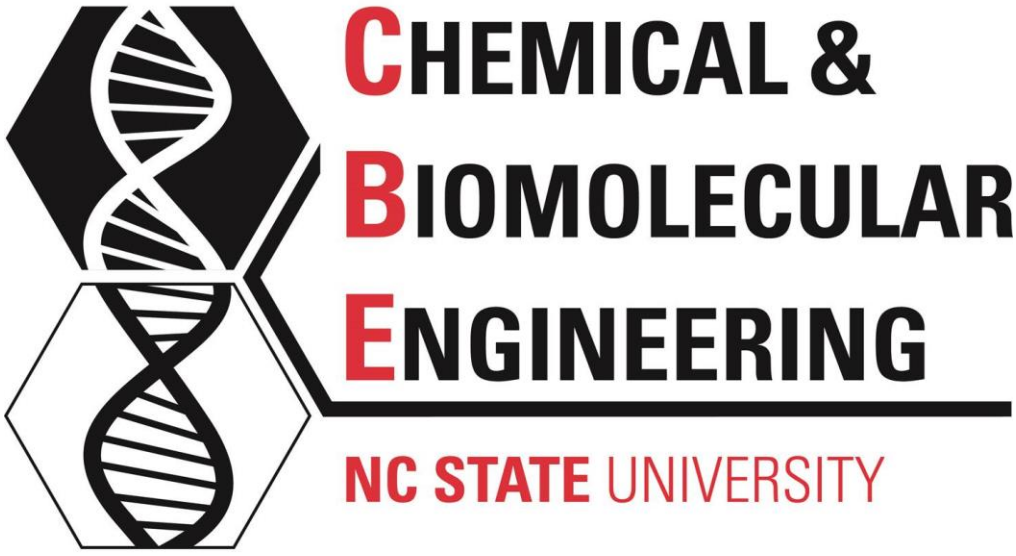
NC STATE UNIVERSITY

ADVISING HANDBOOK



August, 2016

Dear Student:

Welcome to the Department of Chemical and Biomolecular Engineering! The Advising Handbook is intended to be your comprehensive reference for information about the Department and its undergraduate academic programs. The Handbook contains information about courses and curricula, academic policies and procedures, scholarships, the Co-operative Education Program, and student activities in the department. In addition, there is helpful information about professional development topics such as resumes, cover letters, and interviewing. To make the best use of this information, you should consult the Handbook at least once each semester prior to meeting with your academic advisor during the registration advising period. On the last page there is space for you to list your professional and personal goals while at NC State. We encourage you to take the time to reflect on your own goals and to document them – this is the first step toward reaching them!

One copy of the Handbook is provided to each student after you've been accepted as a degree candidate (CODA'd) into the department. Since you'll receive only one copy of the Handbook, we recommend that you keep it with your other reference books and that you treat as the valuable resource it is. Please send any comments or suggestions for improvements to the Handbook to Dr. Lisa Bullard.

Dr. Peter S. Fedkiw
Department Head

Dr. Lisa G. Bullard
Director of Undergraduate Studies

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52 Things To Do Before You Graduate

With a little help from our Facebook fans and other devoted alumni, the staff of the alumni magazine compiled this list of can't-miss NC State experiences. How many can you check off the list?

- ❑ 1. Live on campus.
- ❑ 2. Get to know D.H. Hill Library.
- ❑ 3. Attend a basketball game at the RBC Center and sit in the student section.

TIM O'BRIEN/STUDENT MEDIA

- ❑ 4. Camp out for men's basketball tickets.
- ❑ 5. Travel with the Pack when they make postseason play.
- ❑ 6. Paint your face red and white.
- ❑ 7. Support non-revenue sports.
- ❑ 8. Memorize the "Red & White Song," fight song and alma mater.
- ❑ 9. Participate in Homecoming.
- ❑ 10. Guard the Free Expression Tunnel from our rivals.
- ❑ 11. Purchase a class ring.
- ❑ 12. Tell others why you love NC State.
- ❑ 13. Take a class that sounds fun.
- ❑ 14. Take a class not listed in the Course Catalog.
- ❑ 15. Be a guinea pig for a research experiment.
- ❑ 16. Sign up for a student competition.
- ❑ 17. Get a part-time job or an internship.

LUIS ZAPATA/STUDENT MEDIA

- ❑ 18. Milk a cow on the Brickyard.
- ❑ 19. Head to the Arts to Wear fashion show.
- ❑ 20. Tailgate before a home football game.
- ❑ 21. Attend a concert by a student a cappella group.
- ❑ 22. Check out a University Theatre performance.
- ❑ 23. Attend a showcase of student work.
- ❑ 24. Eat a feast served by University Dining.
- ❑ 25. Rub the Strolling Professor's head for good luck.
- ❑ 26. Whisper to a friend using the parabolic reflectors behind D.H. Hill Library.
- ❑ 27. Try a scoop of Howling Cow ice cream.
- ❑ 28. Take your picture with a wolf sculpture on campus.
- ❑ 29. Enjoy a picnic on the Court of North Carolina.
- ❑ 30. Watch a movie outdoors on Harris Field.
- ❑ 31. Visit the Gregg Museum of Art & Design.
- ❑ 32. Check out NCSU Libraries' latest exhibit.

NC STATE ALUMNI ASSOCIATION RED&WHITE FOR LIFE

- ❑ 33. Catch a glimpse of the Bell Tower when it's lit up red.
- ❑ 34. Watch a game in the Old Barn.
- ❑ 35. Take a campus tour using NCSU Libraries' WolfWalk.
- ❑ 36. Skate around Harrelson Hall's circular ramp.
- ❑ 37. Visit the Burlington Nuclear Reactor.
- ❑ 38. Support Student Media.
- ❑ 39. Join an intramural team or make use of Carmichael Complex.
- ❑ 40. Help build a shack during Shack-a-thon.
- ❑ 41. Donate your blood and package meals for Service NC State.
- ❑ 42. Jump into Lake Raleigh for Polar Plunge.

DEMI OLUBANWO/STUDENT MEDIA

- ❑ 43. Attend a Hoops 4 Hope women's basketball game.
- ❑ 44. Run the Krispy Kreme Challenge.
- ❑ 45. Donate your gently-used items to Wolf Pac 'N' Go.
- ❑ 46. Join a club, student organization or fraternity/sorority.
- ❑ 47. Strike up a conversation with a stranger in the dining hall or on the bus.
- ❑ 48. Meet a professor for coffee.
- ❑ 49. Listen to your academic adviser.
- ❑ 50. Go somewhere off campus and see the world.
- ❑ 51. Paint the Free Expression Tunnel.
- ❑ 52. Attend your commencement.

A Survival Guide to Chemical and Biomolecular Engineering

Dr. Lisa G. Bullard
Department of Chemical and Biomolecular Engineering
North Carolina State University

As you prepare to take your first chemical engineering course, you may be feeling a bit smug, or perhaps a bit nervous, or both. You managed to navigate your one-person kayak through the relatively smooth waters of the freshman year, easily maneuvering around the rocks of calculus, chemistry, and physics by spending about 30-45 minutes (usually 30) on any given homework assignment and studying the night before a test, usually for an hour and a half at the most. The terrain was familiar based on your strong high school preparation. Group work was not necessary (hence your one-person kayak); you may have noticed your fellow kayakers paddling along, some falling by the wayside, but most keeping pace with the group.

Now you and some others have made your way to what looks to be a large, remote island. As you climb out and gaze at the island, you see in the distance that there are spectacular, steep cliffs. Some have beautiful waterfalls cascading down. You can see beautiful flowers and exotic plants before you. All of a sudden some natives emerge from the forest to greet you and your fellow travelers. They look a little strange and they are speaking a language that you don't understand. They hold out some sort of tools in an effort to be friendly (you hope), but you have no idea what they are or how to use them. You realize that you've developed strong paddling skills in order to get here, but you have no idea what lies ahead of you and how to reach those spectacular cliffs.

Welcome to Chemical and Biomolecular Engineering.

Taking the first course in your major – any major – is an exciting but scary step into the unknown. There's the excitement of feeling like you're FINALLY getting into your chosen field, accompanied by the nagging feeling that you're not sure what it really is or what you'll end up doing with it. After teaching the first course in Chemical Engineering – CHE 205 – several times, I've observed that the course is a big shock for many students. They spend several weeks or perhaps the whole semester discovering ways in which CHE 205 is different from courses they've taken before, and trying to figure out how to be successful. Some students quickly get "the lay of the land" and adapt their study habits to achieve success. Other students fight it kicking and screaming all semester, and either give up or barely limp through, feeling battered and betrayed at the end of the semester.

In an effort to equip and inform you from Day 1, I asked some current and former undergraduate and graduate students to share advice and observations that might help you avoid the mistakes they made when they took the course. I hope that you'll take their advice to heart, since they have successfully scaled the high cliffs and stand looking back on the journey with valuable perspective on the potential pitfalls along the way. Comments in italics come directly from students – they say it best.

- **Develop a strong work ethic**. This theme was echoed in almost every student response.

There is no such thing as a lazy (successful) chemical engineer.

You do not have to be brilliant to be a CHE, but you do have to have the dedication, persistence, and downright stubbornness to keep working at it until you get it. Along the way you will doubt yourself. Those who really want it will succeed.

Most importantly, CHE 205 requires time, lots of time. Time spent reading the text, reviewing notes, speaking to the professor, working on the problem sets solely, working on the problem sets collectively, speaking to the TA, and going to problem session. One is also required to quickly develop a work ethic that has never been required before, because in high school they never studied and did well and freshmen year was hard but they still managed to do well with simply doing the homework and studying right before the test. This approach will not prove successful in chemical engineering.

- **Get used to working in groups.**

I recommend that everybody taking these classes should have a group of people that they can study with. Everyone approaches complex problems differently, so working with a team may allow someone to see an aspect of the problem that they would otherwise not consider.

At the beginning of CHE 205, you may think you have it all under control. Don't learn the hard way that a study group is a great source for understanding CHE material. In addition, you may be the resource someone else needs to understand a topic. Working in groups has mutual benefits. Remember, the group members need and value your input as much as you need and value theirs.

I did everything short of going to the bathroom with my group.
Learning how to band together as a class, going beyond our groups to tackle the difficult homework sets became the essence of what we learned in CHE205: hard work, cooperation, and the satisfaction of a team victory.

Once you start working in CHE205 groups, never work on problem sets alone again. Set aside the required time during your week, every week, to do group work. Make it a high priority.

- **…But don't rely on group work (or other resources) to carry you through.**

My instructors always emphasized working in groups, but being able to do the problems independently. Unfortunately, I didn't fully appreciate that advice until later on. The problems never look that difficult when you see the solutions your group members or instructors develop. The solutions are usually straightforward and relatively short. However, the amount of trial and error and flipping through notes and books that it takes to develop those answers seems endless if you actually complete all the problems on your own. So when you sit down and take your first exam, you need to be able come up with these "short" answers on your own from all the information you have been taught up until that point. This can be difficult or impossible if you have relied on your group to carry you along.

There are many resources out there where you can get the answer to most homework problems in CHE 205. By copying those answers, you are cheating yourself of the experience to figure out how to solve that problem. Getting the correct answer to a problem is not worth risking your academic integrity or your opportunity to continue being a Chemical Engineering student.

If you ever feel tempted to copy or cheat, take a minute and pause. More often than not, it's because you're stressed out or pressed for time. Walk away from the books, take a breather, and really think about how much it's worth to you. I bet you will reconsider. Your professors will be much more proud of you turning an assignment in late and completed well, rather than on-time and dishonestly.

- **Get organized.**

Get organized and stay organized. I began each semester with everything in order and color-coded. As the semester progressed and the workload increased, before I realized what was happening, my organized notebooks and folders were in disarray. I soon learned the importance of setting aside just a few minutes one day a week to re-organize. It's much easier to maintain organization!

You should be able to pick up notes from classes a year ago and be able to read and understand them. You should also be able to look at a problem you worked and know what you were doing.
Beginning to use calendar software during my junior year was the single most powerful self-investment I made during CHE. It made assignment deadlines easy to make, extracurricular activities easy to manage, and allowed me to do more than I ever thought possible with my time.

- **Embrace CHE as a new community.**

Learn to love the AIChE Lounge and to join AIChE as early as possible. There is always someone there to help you if you need help, or if you just want someone to talk with. I think that is one reason that I like being a CHE so much — we all stick together and work with each other and generally care about each other. I would recommend that students visit the lounge if they have a problem they can't solve, generally there will be someone from their class or a helpful upperclassman that has been through it and knows their pain.

The best friendships of my life were found in the ChE lounge.

CHE is more than a major, it is a lifestyle.

If you look around the room in your CHE 205 class, you'll see people that will become a significant part of life in the coming three years. You may not realize it now, but you will be spending a large amount of time with them. They will inevitably become your friends as you share pains and triumphs in the coming years. Take some time to get to know them. Go out to dinner together and talk about something other than CHE.

