-level courses developed by Profs. Richard Felder, Lisa Bullard and Matthew Cooper for first offering in Spring 2018, will pave the way for these students to enter the MS program.

Through this proposal we are requesting premium tuition of \$2,400 per semester for each full-time Master's student, phased in (in increments of ½) over 2 years. The tuition will be prorated for part-time students such as Distance Education Master's students. Approval of this proposal will provide the critical resources needed to expand our on-campus MS program, maintain our Distance Education MS, and develop an enriching experience for students that would rival our highly selective doctoral program. Details of such an endeavor are presented below as we answer the relevant issues posed by the UNCGA policy.

#### **A. Anticipated impact of the proposed tuition premium on program quality**

The proposed tuition premium will have a huge positive impact on our Master's program. Our on-campus Master's is essentially non-existent (we have 1 student in Fall 2016) because of a lack of resources to support the influx of new students. We have been receiving over 100 qualified Master's applicants each year for the past few years which we turn down. We just do not have the resources to provide TA and/or class-section support for additional students. Concurrently our Distance Education program is growing (we have 50 students enrolled now), but it is becoming increasingly difficult financially to sustain the quality of the program from several fronts: TA support, creation of new sections, and developing new graduate electives. The resources generated from the premium tuition will not only alleviate these issues but will also serve to enhance our program and keep it competitive. The following outlines some of the impact of the premium tuition:

1. It will help us establish much needed new TA positions by providing TA supplements. With the anticipated 20 new on-campus MS students (this is a relatively large number for a doctoral-intensive Chemical Engineering program) and the strong enrollment in Distance Education, it is imperative to have more TAs. Depending on the number of students, we may need to create additional sections to teach. This will need faculty resources and TA support, which the premium tuition will provide.
2. There is a strong need to create electives for both the MS and general grad programs. The additional resources from the Premium Tuition program will be used to hire well-qualified

adjuncts to teach undergraduate courses, which would free up our faculty to create new graduate elective courses.

3. We would eventually like to create tracks for our MS program, such as Soft Matter (polymers, colloids) and Biotechnology. The dynamics of our field necessitates the creation of such tracks to keep our program relevant and vibrant. Industries often ask us about these areas. We have core faculty competency in these areas, and we want to leverage the resources of the premium tuition to uniquely position our program.
4. Our program needs to remain competitive with other schools. There has been a change in demography with a high demand for MS chemical engineering students in the industrial sector. Several leading chemical engineering programs have already jumped into this arena by expanding their Master's program. These include schools like Delaware, Florida, Purdue, Cornell, and Carnegie Mellon, to name a few. We are behind; with the resources and plans outlined in #2, and #3, we can strategically jump ahead of our peers.
5. While our Distance Education MS program is unique in that it offers a regular Master's of Science, other universities have started to emulate it. Without additional resources, we will stagnate whereas others will thrive. The topics discussed in #1-3 will help to keep our Distance Education MS program one of the best in the nation.
6. We would like to create supplementary fellowship/financial assistance slots, based on both need and merit. For students whose expenses are not reimbursed by companies (in the case of Distance Ed students) or have a documented financial need, we would like to help them with financially. Special emphasis will be given to underrepresented groups. In this regard, we may utilize some of the resources to recruit them from schools such as NCA&T and Howard by offering supplementary merit-based fellowships.
7. Last but not least, the expanded MS student pool will serve as a conduit to our doctoral program. Meritorious students who have already finished their MS can transition to the doctoral program, paving the way to improving our doctoral program as well.

## **B. The projected impact of increased tuition on access for North Carolina residents**

We envision that the increased tuition will have minimal effect on the access of North Carolina residents to our program. In fact, the long term benefits will significantly outweigh any immediate costs incurred. The increase in salary with a Master's degree is ~\$14K/year. The proposed tuition premium will increase the cost of the Master's degree by about \$7200. Given the increase in salary with having a Master's degree, it would take a student no more than a year (after taxes) to recover the cost of the tuition. This does not take into account other positive aspects that this degree would bring to the table: more job opportunities, quality of career choices and ability to rise in the corporate ladder. The percentage of students in our Distance Education Master's program who are North Carolina residents is approximately 25%. About 85% of these students have their tuition paid by their employer. So, for them getting the quality education will come at no additional cost.

Part of the tuition increase will be set aside for financial assistance, particularly for underrepresented groups and other US students with financial hardship. The ~15% of the

Distance Education students who are self-funded and on-campus students with financial needs can benefit from the assistance program. At present, we offer no financial assistance to any Master's student.

Finally, even with the premium tuition, our in-state tuition will be competitive with our peer institutions. This factor together with the fact that the quality of our program is commensurate with our highly selective PhD program (e.g., students take same courses as our PhD unlike other places) will offer NC residents a unique opportunity to expand their career choices.