Making friends with my assigned group teammates in CHE205 helped me to meet people in other teams, and thus make more friends. As the problems became increasingly difficult, we all had to reach out to other teams and the TA's for help with them. By the end of CHE205, the difficulty of the homework sets began to bring the whole class together. Little did we know, but this same cycle would repeat for every CHE class we took from there forward—with less individual struggling and more teamwork at each turn. By the end of this road, we all graduated with a feeling of camaraderie and friendship that we will all cherish for a very long time.

Putting together a major event for the department and College of Engineering helped solidify my place in this community. It opened doors for me, and I made friends that I will keep for life. My words of advice

are only two: be proactive. If you knock on doors and ask good questions, you will find good neighbors and better answers. Don't wait for someone else to make the change you want to see.

Those who journeyed with me through CHE will be the people that I can call on in the future—they are my friends for life.

- **Recognize that you have to train your brain to think differently.**

Many students think the way to do well is to understand a little bit or memorize. In CHE, memorizing stuff is not important, but the way you THINK is. This retraining the brain to think like an engineer is trivial for some people, not hard for others, and nearly impossible for others that just don't understand how to apply concepts.

If something isn't clicking for you, let another show you how to make it click. Sit down with someone who is "getting it," and have them explain to you how they tackle a problem. Don't try to understand the details or the calculations. Just focus on the way they visualize the big picture, break it down, and then build it up again. Soon, analysis and synthesis will become your natural ways of solving problems, too—and you will be headed in the right direction.

- **Get used to the idea that you will never see multiple choice tests again.**

Studying tips [From a former TA]:

- *Make a 'per exam' cheat sheet (cheat sheet for Exam 1, then 2, then 3) and figure out what you think will be most fruitful to put onto your "torpedo." Do not make the torpedo so confusing you cannot use it.*
- *Practice. In ALL of your further CHE courses, practice in doing various types of problems is the key to doing well. You will encounter problems in tests that make you go to the next level and expand on what you already know.*
- *Make your review problems that you do logical, neat and organized so you can always follow through what you did as a "summary" of the problem. You may get lucky and do a practice problem that the professor uses as an exam problem – it's been known to happen!*
- *Do not get into the habit of plugging and chugging. It will not serve you well. Understand what is going on, make a reasonable analysis of the problem, and try to figure out what you should be getting. Doing this through the review problems will make them sink in and you will then remember what to do on the final.*
- *Memorizing and solving calculations is work for a computer. Understanding the significance of the calculations, and then organizing a way to solve them, is work for an engineer.*

You have to invest the time before the test to know exactly how to find what you need in the book, and where it is. Putting tabs in your book might look geeky, but it will save you time in looking up commonly used tables and equations. And actually reading the book just might help, too.

- **Chemical engineering is not chemistry.**

Engineering is different from purely scientific fields. Where chemists and physicists seek new scientific principles without bound, engineers realize and accept limitations and concentrate on what is practical. Upcoming students should be ready to be trained in this way of solving problems. An engineering

education seems to be more of a way of looking at the world and putting it to use than looking at the world and trying to explain it.

Chemistry is a cornerstone of a chemical engineer's toolbox, and will be important knowledge for your future career. By the time that you graduate, however, you will realize that it is just one tool among many; physics, mathematics, economics, creativity, problem solving…

The Chemist creates or discovers new chemistries, and the Chemical Engineer finds a way to use them for mankind's gain.

- **You can't get away with procrastination.**

I think that time management is the biggest thing that a student must learn when coming into the CHE curriculum. In other classes, it is often easy to wait until the last day to do an assignment, and still end up with a good grade. In CHE, it is a necessity to start the work early. There are too many concepts that will escape your grasp if you don't start early because the problems take a large amount of time, and you will never finish them in one sitting. Scheduling time to ask questions (with a teacher or TA) is also a must. It is inevitable that there will be a time when you get stuck on a problem, and none of your classmates are able to figure it out either. Basically, I believe it is impossible to procrastinate and be successful in the CHE curriculum.

Get together with two or three other people far in advance of the homework due date, and work single problems as a team. Never divide up the work. No, it is not the most efficient way to complete the assignment. But, working together on a problem is more fun. You also get "stuck" less often, and almost undoubtedly will understand all of the material upon finishing the homework. In the end, paying it forward will be worth the time you save in reworking wrong problems and cramming for tests. You will soon see: the best students are the ones who figure out that CHE is all about "down payments." They are also the cheeriest in your morning classes, and happiest at the end of tests.

Teach each other, together, and I promise you it will pay dividends.

- **Follow instructions.**

The syllabus will probably say something like: "Use green engineering paper (available in the Student Supply Store), one side of each page; begin each problem on a new page, and box the final answers. Each completed assignment should be in one person's handwriting. Staple the pages and fold them vertically when you hand them in, putting the names and roles of the participating group members and the problem set number and date on the outside." Follow these instructions – to the letter. You can believe that the TA's will take off points for not stapling, writing on the back, etc. You may think these things are silly but if that's what the prof asks for, do it. One day your client will ask for something just so – and that's what they expect, too.

If the homework is due at the beginning of class, then it had better be there. Set two alarms, get your roommate to wake you up, whatever, but don't be late or the rest of your group will hate you forever (deservedly). If in doubt, put it under the instructor's door the night before (or at 3AM when you finish it).

Writing legibly is a must. You can't get partial credit if no one can decipher your scribbles.

- **Ask for help.**

Get help when you need it. If you are unsure or completely lost, get help from other students in the class, the TA or the professor. Engineering classes are built upon information from your previous classes and previous lectures. If you get lost at one point, it is likely that you will be lost for the rest of the class and possibly longer. Don't make it harder on yourself; there is no shame in getting help. Don't be embarrassed to go to the Engineering Tutorial Center and get a personal or group tutor – that's why they are there!

Get to know your professors by going to see them during office hours. Having the professors get to know you early on at the start of the ChE curriculum can support you and encourage you to try things like research or internships that perhaps you wouldn't be aware of. It's also helpful when it comes time to ask for a recommendation letter.

- **Choose a major for the right reasons.**

[From a former CHE 205 TA]: *There was one commonality with the students who REALLY struggled in the class. During an informal talk with some of these students, I asked them why they chose chemical engineering. And all of them (these are the ones who get D's and F's in CHE 205) told me that they chose chemical engineering because of the money or job opportunities. In contrast to that, the ones who did well tended to respond that they chose chemical engineering because they liked math and science. The students who were really struggling hated every moment of the science, math and engineering courses.*

- **Become comfortable making assumptions.**

Now I have learned to list all the assumptions I am making when solving a problem. It is difficult to learn when you can make certain assumptions and when you can't. Making an assumption when describing a system might make my life easier while solving the problem, but it might not provide an accurate enough picture for the process, depending on the accuracy required. The more problems I work through, the more I know when it is okay to simplify a component/idea to get a solution.

In all the other classes I'd had, there were definite right and wrong answers to a given question; however, in CHE, there may be a number of different ways to arrive at an answer that might be considered correct. This took some getting used to.

- **Don't be devastated if you aren't at the top of the class.**

The majority of people in CHE were at the top of the class at some point during their academic career. Whether it was high school or freshmen courses, chances are you were too. You are now among the best, the competition is a little tougher, and the course material is going to be more difficult. You may not be at the top of the class, but always put forth your best effort. You may not always be satisfied with the result, but you'll know you did everything you could do.
School and grades had been one of the most important things to me in my life up to this point, perhaps, sadly, the most important thing to me. (I say sadly because many parts of life are more important than grades, which are, after all, subjective and superficial. I now believe my spiritual state, my relationships

with other people, actually learning, which is different from making good grades, and my health are more important).

I finished my freshman year with a 4.0 GPA. I had thoughts creeping in telling me that I may be the smartest person in the world. Then I took CHE 205. I spent a LOT of time on the homework, and I made a ~70 on the first test. Since I thought I may be the smartest person in the world, I had figured my grades in my major should be even better than what I had been making This idea was supported by the fact that I did not think I had tried really hard to do well before, even in the classes that I did do well. Actually, I was somewhat of a slacker and a procrastinator I began to realize that I had this attitude: I had to achieve perfection in order to have joy. I thought such a frame of mind was necessary to keep me motivated and doing well. Instead, not being content with anything less than perfection almost destroyed me. Having successfully completed the curriculum and obtained my degree, I now encourage you to study CHE for the sake of learning, not for the sake of being the best.

- **Keep your eye on the goal.**

Listening to people talk about "real" chemical engineering and learning more about different industries and the application of chemical engineering principles can be quite helpful. Because chemical engineers go into such a broad array of fields, I think that it is all the more important that students begin considering where they might like to go early on by learning about what's out there (through attending lectures, conversations with professors/advisors, etc). When I was a junior in college, I felt a certain sense of shame because I could not name 10 chemical engineering-related companies, when in fact there are hundreds of companies which hire ChemE's.

[From an alumnus]: *Encourage the students to view the course as representative of things that real chemical engineers do. Because of this, the hard work is very worthwhile, far beyond the value of getting a good grade. Some graduates (like those who go to medical school) will not use the material very much, but for many others it will be the very core of the value they present to their future employers. Particularly for people in process engineering, in research and development, or for others in the process industries, they will return to the content of this course over and over again. My group essentially applies all the classical chemical engineering approach using the latest advances, but all our work has CHE 205 as a foundation. We use these ideas continuously to the point of them being second nature to us*

[From an alumnus]: *Embrace ChE with all its good and bad. We all love the title and the smugness we get from telling people "I'm an engineer, a CHEMICAL engineer." Kind of like "Bond, James Bond…" I feel good about it because I survived it, because I sacrificed to get it, and because I wanted it more than anything else - other than my family.*

This is my philosophy of, reflection on, and motivation for problem solving, which I believe to be the most valuable thing I learned as a CHE:

- *First, embrace the idea that there are always multiple ways to solve any problem.*
- *Then, recognize the difference between easy problems and hard ones. Easy problems have one solution, and it's straightforward. Hard problems have more than one solution, and no one has found any of them yet.*
- *Now, reflect on how many hard problems you have solved in your life.*
- *Get excited about the hard problems out there—they're waiting for you.*

At this point, you may be thinking one of two things: (1) "This isn't so bad, I think I can probably handle it if I just discipline myself to follow some of these common sense tips;" or (2) "Why would anyone want to survive such a hellish major…and where do I submit my drop form?" If you're inclined to (2), let me offer some words of advice before you run screaming to Registration and Records. First, chemical engineering is an exciting career field and is worth investing your time and effort. You will be able to work in a number of different industries including pharmaceuticals, petrochemicals, electronic materials, paper, textiles, consumer products, and more. You will have the skills to perform many different job functions, including research and development, process engineering, project management, sales, marketing, environmental assessment, quality assurance, technical support, information technology, and management.

Many companies specifically target chemical engineers as new hires because they have found them to have a broad skill set and a strong work ethic. Chemical engineers traditionally have the highest starting salaries of all engineering disciplines, and the job market is always more stable for them than for most other branches of engineering. This is no coincidence—employers assign high value to a chemical engineering degree. It's also no coincidence, therefore, that the curriculum is extremely challenging, and your strong work ethic and broad skill set will take much investment on your part.

Second, others no smarter than you—and many not as smart—have trod this path before and lived to tell about it. Chemical Engineering alumni frequently cite the importance of problem-solving and teamwork skills that were developed during the chemical engineering curriculum and in CHE 205 in particular.[1] And all those horror stories about 50% of the class getting F's are not true – just look at recent grade distributions. In my Fall 2002 section of CHE 205, 70% of the class – those who stuck it out – got A's or B's.

Lastly, if you think you're the only one with doubts, think again. The quotation that follows is from an article about the "Impostor Phenomenon," which is like a tape that people play inside their heads.

> *If you're an engineering student looking around at your classmates, the tape goes something like this: "These people are good—they understand all this stuff. They really belong here…but I don't. Over the years I've somehow managed to fool them all—my family, my friends, my teachers. They all think I'm smart enough to be here, but I know better…and the very next hard test or hard question I get in class will finally reveal me as the impostor I am." And what would happen next is too horrible to contemplate, so at that point you just rewind and replay the tape. What you don't know is that almost everyone else in the class is playing the same tape, and the student in the front row with the straight A average is playing it louder than anyone else. Furthermore, the tape is usually wrong. If you survived your first year of engineering school, you almost certainly have what it takes to be an engineer. Just remember all your predecessors who had the same self-doubts you have now and did just fine. You do belong here, and you'll get through it just like they did. Try to relax and enjoy the trip.*

So anchor your kayak, strap on your backpack, and let's begin. Contrary to rumors you might hear, the natives are not hostile, and some of your fellow travelers actually look somewhat friendly. There may be some spine-tingling adventures ahead, some precarious positions to get through, and a few death-defying moments, but I assure you that the view from the heights is worth the climb.

Acknowledgments

I appreciate the input and feedback from current and former NCSU undergraduate and graduate students and faculty.

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[1] R.M. Felder, "The Alumni Speak," *Chem. Engr. Education, 34*(3), 238–239 (2000). http://www.ncsu.edu/felder-public/Columns/alumni.html

***CHOICES* OF SUCCESSFUL STUDENTS**

SUCCESSFUL STUDENTS...	**STRUGGLING STUDENTS...**
...**ACCEPT SELF-RESPONSIBILITY**, seeing themselves as the primary cause of their outcomes and experiences.	...see themselves as Victims, believing that what happens to them is determined primarily by external forces such as fate, luck, and powerful others.
.....**DISCOVER SELF-MOTIVATION**, finding purpose in their lives by discovering personally meaningful goals and dreams.	...have difficulty sustaining motivation, often feeling depressed, frustrated, and/or resentful about a lack of direction in their lives.
...**MASTER SELF-MANAGEMENT**, consistently planning and taking purposeful actions in pursuit of their goals and dreams.	...seldom identify specific actions needed to accomplish a desired outcome. And when they do, they tend to procrastinate.
...**EMPLOY INTERDEPENDENCE**, building mutually supportive relationships that help them achieve their goals and dreams (while helping others to do the same).	...are solitary, seldom requesting, even rejecting offers of assistance from those who could help.
...**GAIN SELF-AWARENESS**, consciously employing behaviors, beliefs, and attitudes that keep them on course.	...make important choices unconsciously, being directed by self-sabotaging habits and outdated life scripts.
...**ADOPT LIFE-LONG LEARNING**, finding valuable lessons and wisdom in nearly every experience they have.	...resist learning new ideas and skills, viewing learning as fearful or boring rather than as mental play.
...**DEVELOP EMOTIONAL INTELLIGENCE**, effectively managing their emotions in support of their goals and dreams.	...live at the mercy of strong emotions such as anger, depression, anxiety, or a need for instant gratification.
...**BELIEVE IN THEMSELVES**, seeing themselves capable, lovable, and unconditionally worthy as human beings.	...doubt their competence and personal value, feeling inadequate to create their desired outcomes and experiences.

http://www.oncourseworkshop.com/On%20Course%20Principles.htm

WHO TO SEE FOR:

Advisor:	
CHU's, Honors Program, BS/MS CHE CHE Double Majors, CHE Minor	Dr. Lisa Bullard EB1 2012, 515-7455 lisa_bullard@ncsu.edu
Biomolecular concentration	Dr. Robert Kelly Partners 2, Suite 3313, 515-6396 rmkelly@eos.ncsu.edu
Biomanufacturing Sciences concentration	Dr. Michael Flickinger BTEC 196, 515-2000 Michael_Flickinger@ncsu.edu
Nanoscience concentration	Dr. Greg Parsons EB1 2032, 515-7553 gnp@eos.ncsu.edu
Sustainable Engineering, Energy, and the Environment Concentration	Dr. Fanxing Li EB1 2038, 515-7328 (Li) fli5@ncsu.edu
Undergraduate Secretary	Ms. Angela Efimenko EB1 2007, 515-4251 aefimen@ncsu.edu
Graduate Secretary	Ms. Sandra Bailey EB1 2007, 515-6367 sbailey@unity.ncsu.edu

Change from credit to audit, to credit only (pass/fail), or drop a course:

a. before 2-week deadline	use MyPack portal
b. after first six weeks	Dr. Bullard
Cooperative Education (Co-op)	Cooperative Education Office 2100 Pullen Hall, 515-2300

WHO TO SEE FOR:	
Fundamentals of Engineering (FE) Exam (Seniors): a. date, place, requirements	NC State Board of Registration for PE and Land Surveyors 781-9499 or 781-9547 http://www.ncbels.org/
Independent Study (correspondence courses), non-degree programs, evening programs	Lifelong Education McKimmon Center, 515-2261
Inter-institutional forms for the Cooperative Raleigh College (CRC) signature:	Dr. Kim Roberts 118 Page, 515-3263
Jobs: Summer and/or part-time: a. work/study on campus b. off campus	 Financial Aid 2005 Harris, 515-2421 University Career Center 2100 Pullen Hall, 515-2396
Masters in CHE:	Dr. Saad Khan
Senior Re-examination:	Dr. Bullard
Scholarship information a. College of Engineering Scholarship eligibility forms due March 1 of each year http://www.engr.ncsu.edu/students/eligibility/eligibilityForm.php b. Department of Chemical and Biomolecular Engineering	 Dr. Bullard

WHO TO SEE FOR:	
Transfer out of College of Engineering:	Dean's Office in the college you want to transfer to.
Transfer credit for courses completed at other institutions: **(prior approval by Dr. Bullard required)**	Dr. Kim Roberts 118 Page, 515-3263
Withdrawal from NCSU (drop all courses)	Counseling Center 2000 Harris Hall, 515-2423

CHEMICAL AND BIOMOLECULAR ENGINEERING FACULTY

Dr. Milad Abolhasani, Assistant Professor (515-8935); Ph.D., Mechanical Engineering, University of Toronto (2014). Flow Chemistry, Microfluidics, Microscale Technologies for Energy and Environment, Continuous Nano-Manufacturing, Microscale Transport Phenomena. [mabolha@ncsu.edu]. EB1 2086A.

Dr. Chase Biesel, Assistant Professor (513-2429); Ph.D., Chemical Engineering, California Institute of Technology (2009). Synthetic Biology, Microbial systems biology, RNA engineering [cbeisel@ncsu.edu]. EB1 2026.

Dr. Lisa G. Bullard, Teaching Professor and Director of Undergraduate Programs (515-7455); Ph.D., Chemical Engineering, Carnegie Mellon University (1991); [lisa_bullard@ncsu.edu] EB1 2012.

Dr. Ruben G. Carbonell, KoSa Professor; Chemical Engineering Director, William R. Kenan, Jr., Institute for Engineering, Technology & Science; Director, Golden LEAF Biomanufacturing Training and Education Center (BTEC); (515-5118 or 513-0050); Ph.D., Chemical Engineering, Princeton University (1973); Biochemical engineering; molecular recognition; bioseparations; immunodiagnostics; colloid and interface science; transport phenomena, compressed fluid processes. [ruben@ncsu.edu] Partner's Building 1, Centennial Campus, Suite 3200.

Dr. Matthew E. Cooper, Teaching Assistant Professor (513-1623); Ph.D, Chemical Engineering, Ohio University (2008) [mecoope3@ncsu.edu]. EB1 2044.

Dr. Joe DeSimone, William R. Kenan, Jr. Distinguished Professor of Chemistry; Chemical Engineering Director, NSF Science and Technology Center for Environmentally Responsible Solvents and Processes; Co-Director of the Kenan Center for the Utilization of CO_2 in Manufacturing. (962-5468); Ph.D., Chemistry, Virginia Polytechnic and State University (1990); polymer synthesis in supercritical fluids; surfactant design for applications in interfacial chemistry. [desimone@unc.edu].

Dr. Michael Dickey, Professor (513-2917); Ph.D., Chemical Engineering, University of Texas at Austin (2006). Alternative micro- and nano-fabrication, Microfluidics, Electronic materials, and Photo-curable materials for nanotechnology [mdickey@ncsu.edu]. EB1 2088G.

Dr. Kirill Efimenko, Research Associate Professor (513-05480); Ph.D., Material Science and Technology, Institute of Chemical Technology in Prague (1999); [efimenko@ncsu.edu]. 3507 Partners I.

Dr. Peter S. Fedkiw, Department Head and Professor (515-3572); Ph.D., Chemical Engineering, University of California, Berkeley (1978); Electrochemical reaction engineering; Electrocatalysis; Environmental applications of electrochemistry. [fedkiw@eos.ncsu.edu] EB1 2006.

Dr. Richard M. Felder, Celanese Emeritus Professor (515-2327); Ph.D., Chemical Engineering, Princeton (1966); Learning and teaching styles in engineering education. [rmfelder@mindspring.com] EB1 2090B.

Dr. Michael C. Flickinger, Professor (515-2000); Ph.D., Pharmaceutical Biochemistry, University of Wisconsin, Madison (1977), Post Doctoral, Chemical Engineering, Purdue University; Bioprocess and

cell culture engineering, biocatalytic coatings, bioprocess intensification and miniaturization, bioseparation media, bionanotechnology. [Michael_Flickinger@ncsu.edu] BTEC 196.

Dr. Jan Genzer, Celanese Professor (515-2069); Ph.D., Materials Science and Engineering, University of Pennsylvania (1996); polymer characteristics at surfaces and interfaces. [jgenzer@unity.ncsu.edu] EB1 2088H.

Dr. Christine S. Grant, Professor (515-2317); Ph.D., Chemical Engineering, Georgia Institute of Technology (1989); Surface and interfacial science, mass transfer, environmental engineering. [grant@eos.ncsu.edu] EB1 2088B.

Dr. Keith E. Gubbins, H. Clark Distinguished University Professor (513-2262); Ph.D., Chemical Engineering, London University (1962); Molecular simulation and statistical mechanics applied to chemical engineering problems, phase equilibria and surface property prediction. [keg@ncsu.edu] EB1 2088A.

Dr. Carol K. Hall, Alcoa Professor and Camille Dreyfus Distinguished University Professor (515-3571); Ph.D., Physics, S.U.N.Y. Stony Brook (1972); Molecular thermodynamics and computer simulation, equations of state, polymer modeling, bioseparations, protein folding. [hall@turbo.che.ncsu.edu] EB1 2024.

Dr. Jason M. Haugh, Professor (513-3851); Ph. D. Chemical Engineering, MIT (1999); Biomedical and biochemical engineering; signal transduction networks; mammalian cell engineering. [jason_haugh@ncsu.edu] Partners II 3100.

Dr. Harold B. Hopfenberg, Camille Dreyfus Emeritus Professor (515-2318); PhD, Chemical Engineering, MIT (1965); Membrane separations and the study of aging phenomena in organic glasses, controlled drug delivery systems for human and veterinary medicine, and barrier plastics for specialty packaging of anhydrobiotic organisms. [hbg@ncsu.edu] EB1 1060.

Dr. Lilian Hsiao, Assistant Professor (515-8057); PhD Soft matter and colloids, Complex fluids, Biomimetic and responsive materials. [lilian_hsiao@ncsu.edu] EB1 2088D.

Dr. Robert M. Kelly, Alcoa Professor (515-6396); PhD., Chemical Engineering, North Carolina State University (1981); Biochemical engineering, biocatalysis at extremely high temperatures, microbial physiology, enzyme engineering. [rmkelly@eos.ncsu.edu] Partners 2, Centennial Campus, Suite 3313/EB1 2014.

Dr. Albert Keung, Assistant Professor (515-3352); PhD., Chemical Engineering University of California Berkeley (2012); Synthetic Biology, Chromatin Engineering, Molecular and Cellular Engineering, Stem Cell Engineering [ajkeung@ncsu.edu] 2088F EB1.

Dr. Saad A. Khan, Alcoa Professor and Director of Graduate Programs (515-4519); Ph.D., Chemical Engineering, MIT (1985); Polymer Science; Rheology of Complex Fluids; Sol-Gel Rheology. [khan@eos.ncsu.edu] EB1 2034.

Dr. H. Henry Lamb, Professor (515-6395); Ph.D., Chemical Engineering, University of Delaware (1988); Catalysis, surface organometallic chemistry, electronic materials processing, surface science. [lamb@eos.ncsu.edu] EB1 1056.

Dr. Fanxing Li, Associate Professor (515-7328); Ph.D., Chemical Engineering, Ohio State University (2009). Energy and environmental engineering, nano reagent and catalyst particles for biomass and fossil energy conversions, CO_2 capture and pollutant control [fli5@ncsu.edu]. EB1 2038

Dr. P. K. Lim, Professor (515-2328); Ph.D., Chemical Engineering, University of Illinois (1979); Interfacial phenomena, homogeneous catalysis, free radical chemistry. [lim@eos.ncsu.edu] EB1 2040.

Dr. Stefano Menegatti, Assistant Professor (515-6398); Ph.D. Chemical Engineering, NC State; Bioseparations [smenega@ncsu.edu] EB1 1054.

Dr. David F. Ollis, Distinguished Professor (515-2329); Ph.D. Chemical Engineering, Stanford (1969); Biochemical Engineering, Photochemical Engineering. [ollis@eos.ncsu.edu] EB1 2016.

Dr. Gregory N. Parsons, Alcoa Professor (515-7553); Ph.D., Physics, North Carolina State University (1990); Surface reactions and chemical processes in electronic materials synthesis; Bonding structure and electronic properties of inorganic semiconductors and insulators; [gnp@eos.ncsu.edu] EB1 2032.