### **C. The availability of student financial aid for students with economic need and of tuition remission**

Financial aid for students would actually go up with the introduction of premium tuition. At present, we offer no financial assistance to any student in our Master's program. As we already mention, a component of the funds we receive from the premium tuition will be directed towards recruitment of and financial aid for underrepresented minorities as well as for US citizens with financial burden. Students from both the on-campus and Distance Education MS program will be eligible for this aid. We will set aside tentatively 30% of the annual premium-tuition revenue for financial assistance and fellowships, with flexibility built in to adjust the amount in each category, as desired. This aid can be in the form of partial tuition remission and/or supplementary fellowships. In addition to our assistance, students in this degree program are also eligible for need-based subsidized and un-subsidized federal programs (e.g., Perkins and Stafford loans), as well as the federal PLUS program.

### **D. The extent to which current and prospective students can afford increases in tuition**

The rise in tuition should not be detrimental to current and prospective students. Resources generated from the increased tuition will, in fact, offer several benefits to the students that far surpass the immediate expense that may incur. The latter itself will be recouped in less than a year. We highlight these facets in the following.

1. The current average salary of a BS Chemical Engineer is \$64,000. With a MS degree, this increases by ~\$14K annually initially. The cost of the premium tuition is \$7,200 over the degree program. So, a student can easily recoup the cost in a year or less. From then onwards, the new degree will provide only financial benefits.
2. The new degree will also open up new job opportunities and career path forward, which would not have been likely without the Master's degree. To give an example, one of our MS Distance Education graduate just got promoted to a research manager. This would have never happened otherwise. So the return on investment is high.
3. About a third of our Distance Ed MS students come from a background that is not Chemical Engineering; this population is growing. For them, getting the benefit of a Chemical Engineering MS is enormous. They will have a substantially higher salary increase (as base salary for chemist, for example, is lower than that of a chemical engineer); more importantly, the quality and availability of career choices increases significantly.

4. Many of our students are Distance Education students; their employers often pay for their tuition. So, there is no additional cost incurred by them because of the premium tuition.
5. The addition of TAs, creation of new elective courses, and development of sub-area (bio, polymer, etc) tracks will greatly enhance the quality of the program. These features together with the fact that our MS students are required to take same courses as our PhD student; will make our program unique and our students exceptionally poised for career choices.

**E. The relationship between projected tuition revenue to institutional and/or program costs**

Our goal is to ensure that the programmatic changes we develop are covered by the revenue generated from the increased tuition. With the anticipated increase in on-campus MS enrollment (20/year) and a conservative estimate of 45 Distance Education students enrolling each year, the expected revenue generated through approval of this proposal would be ~\$168,000. A substantial portion of this revenue will be used to create TA supplements. We believe that the amount allocated (58%) for this and hiring adjunct faculty members to free up our faculty to develop new courses can be met from the new revenue. While our Departmental staff is involved in administering graduate student issues, allocation of new financial aid and fellowship for the new program will increase work load. We have thus allocated a modest amount (12%) for administrative support (~0.5 FTE). The addition of premium tuition will not affect the GSSP cost to the university because our financial packages will be in terms of tuition support or supplemental fellowship that would be less than the amount to trigger GSSP to come into effect. In summary, our plan for program enhancement will be self sufficient financially from the revenue generated by the tuition increase.

**F. Tuition and fees, net of remissions and waivers, charged by peer institutions or programs as compared to tuition and fees, net of remissions, for the program (the public subsidy received by students at public institutions or programs in the peer set, including the program in question, will also be identified as part of the comparison)**

We show below in tabular form the tuition and fees of NC State in comparison to our peer institutions. Table 1 reflects the in-state tuition whereas Table 2 exhibits the out-of-state tuition.

**Table 1: In-state tuition and fees charged by peer institutions for one academic year\***

University	Resident Tuition & Fees
Pennsylvania State University	\$19,328
University of Illinois-Urbana Champaign	\$15,630
University of Maryland	\$14,558
Virginia Tech	\$14,532
Rutgers University-New Brunswick	\$14,131
Michigan State University	\$13,980

University of California-Davis	\$13,951
<b>NC State-proposed</b>	<b>\$13,942</b>
The Ohio State University	\$12,934
University of Florida	\$12,740
University of Arizona	\$12,397
Georgia Tech	\$12,234
Colorado State University	\$11,982
University of Wisconsin-Madison	\$11,868
<b>NC State-present</b>	<b>\$11,542</b>
Purdue University	\$10,002
Iowa State University	\$9,449
Texas A&M University	\$6,830

\*Data reflects 2016-2017 academic year or most recent (June 2016) information published on school's website