Dr. Steven W. Peretti, Associate Professor (515-6397); Ph.D., Chemical Engineering, California Institute of Technology; Metabolic Characterization and Manipulation. [peretti@eos.ncsu.edu] EB1 2042.

Dr. Balaji Rao, Associate Professor; (513-0129); Ph.D., Chemical Engineering, MIT (2004); Molecular and cell bioengineering; molecular control of cellular processes; stem cell bioengineering. [bmrao@ncsu.edu] EB1 2088C.

Dr. Gregory T. Reeves, Assistant Professor (513-0652); Ph.D., Chemical Engineering, Princeton (2008); Control of patterning in developmental biology. [gtreeves@unity.ncsu.edu] EB1 2014.

Dr. Adriana San Miguel 515-2934 [asanmig@ncsu.edu] 2010 EB1.

Dr. Erik E. Santiso, Assistant Professor; Ph.D., Chemical Engineering, North Carolina State University (2007). Computer-based discovery of new materials and chemicals, Molecular modeling of solids and structured fluids, Crystallization [eesantis@ncsu.edu] EB1 2100D

Dr. Richard J. Spontak, Professor (515-4200); Ph.D., Chemical Engineering, University of California, Berkeley (1988); Morphological Design and Characterization of Microstructured Polymer Systems; Polymer Physics; Polymer Thermodynamics. [Rich_Spontak@ncsu.edu] EB1 2088E.

Dr. Orlin D. Velev, INVISTA Professor (513-4318); Ph.D., Physical Chemistry, Sofia University, Bulgaria (1996); Colloidal science and engineering, colloidal interactions, self-assembly and crystallization; assembly of nano- and microstructures with photonic, optical and electrical functionality; protein interactions and phase equilibria, biosensors. [odvelev@unity.ncsu.edu] EB1 2030.

Dr. Phillip R. Westmoreland, Professor and Executive Director, NCSU Institute for Computational Science and Engineering (515-7121); Ph.D., Chemical Engineering, Massachusetts Institute of Technology (1986); Energy and the environment, biofuels, chemical kinetics, computational chemistry, molecular-beam mass spectrometry. [phil.westmoreland@ncsu.edu] EB1 2036.

CHEMICAL AND BIOMOLECULAR ENGINEERING STAFF

Ms. Amy Alexander, Business Services Coordinator, (513-3818), [ajmille9@ncsu.edu], EB1 2011

Ms. Sandra Bailey, Administrative Support Specialist, Graduate Students (515-6367), [sbailey@unity.ncsu.edu], EB1 2007.

Ms. Kathleen Berding, Contracts and Grants Manager (513-2177), [kberding@ncsu.edu], EB1 2005.

Ms. Christiana Boyle, University Business Officer (515-6391) [christiana_boyle@ncsu.edu], EB1 2008.

Ms. Maria Moreno, University Program Associate (513-7763) [mdmoreno@ncsu.edu], EB1 2011.

Ms. Saundra Doby, Administrative Support Specialist (515-3999), [sdoby@unity.ncsu.edu], EB1 2001.

Ms. Angela Efimenko, Administrative Associate, Undergraduate Students (515-4251), [aefimen@ncsu.edu], EB1 2007.

Ms. Michelle Bunce, Administrative Assistant (515-6394), [mubunce@unity.ncsu.edu]. EB1 2003.

Ms. Shirley Kow, Technology Support Specialist (515-2425), [skow@eos.ncsu.edu], EB1 1058.

Mr. Michael Mantini, Specialty Trades Technician (515-7005), [mjmanti2@ncsu.edu], EB1 B014

Ms. Joan O'Sullivan, Environmental Health and Safety (515-3615), [jno@ncsu.edu], EB1 2005.

Ms. Allison Stieglitz, NANO Initiative Coordinator (515-6390), [astiegl@ncsu.edu], EB1 2100A.

CHEMICAL AND BIOMOLECULAR ENGINEERING COURSES - A brief description of selected CHE courses follows, along with the course prerequisites and scheduling information. Students should note that all prerequisites in Chemical Engineering are strictly enforced. It is the student's responsibility to check prerequisites and see the instructor or Dr. Bullard if there is a question about prerequisites. PIN exceptional circumstances, prerequisites may be waived on a case-by-case basis by Dr. Bullard. **Failure to complete prerequisites prior to enrolling in a CHE course may result in the student's administrative disenrollment from the CHE course after the deadline to enroll in other courses has passed.**

CHE 205 Chemical Process Principles. Preqs: Grade of C or better in MA 241 and PY 205; C- or better in (CH 201/203 or CH 221/225). 4 hr. Offered in Fall and Spring. Engineering methods of treating material balances, stoichiometry, phase equilibrium calculations, thermophysics, thermochemistry and the first law of thermodynamics.

CHE 225 Chemical Process Systems. Preqs: C- or better in both CHE 205 and MA 242. Coreq: MA 341. 3hr. Offered in Spring and Summer. Introduction to mathematical and computational tools for analyzing chemical engineering problems. Sequential modular and equation-based simulation of steady-state chemical processes using advanced spreadsheet methods and multivariate root-finding algorithms. Material and energy balances on transient processes and their solution using analytical and numerical methods. Introduction to microscopic material and energy balances using the "shell balance" approach to develop the governing differential equations. Solutions to steady-state boundary value problems in heat conduction and Fickian diffusion.

CHE 311 Transport Processes I. Preqs: C- or better in both CHE 225 and MA 341; must be CODA'd into CHE or pursuing CHE minor. 3hr. Offered in Fall and Spring. Fundamental aspects of momentum and heat transfer, and the use of these fundamentals in solving problems in transport operations.

CHE 312 Transport Processes II. Preq: C- or better in CHE 311. 3hr. Offered in Fall and Spring. Fundamental aspects of mass transfer and the use of these basic principles in solving problems in transport operations.

CHE 315 Chemical Process Thermodynamics. Preq: C- or better in CHE 225; must be CODA'd into CHE or pursuing CHE minor. 3hr. Offered in Fall and Spring. Laws of thermodynamics and their application to chemical engineering problems, both in theory and in practice. Criteria of equilibrium in physical and chemical changes. Behavior of real fluids, including mixtures.

CHE 316 Thermodynamics of Chemical and Phase Equilibria. Preq: C- or better in CHE 315. 3hr. Offered in Fall and Spring. Systematic study of chemical reaction equilibria and phase equilibrium. Use of fugacity, activity and chemical potential concepts for predicting the effect of such variables as temperature, pressure on equilibrium compositions. Methods for measuring and estimating thermodynamic properties important to equilibrium calculation in real systems.

CHE 330 Chemical Engineering Lab I. Preq: CHE 311, 3 hr. Offered in Fall and Spring (sometimes Summer). Laboratory experiments in unit operations of heat transfer and fluid flow. Laboratory safety, technical report writing, statistics, experimental design, error analysis, and instrumentation.

CHE 331 Chemical Engineering Lab II. Preqs: CHE 312, CHE 330. 2 hr. Offered in Fall and Spring. Laboratory experiments in mass transfer and reaction kinetics. Experimental planning, technical report writing and oral presentations are emphasized.

CHE 395 Professional Development Seminar. 1 hr. Offered in Fall and Spring. Professional development and topics of current interest in chemical engineering.

CHE 435 Process System Analysis and Control. Preq: CHE 312. 3hr. Offered in Fall and Spring. Dynamic analysis and continuous control of chemical engineering processes. Process modeling; stability analysis, design and selection of control schemes. Solution of differential equations using Laplace transform techniques.

CHE 446 Design and Analysis of Chemical Reactors. Preq: CHE 316. 3hr. Offered in Fall only. Characterization and measurement of the rates of homogeneous and heterogeneous reactions. Design and analysis of chemical reactors.

CHE 447 Bioreactor Engineering. Preq: BCH 451, CHE 312, CHE 316. 3 hr. Offered in Fall only. Design and analysis of chemical reactors with emphasis on enzyme-catalyzed reactions, microbial fermentation, and animal cell culture. Empirical kinetics of enzymatic reactions and cell growth. Design and scale-up of suspension bioreactors. Immobilized-enzyme and immobilized-cell bioreactors, including the classical Thiele reaction-diffusion analysis.

CHE 450 Chemical Engineering Design I. Preq: CHE 312. 3hr. Offered in Fall only. Applications of cost accounting, cost estimation for new equipment, manufacturing cost and measures of profitability. Use of computer simulation design and cost programs. Procedures for sizing unit operations commonly encountered in the chemical process industry. Heuristics for selection of separation processes and heat exchanger network synthesis.

CHE 451 Chemical Engineering Design II. Preqs: CHE 450, (CHE 446 or CHE 447). 3hr. Offered in Spring only. Chemical process design and optimization. The interplay of economic and technical factors in process development, site selection, project design, and production management. Comprehensive design problems.

CHE 455 Polymer Technology and Engineering. Prereq: MSE 425. 3hr. Offered in Fall only, alternate years. Covers classes of commercially important polymers, advanced topics in the phase behavior, viscoelasticity, fracture, and ultimate properties of polymers; polymer rheology, processing, and permeability; and the design of polymeric materials.

CHE 460 Nano-Electric Materials. Preqs: CHE 312, CHE 446. **Credit for both CHE 460 and CHE 560 is not allowed**. 3hr. Offered in Spring only, alternate years. Plasma and thermal inorganic chemical processes in semiconductor device fabrication. Thin films and electronic devices. Kinetics and chemical transport in electronic materials synthesis, modification and etching. Plasma physics and chemistry, reactors and process diagnostics.

CHE 461 Polymer Science and Technology. Preqs: CH 223, CHE 316. **Credit for both CHE 461 and CHE 543 is not allowed**. 3hr. Offered in Fall only, alternate years. Concepts and techniques for polymerization of macromolecules. Structure, properties, and applications of commercially important polymers.

CHE (BEC) 462 Fundamentals of Bio-Nanotechnology. Prerequisite: MA 241, PY 208, CH 223. Concepts of nanotechnology are applied in the synthesis, characterization, recognition and application of biomaterials on the nanoscale. Emphasis will be given to hands-on experience with nanostructured biomaterials; students will also be familiarized with the potential impact of these materials on different aspects of society and potential hazards associated with their preparation and application.

CHE (BEC) 463/563 Fermentation of Recombinant Microorganisms Preq: CH 223 or BIT 410 or BIT 810 or MB 409 or BCH 454. 2hr. Offered in Fall and Spring. Introduction to fermentation and protein chemistry. Theory behind laboratory techniques and overview of industrial scale expression systems. Laboratory sessions involve use of microbial expression vectors, fermentation systems, and large-scale purification of recombinant protein. Half semester course, first part.

CHE (BIT) 464 Protein Purification. Preq: BIT 410 or MB 409 or BCH 454, 2hr. Offered in Spring only, alternate years. Comparison of several different chromatography techniques for protein purification. Construction of purification tables and SDS-and native-PAGE analysis. Cost-benefit analysis of industrial-scale procedures. Half semester course, second part.

CHE 467 Polymer Rheology. Preq: CHE 311 or equivalent. **Credit for both CHE 467 and CHE 567 is not allowed**. 3hr. Offered in Spring only, alternate years. Theoretical principles and experimental techniques associated with flow and deformation of polymer systems. Systems include: meffs and solutions, suspension, gels, emulsions, and thixotropic mixtures.

CHE (ECE) 468/568 Conventional and Emerging Nanomanufacturing Techniques and Their Applications in Nanosystems. 3 hr. Offered in fall only. Conventional and emerging nano-manufacturing techniques and their applications in the fabrication of various structures and devices. Review of techniques for patterning, deposition, and etching of thin films including emerging techniques such as an imprint and soft lithography and other unconventional techniques. Electronic and mechanical properties of 0 to 3-D nanostructures and their applications in nano-electronics, MEMS/NEMS devices, sensing, energy harvesting, storage, flexible electronics and nano-medicine. Credit for both ECE/CHE 468 and ECE/CHE 568 is not allowed.

CHE 475 Advances in Pollution Prevention: Environmental Management for the Future. Preqs: MA 341, PY 208. **Credit for both CHE 475 and CHE 575 is not allowed**. 3hr. Offered in Spring only. Design of industrial processes which minimize or eliminate wastes. Regulations and the corporate organization of current pollution prevention efforts. Current pollution prevention research. Product life cycle analysis and the application to design of more efficient processes.

CHE (BEC) 488 Animal Cell Culture Engineering. Preqs: CHE 447 or BEC 463 or BEC 420 or BIT 466. 2 hr. Offered in spring only. Design and operation of animal cell culture bioreactors for therapeutic protein production. Topics include: batch, fed-batch and perfusion bioreactors, agitation and aeration for mixing and oxygen mass transfer, bioreactor monitoring and control, optimizing bioreactor performance, and single-use (disposable) bioreactors. This is a half-semester course.

CHE 495 Honors Thesis Preparation. Preq: CHE 497, senior level standing, Honors Program only. 1hr. Offered in Spring only. Development and presentation of Honors Thesis in Chemical Engineering and discussion of graduate school selection and preparation.

CHE 497 Chemical Engineering Projects I. Preq: Junior standing. 3hr. Offered in Fall and Spring. Introduction to chemical engineering research through experimental, theoretical and literature studies. Oral and written presentation of reports. Requires 150 hours of work and a final written report. Students should contact faculty directly regarding project availability.

CHE 498 Chemical Engineering Projects II. Preq: Junior standing. 1-3hr. Variable Credit. Offered in Fall and Spring. Projects in research, design or development in various areas of chemical engineering. Requires 50 hours of work per credit hour and a final written report. Students should contact faculty directly regarding project availability.

CHE 525 Process System Analysis and Control. Preq: CHE 312. **Credit for both CHE 435 and CHE 525 is not allowed**. 3hr. Offered in Spring only. Dynamic analysis and continuous control of chemical engineering processes. Process modeling; stability analysis, design and selection of control schemes. Solution of differential equations using Laplace transform techniques.

CHE 543 Polymer Science and Technology. Preqs: CH 223, CHE 316. **Credit for both CHE 461 and CHE 543 is not allowed**. 3hr. Offered alternate years. Concepts and techniques for polymerization of macromolecules. Structure, properties, and applications of commercially important polymers.

CHE 546 Design and Analysis of Chemical Reactors. Preq: CHE 316. **Credit for both CHE 446 and CHE 546 is not allowed**. 3hr. Offered in Fall only. Characterization and measurement of rates of homogeneous and heterogeneous reactions. Design and analysis of chemical reactors.

CHE 551 Biochemical Engineering. Preqs: CHE 312, (CHE 446 or CHE 447). 3hr. Offered in Spring only. Enzyme and microbial kinetics and reactor design for processes involving enzymes and single and mixed cultures. Samples drawn from full range of applications: food processing, single cell proteins, tissue culture and vaccines, monoclonal antibodies, recombinant DNA and hybridomas, artificial organs, biological waste treatment and environmental processes.

CHE 560 Chemical Processing of Electronic Materials. Preqs: CHE 312, CHE 446. **Credit for both CHE 460 and CHE 560 is not allowed**. 3hr. Offered in Spring only. Plasma and thermal inorganic chemical processes in semiconductor device fabrication. Thin films and electronic devices. Kinetics and chemical transport in electronic materials synthesis, modification and etching. Plasma physics and chemistry, reactors and process diagnostics.

CHE (BEC) 577 Advanced Biomanufacturing and Biocatalysis. Graduate standing in engineering. 3hr. Overview of biomanufacturing using microorganisms (bacteria, yeast, fungi), eukaryotic cells (hybridomas, insect, plant, CHO) and recombinant enzymes focusing on methods used in industry. Course will emphasize process design for optimization of heterologous protein expression, metabolic/cell line engineering, metabolomics, protein engineering to alter enzymes and antibodies. Pathway engineering strategies include developing microbes to produce new therapeutic compounds or overproduce primary metabolites, antibiotics, biotherapeutics, therapeutic enzymes, diagnostics, recombinant vaccines, and biopharmaceuticals. Utilization of immobilized biocatalysts, and microbial kinetics are covered.

CHE 711 Chemical Engineering Process Modeling (CHE Honors Program Students Only) Preqs: CHE 312, MA 341. 3hr. Offered in Fall only. Applications of methods of mathematical analysis to formulation and solution of problems in transport phenomena, process dynamics and chemical reaction engineering.

CHE 713 Thermodynamics I (CHE Honors Program Students Only) Preq: CHE 316. 3hr. Offered in Fall only. In-depth coverage of chemical engineering thermodynamics principles. Application of non-ideal fluid-phase chemical potentials to problems in phase and chemical reaction equilibria. Relations of molecular structure and intermolecular forces to macroscopic thermodynamic properties.

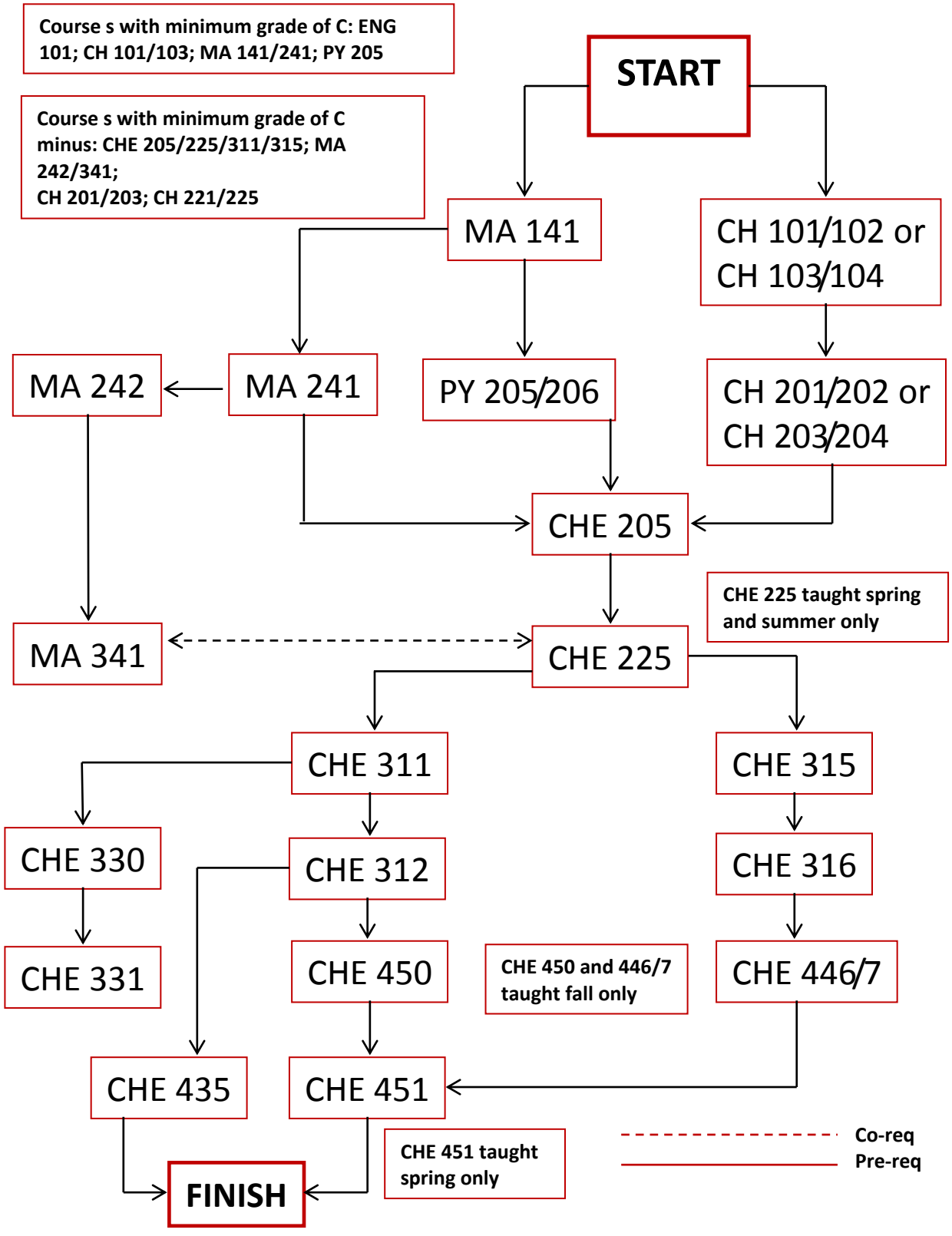
CHE 715 Transport Phenomena (CHE Honors Program Students Only) Preq: CHE 311. 3hr. Offered in Fall only. A theoretical, unified study of transport of momentum, energy and matter. Introduction to diffusional operations including coupled heat and mass transfer in light of the theory.

CHE 717 Chemical Reaction Engineering (CHE Honors Program Students Only) Preq: CHE 446 or 447. 3hr. Offered in Spring only. Rates and mechanisms of homogeneous and heterogeneous reactions. Design, analysis and scale-up of batch and continuous chemical reactors.

Prerequisite and Co-requisite Requirements for CHE courses

Course	Prerequisite	Co-requisite
CHE 205	C or better in MA 241, PY 205 and C- or better in (CH 201/203 or CH 221/225)	
CHE 225	C- or better in CHE 205 and MA 242 *Note: only taught in spring and summer*	MA 341
CHE 311	C- or better in CHE 225 and MA 341; *must be CODA'd in CHE or pursuing CHE minor*	
CHE 312	C- or better in CHE 311	
CHE 315	C- or better in CHE 225; *must be CODA'd in CHE or pursuing CHE minor*	
CHE 316	C- or better in CHE 315	
CHE 330	CHE 311	
CHE 331	CHE 312, CHE 330	
CHE 435	CHE 312	
CHE 446	CHE 316 *Note: only taught in fall*	
CHE 447	BCH 451, CHE 312, CHE 316 *Note: only taught in fall*	
CHE 450	CHE 312 *Note: only taught in fall*	
CHE 451	CHE 450, (CHE 446 or CHE 447) *Note: only taught in spring*	
CHE 455	MSE 425	
CHE 460	CHE 312, CHE 446	
CHE 461	CH 223, CHE 316	
CHE/BEC 463	BIT 410 or CH 223	
CHE/BIT 464	BIT 410	
CHE 467	CHE 311	
CHE/BEC 465	MA 241, PY 208, CH 223	
CHE 469	CH 223, CHE 316	
CHE 475	MA 341, PY 208	
CHE/BEC 488	CHE 447 or BEC 463 or BEC 420 or BIT 466	
CHE 495	CHE 497, senior standing, honors program.	
CHE 497	Junior standing	
CHE 498	Junior standing	
CHE 551	CHE 312, (CHE 446 or CHE 447) *Note: only taught in spring*	
CHE 711	CHE Honors Program Students Only, CHE 311H, CHE 312H, MA 341	
CHE 713	CHE Honors Program Students Only, CHE 315, CHE 316	
CHE 715	CHE Honors Program Students Only, CHE 311H	
CHE 717	CHE Honors Program Students Only, CHE 446 or CHE 447	

Prerequisite Flowsheet for CHE Core Classes



CHEMICAL ENGINEERING CURRICULA - Students may choose one of several parallel curricula in the department: the standard chemical engineering curriculum, the Biomolecular concentration, the Biomanufacturing Sciences concentration, the Nanoscience concentration, the Sustainable Engineering, Energy, and the Environment concentration, or the CHE Honors Program. The Biomolecular concentration is designed for students who wish to develop expertise in biochemical engineering and in the biological sciences; the Biomanufacturing Sciences concentration is designed for students who are interested in industrial applications in the pharmaceutical and biomanufacturing sector; the Nanoscience concentration is designed for students interested in technology associated with microelectronics and/or polymers manufacturing; and the Sustainable Engineering, Energy, and the Environment concentration is designed to prepare students to solve technical challenges in a way that produces sustainable outcomes.

The CHE Honors Program is open to students by invitation, based upon their CHE and overall grade point averages at the completion of CHE 225, and is designed to serve as a preparation for graduate study in chemical engineering. Candidates for admission to the CHE Honors Program must have earned a minimum over-all grade point average of 3.50, and a minimum major grade point average of 3.5 based on taking CHE 205 and CHE 225. Students must graduate with a total GPA of at least 3.25.

Upon their CODA into chemical engineering, students are normally enrolled in the standard CHE curriculum unless they request otherwise at the time of CODA. Students must contact Dr. Bullard to request the change to a concentration so that their curriculum display can be modified.

MY PROFESSIONAL AND PERSONAL GOALS WHILE AT NC STATE

In order to be successful, it's important to set goals early in your academic career and then developing a plan to achieve them. List some of your goals below and talk with your advisor about how to prepare yourself for the career you envision.