**Table 2: Out-of-state tuition and fees charged by peer institutions for one academic year\***

<b>University</b>	<b>Non-Resident Tuition &amp; Fees</b>
University of California-Davis	\$38,569
Pennsylvania State University	\$33,142
The Ohio State University	\$32,872
Georgia Tech	\$32,426
University of Arizona	\$32,148
University of Illinois-Urbana Champaign	\$31,252
University of Florida	\$30,134
University of Maryland	\$29,618
Rutgers University-New Brunswick	\$29,521
Purdue University	\$28,804
<b>NC State-proposed</b>	<b>\$28,464</b>
Virginia Tech	\$27,764
Michigan State University	\$26,238
<b>NC State-present</b>	<b>\$26,064</b>
Colorado State University	\$25,698
University of Wisconsin-Madison	\$25,196
Iowa State University	\$23,261
Texas A&M University	\$13,976

\*Data reflects 2016-2017 academic year or most recent (June 2016) information published on school's website

We observe that our current in-state tuition/fees are in the bottom quartile with 13 of the 16 peer institution having tuition higher than us. A similar observation is made in terms of out-of-state tuition where 12 schools have higher numbers than us. This comparison demonstrates unequivocally NC State University is remarkably inexpensive, consistent with the fact that it is one of the best-buy institutions in the nation.

What is remarkable is that even with the tuition increase, we remain competitive. For in-state students, our proposed tuition will be in the middle of the others, with 7 schools having tuition higher than us. For out-of-state students, we would be in the bottom half with 10 schools having higher tuition. We do not have access to public subsidy data for peer institutions but the tuition metrics used presents a compelling story for NC State's tuition increase.

Within NC State, our proposed tuition increase would be commensurate with other Departments in the College of Engineering but much lower than other premium tuition programs such as the Master's of Business Administration (\$23,697 in-state, \$38,704 out-of-state), Analytics (\$20,572 in-state, \$35,094 out-of-state), and Financial Mathematics (\$16,572 in-state, \$31,094 out-of-state).

**G. A plan for the intended use of additional tuition receipts (e.g., needed improvements to the educational program, funding for competitive salary increases, financial aid, etc)**

We intend to allocate the revenue generated from the proposed tuition increase as follows:

- Financial aid-15%
- TA support and faculty assistance-58%
- Graduate program staff-12%
- Fellowship-15%

Annual budget for each of the category is detailed in Form A and totals to \$168,000. In arriving at this revenue, we have assumed 20 on-campus students entering each year, and enrollment of 45 Distance Education students each year. Typically the Distance Ed students take 1 course per semester, so they have been counted as 1/3 FTE. We have also assumed that about a quarter of our students would be in-state based on current enrollment data.

All of the financial aid allocation will be for need-based support. We will pay particular attention to underrepresented groups as well as US students with financial need. The financial aid will be granted as partial or total tuition support. The fellowship allocation will be used for recruiting purposes of underrepresented groups, and will be given as supplementary fellowship towards the student's degree cost. We intend to recruit students from NCA&T, Howard University and NCCU. We will, however, retain flexibility in moving resources between fellowship and financial as deemed necessary. As an example, it is possible that if a student who is doing a Distance Education MS loses his/her employment, we will use resources from either source to assist the student.



The biggest allocation in the budget is for TA support and hire of adjunct (teaching) faculty. We envision the number of TAs to grow substantially. In addition, current supplements for TAs are essentially non-existent with recurring budget cuts in the Department for the last several years. We intend to offer a graduate student a supplement of \$2500 to TA a course (commensurate with the procedure which worked well before the 2009 and subsequent years' budget cuts). With approximately 16 TA supplements during the course of a year, we anticipate the TA supplements to be a major component of this allocation. We will also have at least two ¼ time TAs (\$12,000 per TA) for the two bridging course that we are developing for non Chemical Engineering students to prepare them for embarking on a graduate program in Chemical Engineering at any place. The non-chemical engineering students enrolled in these graduate courses will require enhanced tutorial work (e.g., more office hours, supplementary problem sessions). In addition, we will hire adjunct professors (~ 2 per year at a salary of \$13000/semester including fringe) to teach select undergraduate courses (e.g., senior design and/or controls courses). This will free up time for faculty members to design and offer new elective courses, something that is in high demand from various industrial sectors, and will also serve to differentiate our program from that of our peers.

We have set aside a small allocation for administrative purposes. Assigning new TA supplements, offering financial aid, etc., will require extra effort and responsibility on the part of our staff. This allocation (~0.5 FTE staff) will be used to help the staff by hiring temporary/part-time employees and work study students.

## **H. Assistantships or grant support for graduate students**

A portion (30%) of the revenue generated has been allocated for student financial aid and fellowship. The total amount is substantial and exceeds \$50,000 annually. This is in contrast to our current system in which we offer no financial assistance to MS students. The resources obtained from the tuition increase will help in two areas. It will provide support to students with demonstrable needs. The resources will also help in recruiting top quality students, with special focus on underrepresented minorities.