- I would like to have a GPA at graduation of _____
- I would like to get work experience via summer internships or co-ops at companies like:
- I would like to get involved in campus activities such as:
- I would like to get involved in community activities like:
- I would like to develop my leadership skills by:
- After graduation, I can see myself….
- Besides my schoolwork, personal goals include:
- 3 things I want to accomplish at NC State:

Bachelor of Science in Chemical Engineering

Fall Semester	Credit	Spring Semester	Credit
CH 101 (or 103) General Chemistry I[1a]	3	CH 201 (or 203) General Chemistry II[1b]	3
CH 102 (or 104) General Chemistry I Lab[1a]	1	CH 202 (or 204) General Chemistry II Lab	1
E 101 Introduction to Engr & Prob Solv[1a]	1	MA 241 Calculus II[1a]	4
E 115 Intro to Computing Environ	1	PY 205 Physics for Engr & Sc I[1a]	3
ENG 101 Academic Writing and Research[1a]	4	PY 206 Physics for Engr & Sc I Lab[1a]	1
MA 141 Calculus I[1a]	4	EC 205 Econ (or EC 201 or ARE 201)*	3
HESx 1** Fitness & Wellness Course*	1	HESx (100 or 200 level) Elective*	1
	15		**16**

Fall Semester	Credit	Spring Semester	Credit
CH 221 (or 225) Organic Chemistry I[1b]	3	CH 223 (or 227) Organic Chemistry II	3
CH 222 (or 226) Organic Chemistry I Lab	1	CH 224 (or 228) Organic Chemistry II Lab	1
CHE 205 Chemical Proc Prin[1b]	4	CHE 225 Chemical Proc Systems[1b]	3
MA 242 Calculus III[1b]	4	MA 341 Applied Differential Eq[1b]	3
GEP Requirement*	3	PY 208 Physics Engr & Sci II	3
	15	PY 209 Physics Engr & Sci II Lab	1
		GEP Requirement*	3
			17

Fall Semester	Credit	Spring Semester	Credit
CH *** Chemistry Elective[2]	4	CH 315 Quantitative Analysis	3
CHE 311 Transport Processes I[1b]	3	CH 316 Quantitative Analysis Lab	1
CHE 315 Chem Process Thermo[1b]	3	CHE 312 Transport Processes II	3
ECE 331 Prin Electrical Engr ***OR***	3	CHE 316 Thermo of Chem & Phase Eq	3
MSE 201Struct & Prop Engr Mat		CHE 330 Chem Engr Lab I	4
GEP Requirement*	3	Free Elective	3
CHE 395 Professional Dev Seminar	1		**17**
	17		

Fall Semester	Credit	Spring Semester	Credit
CHE 331 Chem Engr Lab II	2	CHE 435 Proc System Analy & Control	3
CHE 446 Des & Analy Chem Reactors	3	CHE 451 CHE Design II	3
CHE 450 CHE Design I	3	Technical Elective [3]	3
Technical Elective[3]	3	GEP Requirement*	3
GEP Requirement*	3	GEP IP Requirement*	2-3
	14		**14-15**

Minimum Credit Hours Required for Graduation: **125**

Major/Program requirements and footnotes:

[1a] Must be completed with grade of (C) or higher.

[1b] Must be completed with grade of (C-) or higher.

[2] Chemistry electives include: PCC 461/464: Chemistry of Polymeric Materials (fall only): BCH 451: Principles of Biochemistry; BCH 351, General Biochemistry; CH 437: Physical Chemistry; FS 402: Chemistry of Food and Bioprocessed Materials (fall only); PSE 335: Green Chemistry (fall only

[3] Technical Electives: Any CHE elective course higher than CHE 455; BEC 462, CE 214, CE 373, CSC 112/113/114/116, E 304, ECE 331 (if not previously taken), ISE 311, MAE 206, MSE 201 (if not previously taken), NE 419, PSE 425, E304

***General Education Program (GEP) requirements:**

To complete the requirements for graduation and the General Education Program, the following credit hours and co-requisites must be satisfied. University approved GEP course lists for each category can be found at http://www.ncsu.edu/uap/academic-standards/ .

PHYSICAL EDUCATION - 2 hours to be selected from the approved GEP Physical Education list.
a. One fitness and wellness course (any PE 100-level course).
b. One additional credit hour of PE activity courses.
HUMANITIES - 6 credits to be selected in two different disciplines (two different course prefixes) from the approved GEP Humanities list.
SOCIAL SCIENCES - 3 credits to be selected in a discipline other than economics from the approved GEP Social Sciences list. EC 205 (or EC 201 or ARE 201) taken as part of the Major requirements satisfies 3 credit hours of the 6 credit hours needed to fulfill the GEP Social Sciences requirement.
ADDITIONAL BREADTH - 3 credits to be selected from the approved GEP Humanities, Social Sciences or Visual and Performing Arts lists.
INTERDISCIPLINARY PERSPECTIVES - 5 credits to be selected from the approved GEP Interdisciplinary Perspectives list.

Co-requisites:

U.S. Diversity and Global Knowledge co-requisites must be satisfied to complete the General Education requirements. Choose course(s) that are identified on the approved GEP course lists as meeting the U.S. Diversity and Global Knowledge co-requisites.

Foreign Language proficiency at the FL_102 level will be required for graduation.

Bachelor of Science in Chemical Engineering
Biomolecular Engineering Concentration

Fall Semester	Credit	Spring Semester	Credit
CH 101 (or 103) General Chemistry I[1a]	3	CH 201 (or 203) General Chemistry II[1b]	3
CH 102 (or 104) General Chemistry I Lab[1a]	1	CH 202 (or 204) General Chemistry II Lab	1
E 101 Introduction to Engr & Prob Solv[1a]	1	MA 241 Calculus II[1a]	4
E 115 Intro to Computing Environ	1	PY 205 Physics for Engr & Sc I[1a]	3
ENG 101 Academic Writing & Research[1a]	4	PY 206 Physics for Engr & Sc I Lab[1a]	1
MA 141 Calculus I[1a]	4	EC 205 Econ (or EC 201 or ARE 201)*	3
HESx 1** Fitness & Wellness Course*	1	HESx (100 or 200 level) Elective*	1
	15		**16**

Fall Semester	Credit	Spring Semester	Credit
CH 221 (or 225) Organic Chemistry I[1b]	3	CH 223 (or 227) Organic Chemistry II	3
CH 222 (or 226) Organic Chemistry I Lab	1	CH 224 (or 228) Organic Chemistry II Lab	1
CHE 205 Chemical Proc Prin[1b]	4	CHE 225 Chemical Proc Systems[1b]	3
MA 242 Calculus III[1b]	4	MA 341 Applied Differential Eq[1b]	3
PY 208 Physics Engr & Scientists II	3	BIO 183 Intro Biol: Cellular & Molecular	4
PY 209 Physics Engr & Scientists II Lab	1	GEP Requirement*	3
	16		**17**

Fall Semester	Credit	Spring Semester	Credit
BCH 451 Intro Biochemistry	4	BIT *** BIT Lab Module – Group 1[2] *	2
CHE 311 Transport Processes I[1b]	3	BIT *** BIT Lab Module – Group 2[2] *	2
CHE 315 Chem Process Thermo[1b]	3	CHE 312 Transport Processes II	3
BIT 410 Manipulation ReDNA (4 cr.)	4	CHE 316 Thermo of Chem & Phase Eq	3
GEP Requirement*	3	CHE 330 Chem Engr Lab I	4
CHE 395 Professional Dev Seminar	1	GEP Requirement*	2-3
	18		**16-17**

Fall Semester	Credit	Spring Semester	Credit
CHE 447 Bioreactor Engineering	3	CHE 435 Proc System Analy & Control	3
CHE 450 CHE Design I	3	CHE 451 CHE Design II	3
CHE 497 Chemical Engr Projects	3	CHE 551 Biochemical Engineering	3
GEP Requirement*	3	Technical Elective[4]	2-3
Biotech Minor Grp E (GEP IP req*)[3]	3	GEP Requirement*	3
	15		**14-15**

Minimum Credit Hours Required for Graduation*: **127**

Major/Program requirements and footnotes:

[1a] Must be completed with grade of (C) or higher.

[1b] Must be completed with grade of (C-) or higher.

[2] Students must take two 2-hour BIT lab modules from the following list:

Group 1 (Engineering-Based Elective): BIT 464, 467, 477, 495 (from the group of: Genetic Engineering of Yeast and Fungi, Immunology Methods, Genome Engineering, Virus Biotechnology, Yeast Metabolic Engineering, Immunology Methods, Confocal Microscopy, Next Generation DNA Forensics, or CRISPR Tech.), 572, 574

Group 2: Any course in Group 1 above + BIT 466, 471, 478, 495 (from the group of: Computational Biology, mRNA, Gene Manipulation in Zebrafish, Mapping the Brain, or Stem Cells).

[3] Biotech Minor Group E must be selected from: IDS 201, 303; STS 302, 304; STS(PHI) 325. If another IP GEP course has already been taken, BIT 501 (1 hr) can satisfy the Biotech Minor Group E requirement.
[4] Technical Elective must be selected from: BEC 330, BEC(CHE) 462, BEC(CHE) 463, BEC 480, BEC 485, BEC 488, BBS 426, CHE(BIT) 464, PSE 425, CE 373, ECE 331, MSE 201, NE 419, TE 466.

***General Education Program (GEP) requirements:**

To complete the requirements for graduation and the General Education Program, the following credit hours and co-requisites must be satisfied. University approved GEP course lists for each category can be found at http://www.ncsu.edu/uap/academic-standards/gep/courselists/index.html

PHYSICAL EDUCATION - 2 hours to be selected from the approved GEP Physical Education list.
a. One fitness and wellness course (any PE 100-level course).
b. One additional credit hour of PE activity courses.
HUMANITIES - 6 credits to be selected in two different disciplines (two different course prefixes) from the approved GEP Humanities list.
SOCIAL SCIENCES - 3 credits to be selected in a discipline other than economics from the approved GEP Social Sciences list. EC 205 (or EC 201 or ARE 201) taken as part of the Major requirements satisfies 3 credit hours of the 6 credit hours needed to fulfill the GEP Social Sciences requirement.
ADDITIONAL BREADTH - 3 credits to be selected from the approved GEP Humanities, Social Sciences or Visual and Performing Arts lists.
INTERDISCIPLINARY PERSPECTIVES - 2 credits to be selected from the approved GEP Interdisciplinary Perspectives list. Course chosen to meet the Biotech Minor Grp E requirement in the Major satisfies 3 credit hours of the 5 credit hours needed to fulfill the GEP Interdisciplinary Perspectives requirement.

Co-requisites:

U.S. Diversity and Global Knowledge co-requisites must be satisfied to complete the General Education requirements. Choose course(s) that are identified on the approved GEP course lists as meeting the U.S. Diversity and Global Knowledge co-requisites.
Foreign Language proficiency at the FL_102 level will be required for graduation.

B. S. in Chemical Engineering
Biomanufacturing Sciences Concentration

Fall Semester	Credit	Spring Semester	Credit
CH 101 (or 103) General Chemistry I[1a]	3	CH 201 (or 203) General Chemistry II[1b]	3
CH 102 (or 104) General Chemistry I Lab[1a]	1	CH 202 (or 204) General Chemistry II Lab	1
E 101 Introduction to Engr & Prob Solv[1a]	1	MA 241 Calculus II[1a]	4
E 115 Intro to Computing Environ	1	PY 205 Physics for Engr & Sc I[1a]	3
ENG 101 Academic Writing & Research[1a]	4	PY 206 Physics for Engr & Sc I Lab[1a]	1
MA 141 Calculus I[1a]	4	EC 205 Econ (**or** EC 201 **or** ARE 201)*	3
HESx 1** Fitness & Wellness Course*	1	HESx (100 or 200 level) Elective*	1
	15		**16**

Fall Semester	Credit	Spring Semester	Credit
BEC 220 Intro Biomanufacturing	1	BIO 183 Intro Bio: Cellular & Molecular	4
CH 221 (or 225) Organic Chemistry I[1b]	3	CH 223 (or 227) Organic Chemistry II	3
CH 222 (or 226) Organic Chemistry I Lab	1	CH 224 (or 228) Organic Chemistry II Lab	1
CHE 205 Chemical Proc Prin[1b]	4	CHE 225 Chemical Proc Systems[1b]	3
MA 242 Calculus III[1b]	4	MA 341 Applied Differential Eq[1b]	3
PY 208 Physics Engr & Scientists II	3	GEP Requirement*	3
PY 209 Physics Engr & Scientists II Lab	1		**17**
	17		

Fall Semester	Credit	Spring Semester	Credit
BCH 451 Intro Biochemistry	4	BEC 426 Industrial Micro & Bioman Lab	2
BEC 363 Found Recomb Micro for Biom	2	BEC 330 Prin & Applications of Biosep	2
BEC 463 Ferm of Recomb Microorg	2	CHE 312 Transport Processes II	3
CHE 311 Transport Processes I[1]	3	CHE 316 Thermo of Chem & Phase Eq	3
CHE 315 Chem Process Thermo[1]	3	Free Elective	3
GEP Requirement*	3	GEP Requirement*	3
	17		**16**

Fall Semester	Credit	Spring Semester	Credit
BEC 436 Downstream Proc of Biomat	2	Biomanufacturing Elective[2]	2
BEC 480 Large Scale Fermentation **OR**	2	CHE 435 Proc System Analy & Control	3
BEC 485 Large Scale Recov & Purif		CHE 451 CHE Design II	3
CHE 395 Professional Dev Seminar	1	Bioethics Course (GEP IP Req*)[3]	3
CHE 447 Bioreactor Engineering	3	GEP Requirement*	2-3
CHE 450 CHE Design I	3		**13-14**
GEP Requirement*	3		
	14		

Minimum Credit Hours Required for Graduation*: **125**

Major/Program requirements and footnotes:

[1a] Must be completed with grade of (C) or higher.

[1b] Must be completed with grade of (C-) or higher.

[2] The Biomanufacturing elective course must be selected from the following list: BEC 440/540, BEC 441/541, BEC/CHE 462, BEC 475/575, BEC 480/580, BEC/BME 483, BEC 485/585, BEC/CHE 488, BEC 497, BIT 466. NOTE: Course selected from the choice of either BEC 480/485 cannot be used to satisfy this requirement (i.e. counted twice).

[3] The bioethics course must be selected from: IDS 201, 303; STS 302, 304; STS(PHI) 325

* **General Education Program (GEP) requirements:**

To complete the requirements for graduation and the General Education Program, the following credit hours and co-requisites must be satisfied. University approved GEP course lists for each category can be found at http://www.ncsu.edu/uap/academic-standards/gep/courselists/index.html .

PHYSICAL EDUCATION - 2 hours to be selected from the approved GEP Physical Education list.
a. One fitness and wellness course (any PE 100-level course).
b. One additional credit hour of PE activity courses.
HUMANITIES - 6 credits to be selected in two different disciplines (two different course prefixes) from the approved GEP Humanities list.
SOCIAL SCIENCES - 3 credits to be selected in a discipline other than economics from the approved GEP Social Sciences list. EC 205 (or EC 201 or ARE 201) taken as part of the Major requirements satisfies 3 credit hours of the 6 credit hours needed to fulfill the GEP Social Sciences requirement.
ADDITIONAL BREADTH - 3 credits to be selected from the approved GEP Humanities, Social Sciences or Visual and Performing Arts lists.
INTERDISCIPLINARY PERSPECTIVES - 2 credits to be selected from the approved GEP Interdisciplinary Perspectives list. Course chosen to meet the Bioethics course requirement in the Major satisfies 3 credit hours of the 5 credit hours needed to fulfill the GEP Interdisciplinary Perspectives requirement.

Co-requisites:
U.S. Diversity and Global Knowledge co-requisites must be satisfied to complete the General Education requirements. Choose course(s) that are identified on the approved GEP course lists as meeting the U.S. Diversity and Global Knowledge co-requisites.
Foreign Language proficiency at the FL_102 level will be required for graduation.

B.S. in Chemical Engineering
Sustainable Engineering, Energy and the Environment

Fall Semester	Credit	Spring Semester	Credit
CH 101 (or 103) General Chemistry I[1a]	3	CH 201 (or 203) General Chemistry II[1b]	3
CH 102 (or 104) General Chemistry I Lab[1a]	1	CH 202 (or 204) General Chemistry II Lab	1
E 101 Introduction to Engr & Prob Solv[1]	1	MA 241 Calculus II[1a]	4
E 115 Intro to Computing Environ	1	PY 205 Physics for Engr & Sc I[1a]	3
ENG 101 Academic Writing and Research[1]	4	PY 206 Physics for Engr & Sc I Lab[1a]	1
MA 141 Calculus I[1a]	4	EC 205 Economics (or EC 201 or ARE	3
HESx 1** Fitness & Wellness Course*	1	201)*	1
	15	HESx (100 or 200 level) Elective*	**16**

Fall Semester	Credit	Spring Semester	Credit
CH 221 (or 225) Organic Chemistry I[1b]	3	CH 223 (or 227) Organic Chemistry II	3
CH 222 (or 226) Organic Chemistry I Lab	1	CH 224 (or 228) Organic Chemistry II Lab	1
CHE 205 Chemical Proc Prin[1b]	4	CHE 225 Chemical Proc Systems[1b]	3
MA 242 Calculus III[1b]	4	MA 341 Applied Differential Eq[1b]	3
GEP Requirement*	3	PY 208 Physics Engr & Scientists II	3
	15	PY 209 Physics Engr & Scientists II	1
		GEP Requirement*	3
			17

Fall Semester	Credit	Spring Semester	Credit
PSE 335 Principles of Green Chemistry	4	CH *** Chemistry Elective[2]	4
CHE 311 Transport Processes I[1b]	3	CHE 312 Transport Processes II	3
CHE 315 Chem Process Thermo[1b]	3	CHE 316 Thermo of Chem & Phase Eq	3
CHE 497 Chem Engr. Proj.	3	CHE 330 Chem Engr Lab I	4
Free Elective	3	GEP Requirement*	3
	16		**17**

Fall Semester	Credit	Spring Semester	Credit
CHE 331 Chem Engr Lab II	2	CHE 435 Proc System Analy & Control	3
CHE 446 Des & Analy Chem Reactors	3	CHE 451 CHE Design II	3
CHE 450 CHE Design I	3	Concentration Elective[3]	3
Concentration Elective[3]	3	GEP Requirement *	3
GEP Requirement*	3	GEP Requirement*[4]	2-3
CHE 395 Professional Dev Seminar	1		**14-15**
	15		

Minimum Credit Hours Required for Graduation*: **125**

Major/Program requirements and footnotes:

[1a] Must be completed with grade of (C) or higher.

[1b] Must be completed with grade of (C-) or higher.

[2] Chemistry electives include: CH 437 Physical Chemistry; BCH 351 General Biochemistry; BCH 451 Princ of Biochemistry; FS 402 Chem of Food & Bioprocessed Materials; WPS 301: Introduction to Wood Chemistry; PCC 461/464 Chem of Polymeric Materials

[3] Concentration electives include: CE 373; Principles of Environmental Engineering; CE 476: Air Pollution Control; CE 484: Water and Waste Systems; CE 456: Air Quality; CE 477: Solid Waste Management; CE 478: Energy and Climate; PSE 425 Bioenergy and Biomaterials Engineering; PSE(WPS) 476: Environmental Life Cycle Analysis; BAE 528: Biomass to Renewable Energy Processes; CHE 596 special topics courses (Emerging Energy Frontiers; Biofuels; Green Engineering; as offered and approved by advisor)

***General Education Program (GEP) requirements:**

To complete the requirements for graduation and the General Education Program, the following credit hours and co-requisites must be satisfied. University approved GEP course lists for each category can be found at http://oucc.ncsu.edu/gep-courses.

[4]The GEP Interdisciplinary Perspectives requirement must be satisfied from this list:

- ES 100 Introduction to Environmental Sciences; (Global Knowledge, GK)
- ES 200 Climate Change and Sustainability; (GK)
- ES 300 Energy and Environment; (GK)
- IDS 201 Environmental Ethics; (GK)
- SMT 201 Sustainable Materials for Green Housing (fall only)
- SMT 232 Recycling to Create a Sustainable Environment (spring only)
- PCC 401 Impact of Industry on the Environment and Society

PHYSICAL EDUCATION - 2 hours to be selected from the approved GEP Physical Education list.
a. One fitness and wellness course (any PE 100-level course).
b. One additional credit hour of PE activity courses.
HUMANITIES - 6 credits to be selected in two different disciplines (two different course prefixes) from the approved GEP Humanities list.
SOCIAL SCIENCES - 3 credits to be selected in a discipline other than economics from the approved GEP Social Sciences list. EC 205 (or EC 201 or ARE 201) taken as part of the Major requirements satisfies 3 credit hours of the 6 credit hours needed to fulfill the GEP Social Sciences requirement.
ADDITIONAL BREADTH - 3 credits to be selected from the approved GEP Humanities, Social Sciences or Visual and Performing Arts lists.
INTERDISCIPLINARY PERSPECTIVES - 5 credits to be selected from the approved GEP Interdisciplinary Perspectives list.

Co-requisites:

U.S. Diversity and Global Knowledge co-requisites must be satisfied to complete the General Education requirements. Choose course(s) that are identified on the approved GEP course lists as meeting the U.S. Diversity and Global Knowledge co-requisites.
Foreign Language proficiency at the FL_102 level will be required for graduation.

Bachelor of Science in Chemical Engineering
Honors Program

Fall Semester	Credit	Spring Semester	Credit
CH 101 (or 103) General Chemistry I[1a]	3	CH 201 (or 203) General Chemistry II[1b]	3
CH 102 (or 104) General Chemistry I Lab[1a]	1	CH 202 (or 204) General Chemistry II Lab	1
E 101 Introduction to Engr & Prob Solv[1a]	1	MA 241 Calculus II[1a]	4
E 115 Intro to Computing Environ	1	PY 205 Physics for Engr & Sc I[1a]	3
ENG 101 Academic Writing and Research[1a]	4	PY 206 Physics for Engr & Sc I Lab[1a]	1
MA 141 Calculus I[1a]	4	EC 205 Econ (or EC 201 or ARE 201)*	3
HESx 1** Fitness & Wellness Course*	1	HESx (100 or 200 level) Elective*	1
	15		**16**

Fall Semester	Credit	Spring Semester	Credit
CH 221 (or 225) Organic Chemistry I[1b]	3	CH 223 (or 227) Organic Chemistry II	3
CH 222 (or 226) Organic Chemistry I Lab	1	CH 224 (or 228) Organic Chemistry II Lab	1
CHE 205 Chemical Proc Prin[1b]	4	CHE 225 Chemical Proc Systems[1b]	3
MA 242 Calculus III[1b]	4	MA 341 Applied Differential Eq[1b]	3
GEP Requirement*	3	PY 208 Physics Engr & Scientists II	3
	15	PY 209 Physics Engr & Scientists II Lab	1
		GEP Requirement*	3
			17

Fall Semester	Credit	Spring Semester	Credit
CH *** Chemistry Elective[3]	4	CH 315 Quantitative Analysis	3
CHE 311H Transport Processes I[1b]	1	CH 316 Quantitative Analysis Lab	1
CHE 315 Chem Process Thermo[1b]	3	CHE 312H Transport Processes II	3
Mathematics Elective[2]	3	CHE 316 Thermo of Chem & Phase Eq	3
GEP Requirement*	3	CHE 330 Chem Engr Lab I	4
CHE 395 Professional Dev Seminar	3	ENG 333 Comm for Science and Research	3
	1		**17**
	17		

Fall Semester	Credit	Spring Semester	Credit
CHE 446 Des & Analy Chem Reactors	3	CHE 435 Proc System Analy & Control	3
CHE 450 CHE Design I	3	CHE 451 CHE Design II	3
CHE 497 Chemical Engr Projects	3	CHE *** Honors Electives[5]	3
CHE 7** CHE Elective[4]	3	GEP Requirement*	3
GEP Requirement*	3	GEP IP Requirement*	2-3
	15	CHE 495 Honors Thesis Prep[6]	1
			15-16

Minimum Credit Hours Required for Graduation: **127**

Major/Program requirements and footnotes:

[1a] Must be completed with grade of (C) or higher.

[1b] Must be completed with grade of (C-) or higher.

[2] Math electives include: MA 401, 402, 405, 427, 501.

[3] Chemistry electives include: PCC 461/464: Chemistry of Polymeric Materials (fall only): BCH 451: Principles of Biochemistry; BCH 351, General Biochemistry; CH 437: Physical Chemistry; FS 402: Chemistry of Food and Bioprocessed Materials (fall only); PSE 335: Green Chemistry

[4] CHE 7xx includes CHE 711, 713, 715, 717.

[5] Honors electives include CHE 455 and above, CHE 5xx, CHE 7xx.

[6] An honors thesis is required for completion of the Honors Program.

*** General Education Program (GEP) requirements:**
To complete the requirements for graduation and the General Education Program, the following credit hours and co-requisites must be satisfied. University approved GEP course lists for each category can be found at http://www.ncsu.edu/uap/academic-standards/ .

PHYSICAL EDUCATION - 2 hours to be selected from the approved GEP Physical Education list.
a. One fitness and wellness course (any PE 100-level course).
b. One additional credit hour of PE activity courses.
HUMANITIES - 6 credits to be selected in two different disciplines (two different course prefixes) from the approved GEP Humanities list.
SOCIAL SCIENCES - 3 credits to be selected in a discipline other than economics from the approved GEP Social Sciences list. EC 205 (or EC 201 or ARE 201) taken as part of the Major requirements satisfies 3 credit hours of the 6 credit hours needed to fulfill the GEP Social Sciences requirement.
ADDITIONAL BREADTH - 3 credits to be selected from the approved GEP Humanities, Social Sciences or Visual and Performing Arts lists.
INTERDISCIPLINARY PERSPECTIVES - 5 credits to be selected from the approved GEP Interdisciplinary Perspectives list.

Co-requisites:
U.S. Diversity and Global Knowledge co-requisites must be satisfied to complete the General Education requirements. Choose course(s) that are identified on the approved GEP course lists as meeting the U.S. Diversity and Global Knowledge co-requisites.