The added benefit that the financial support will provide can be described by presenting a few scenarios. First, we will be able to reach out to top quality students from schools such NCA&T and NCCU. While NCCU does not have a Chemical Engineering program, they have a strong program in Chemistry, and we routinely admit students from chemistry. The advantage in having assistantship/fellowship at the Master's level is that there is always a cohort of high caliber students who, at least initially, want to do a Master's. With our financial package, we will be well positioned to attract them here, which we are not currently able to do. Almost all other of our peer programs do not offer a financial incentive for Master's students, so we would have an advantage in this regard. Second, there will also be students outside the underrepresented group, who are well qualified but do not have the resources to pursue a Master's degree. We should be able to attract this group of students as well. Finally, it is likely that some of the Master's students would later opt to pursue a PhD, thereby strengthening our doctoral program as well.

## **I. Analysis of student indebtedness levels within the university**

According to information provided by the Office of Scholarships and Financial Aid, only 2 students, or about 5% of the graduating MS cohort for 2015-2016 received need-based loans. The average loan indebtedness, taking into account only those 2 students, was \$19,047. However, the average loan indebtedness taking into account the entire class was \$886.

## **APPENDIX**

- **Form A - Detailed Budget**
  
- **Endorsement Letter - College of Engineering Dean's Office**

**TUITION INCREASE REQUEST FORM  
FOR PROFESSIONAL SCHOOLS  
2015-16 and 2016-17**

**North Carolina State University**  
**Professional School Name and Program: Chemical Engineering**  
**CIP Code: 14.0701 123 000 A MS**

<b>Requested School-Based Tuition Increase</b>	<b>2016-17 Annual Increment</b>	<b>2018-19 Annual Increment</b>
Graduate Residents	\$2,400.00	\$4,800.00
Graduate Nonresidents	\$2,400.00	\$4,800.00

	<b>FTE</b>	<b>FTE</b>
Graduate Residents	9.00	9.00
Graduate Nonresidents	26.00	26.00
<b>Total</b>	<b>35.00</b>	<b>35.00</b>

<b>Projected Revenues</b>		
Graduate Residents	\$21,600.00	\$43,200.00
Graduate Nonresidents	\$62,400.00	\$124,800.00
<b>Total</b>	<b>\$84,000.00</b>	<b>\$168,000.00</b>

<b>Projected Expenditures</b>		
Financial Aid (15%)	\$12,600.00	\$25,200.00
TA support and faculty assistance (58%)	\$48,720.00	\$97,440.00
Graduate program staff (12%)	\$10,080.00	\$20,160.00
Fellowship (15%)	\$12,600.00	\$25,200.00
<b>Total</b>	<b>\$84,000.00</b>	<b>\$168,000.00</b>

**Does your campus intend to charge students in this program the requested graduate CITI plus the SBTI? (respond yes or no in the box)**

**Yes**



College of Engineering  
Office of Research and Graduate Programs

<http://www.engr.ncsu.edu/>

Campus Box 7901  
21 Current Drive, Page Hall  
Raleigh, NC 27695-7901  
P: 919.515.3939

June 17, 2016

Dr. Duane K. Larick  
Senior Vice Provost for Academic Strategy & Resource Management  
NCSU Campus Box 7101  
Holladay Hall, Room 101B  
Raleigh, NC 27695

Dear Duane:

After being reviewed by the Executive Associate Dean, John Gilligan, the Associate Dean for Graduate Programs, Doug Reeves, and in concurrence with Dean Louis Martin-Vega, the College of Engineering strongly endorse the premium tuition proposal increase request by the department of Chemical and Biomolecular Engineering [CBE].

There is potentially a strong international market for this degree, as demonstrated at other top universities. The College of Engineering believes this endorsement will strengthen the departments' academic programs and provide an improved educational experience for their students, at the Masters level. Despite the proposed increase in tuition, costs for this degrees still remains affordable, particularly in the light of career opportunities these graduates will enjoy.

The department of Chemical and Biomolecular Engineering programs has a long record of being amongst the most efficient and productive programs in the university. Their graduate programs have a strong reputations and are in high demand. The program size is projected to remain stable or even grow. Although the proposed numbers of students are small, there is a reasonable expectation that the program will grow.

Thank you in advance for your time and consideration.

Regards,

A handwritten signature in cursive script that reads "John Gilligan".

Dr. John Gilligan, Executive Associate Dean  
College of Engineering, Dean's Office  
North Carolina State University

C: Dean Louis Martin Vega, College of Engineering  
Doug Reeves, Associate Dean of Graduate Programs  
Saad Khan, Director of Graduate Programs, CBE Department