Foreign Language proficiency at the FL_102 level will be required for graduation.

Bachelor of Science in Chemical Engineering
Nanoscience concentration

Fall Semester	Credit	Spring Semester	Credit
CH 101 (or 103) General Chemistry I[1a]	3	CH 201 (or 203) General Chemistry II[1b]	3
CH 102 (or 104) General Chemistry I Lab[1a]	1	CH 202 (or 204) General Chemistry II Lab	1
E 101 Introduction to Engr & Prob Solv[1a]	1	MA 241 Calculus II[1a]	4
E 115 Intro to Computing Environ	1	PY 205 Physics for Engr & Sc I[1a]	3
ENG 101 Academic Writing and Research[1a]	4	PY 206 Physics for Engr & Sc I Lab[1a]	1
MA 141 Calculus I[1a]	4	EC 205 Econ (or EC 201 or ARE 201)*	3
HESx 10* Fitness & Wellness Course*	1	HESx (100 or 200 level) Elective*	1
	15		**16**

Fall Semester	Credit	Spring Semester	Credit
CH 221 (or 225) Organic Chemistry I[1b]	3	CH 223 (or 227) Organic Chemistry II	3
CH 222 (or 226) Organic Chemistry I Lab	1	CH 224 (or 228) Organic Chemistry II Lab	1
CHE 205 Chemical Proc Prin[1b]	4	CHE 225 Chemical Proc Systems[1b]	3
MA 242 Calculus III[1b]	4	MA 341 Applied Differential Eq[1b]	3
PY 208 Physics Engr & Scientists II	3	MSE 201 Struct & Prop Engr Mat	3
PY 209 Physics Engr & Scientists II Lab	1	GEP Requirement*	3
	16		**16**

Fall Semester	Credit	Spring Semester	Credit
CH *** Chemistry Elective[2]	4	CH 437 Phys Chem for Engrs	4
CHE 311 Transport Processes I[1b]	3	CHE 312 Transport Processes II	3
CHE 315 Chem Process Thermo[1b]	3	CHE 316 Thermo of Chem & Phase Eq	3
GEP Requirement*	3	CHE 330 Chem Engr Lab I	4
GEP Requirement*	3	Free Elective	3
CHE 395 Professional Dev Seminar	1		**17**
	17		

Fall Semester	Credit	Spring Semester	Credit
CHE 331 Chem Engr Lab II	2	CHE 435 Proc System Analy & Control	3
CHE 446 Des & Analy Chem Reactors	3	CHE 451 CHE Design II	3
CHE 450 CHE Design I	3	Nanoscience Elective[3]	3
Nanoscience Elective[3]	3	GEP Requirement*	3
GEP Requirement*	3	GEP Requirement*	2-3
	14		**14-15**

Minimum Credit Hours Required for Graduation: **125**

Major/Program requirements and footnotes:

[1a] Must be completed with grade of (C) or higher.

[1b] Must be completed with grade of (C-) or higher.

[2] Chemistry electives include: PCC 461/464: Chemistry of Polymeric Materials (fall only): BCH 451: Principles of Biochemistry; BCH 351, General Biochemistry; CH 315/316: Quantitative Analysis, FS 402: Chemistry of Food and Bioprocessed Materials (fall only); PSE 335: Green Chemistry

[3] Nanosciences Electives include: E304: Introduction to Nano Science and Technology; CHE(ECE) 468: Conventional and Emerging Nanomanufacturing Techniques and Their Applications in Nanosystems; MSE 455: Polymer Technology and Engineering, CH 460: Nano-Electronic Materials, CHE 461: Polymer Sciences and Technology, CHE 462: Fundamentals of Bio-Nanotechnology, CHE 467: Rheology, CHE 470: Colloidal and Nanoscale Engineering, CHE 597D: Colloidal and Macromolecular Physics, CHE 597J: Polymers at Interfaces and in Confined Geometries, ECE 331: Principles of Electrical Engineering I, MSE 425: Polymer Science & Technology, MSE 331: Elec Properties of Materials, MSE 460: Microelectronic Materials, PY 407: Introduction to Modern Physics. Additional nanoscience electives may be approved on a case-by-case basis as new courses are introduced.

***General Education Program (GEP) requirements:**

To complete the requirements for graduation and the General Education Program, the following credit hours and co-requisites must be satisfied. University approved GEP course lists for each category can be found at http://www.ncsu.edu/uap/academic-standards/ .

PHYSICAL EDUCATION - 2 hours to be selected from the approved GEP Physical Education list.
a. One fitness and wellness course (any PE 100-level course).
b. One additional credit hour of PE activity courses.
HUMANITIES - 6 credits to be selected in two different disciplines (two different course prefixes) from the approved GEP Humanities list.
SOCIAL SCIENCES - 3 credits to be selected in a discipline other than economics from the approved GEP Social Sciences list. EC 205 (or EC 201 or ARE 201) taken as part of the Major requirements satisfies 3 credit hours of the 6 credit hours needed to fulfill the GEP Social Sciences requirement.
ADDITIONAL BREADTH - 3 credits to be selected from the approved GEP Humanities, Social Sciences or Visual and Performing Arts lists.
INTERDISCIPLINARY PERSPECTIVES - 5 credits to be selected from the approved GEP Interdisciplinary Perspectives list.

Co-requisites:

U.S. Diversity and Global Knowledge co-requisites must be satisfied to complete the General Education requirements. Choose course(s) that are identified on the approved GEP course lists as meeting the U.S. Diversity and Global Knowledge co-requisites.

Foreign Language proficiency at the FL_102 level will be required for graduation.

Accelerated Master's Degree (BS/MS in CHE)

Fall Semester	Credit	Spring Semester	Credit
CH 101 (or 103) General Chemistry I[1a]	3	CH 201 (or 203) General Chemistry II[1b]	3
CH 102 (or 104) General Chemistry I Lab[1a]	1	CH 202 (or 204) General Chemistry II	1
E 101 Introduction to Engr & Prob Solv[1a]	1	Lab	4
E 115 Intro to Computing Environ	1	MA 241 Calculus II[1a]	3
ENG 101 Academic Writing and Research[1a]	4	PY 205 Physics for Engr & Sc I[1a]	1
MA 141 Calculus I[1a]	4	PY 206 Physics for Engr & Sc I Lab[1a]	3
HESx 1** Fitness & Wellness Course*	1	EC 205 Econ (or EC 201 or ARE 201)*	1
	15	HESx (100 or 200 level) Elective*	**16**

Fall Semester	Credit	Spring Semester	Credit
CH 221 (or 225) Organic Chemistry I[1b]	3	CH 223 (or 227) Organic Chemistry II	3
CH 222 (or 226) Organic Chemistry I Lab	1	CH 224 (or 228) Organic Chemistry II	1
CHE 205 Chemical Proc Prin[1b]	4	Lab	3
MA 242 Calculus III[1b]	4	CHE 225 Chemical Proc Systems[1b]	3
GEP Requirement*	3	MA 341 Applied Differential Eq[1b]	3
	15	PY 208 Physics Engr & Scientists II	1
		PY 209 Physics Engr & Scientists II Lab	3
		GEP Requirement*	**17**

Fall Semester	Credit	Spring Semester	Credit
CH *** Chemistry Elective[2]	4	CH 315 Quantitative Analysis	3
CHE 311 Transport Processes I[1b]	1	CH 316 Quantitative Analysis Lab	1
CHE 315 Chem Process Thermo[1b]	3	CHE 312 Transport Processes II	3
ECE 331 Prin Electrical Engr ***OR***	3	CHE 316 Thermo of Chem & Phase Eq	3
MSE 201Struct & Prop Engr Mat	3	CHE 330 Chem Engr Lab I	4
GEP Requirement*		Free Elective	3
CHE 395 Professional Dev Seminar	3		**17**
	1		
	17		

Fall Semester	Credit	Spring Semester	Credit
CHE 331 Chem Engr Lab II	2	CHE 435 Proc System Analy & Control	3
CHE 446 Des & Analy Chem Reactors	3	CHE 451 CHE Design II	3
CHE 450 CHE Design I	3	500-Level CHE Technical Elective	3
500-Level CHE Technical Elective	3	GEP Requirement*	3
GEP Requirement*	3	GEP IP Requirement*	2-3
	14		**14-15**

Fall Semester	Credit	Spring Semester	Credit
CHE 711 ChE Process Modeling	3	CHE 596U Special Topics in CHE	3
CHE 713 Thermodynamics I	3	CHE 715 Transport Phenomena	3
CHE 717 Chem Reaction Engineering	3	CHE Graduate Elective	3
	9		**9**
Minimum Credit Hours Required for Graduation: [3]			**144**

Major/Program requirements and footnotes:

[1a] Must be completed with grade of (C) or higher.

[1b] Must be completed with grade of (C-) or higher.

[2] Chemistry electives include: PCC 461/464: Chemistry of Polymeric Materials (fall only): BCH 451: Principles of Biochemistry; BCH 351, General Biochemistry; CH 437: Physical Chemistry, FS 402: Chemistry of Food and Bioprocessed Materials (fall only); PSE 335: Green Chemistry (fall only)

[3] Students must have an overall GPA of 3.5 through the end of the junior year and must maintain this GPA through the senior year to be admitted into the program. Students who wish to complete the Accelerated BS/MS ChE degree program must apply for candidacy to the MS degree during the spring semester of the junior year (semester during which CHE 312/316 are completed). The admissions process includes submitting the following information to the Chemical and Biomolecular Engineering Graduate Administrator. Dr. Saad Khan:

(1) Completed copy of the signed graduate application form
(2) NC Residency Form if you wish to claim NC residency for tuition purposes
(3) Non-Refundable application fee in form of a check or money order
(4) Three letters of recommendation
(5) Official transcript sent directly from every college and graduate school attended
(8) Graduate Record Examination (**GRE**) scores

Students must receive a grade of B (3.0/4.0) or better in the double counted graduate level courses. Courses with a grade of B- or below can not be double counted between the two degrees. No more than twelve (12) hours of graduate work may be counted towards the requirements of both degrees. Students must complete the Master's degree within 12 months from the completion of the baccalaureate degree for a non-thesis Master's degree and within 18 months for Master's programs requiring a thesis. If the Master's program is not completed within these time limits, none of the courses can be double counted. Note that the B.S. Degree must be completed in order to get the dual BS/MS (students cannot double major in something else and then skip to the MS CHE). Recipients of the MS degree must earn a minimum semester GPA of 3.0 during the final two semesters, including no more than one C grade in 500 and 700 level CHE courses.

***General Education Program (GEP) requirements:**
To complete the requirements for graduation and the General Education Program, the following credit hours and co-requisites must be satisfied. University approved GEP course lists for each category can be found at http://www.ncsu.edu/uap/academic-standards/ .

PHYSICAL EDUCATION - 2 hours to be selected from the approved GEP Physical Education list.
a. One fitness and wellness course (any PE 100-level course).
b. One additional credit hour of PE activity courses.
HUMANITIES - 6 credits to be selected in two different disciplines (two different course prefixes) from the approved GEP Humanities list.
SOCIAL SCIENCES - 3 credits to be selected in a discipline other than economics from the approved GEP Social Sciences list. EC 205 (or EC 201 or ARE 201) taken as part of the Major requirements satisfies 3 credit hours of the 6 credit hours needed to fulfill the GEP Social Sciences requirement.
ADDITIONAL BREADTH - 3 credits to be selected from the approved GEP Humanities, Social Sciences or Visual and Performing Arts lists.
INTERDISCIPLINARY PERSPECTIVES - 5 credits to be selected from the approved GEP Interdisciplinary Perspectives list.

Co-requisites:
U.S. Diversity and Global Knowledge co-requisites must be satisfied to complete the General Education requirements. Choose course(s) that are identified on the approved GEP course lists as meeting the U.S. Diversity and Global Knowledge co-requisites.

Cooperative BS/MS Degree Programs in Chemical Engineering and Pharmaceutical Sciences (Campbell)

The Cooperative BS/MS degree programs in chemical engineering and pharmaceutical sciences are designed for the chemical engineering biomolecular concentration or biomanufacturing sciences concentration students who want to gain advanced knowledge in an area of specialization in the pharmaceutical sciences. The MS in Pharmaceutical Sciences (Industrial Pharmacy track) includes extensive hands-on training in advanced laboratory techniques. The program is completed after five years, including one summer term during or before the junior year, and graduates from the program should be competent to support and to lead a team for the development of new pharmaceutical products and delivery systems. The BS degree in chemical engineering is completed at NC State and the MS degree in pharmaceutical sciences is completed at Campbell University.

The Master of Science in Pharmaceutical Science (MSPS) at Campbell features specialized training in several areas of the pharmaceutical sciences. The MSPS core curriculum includes a background in molecular biology, analytical instrumentation, pharmacology, biochemistry, and other courses. The student then takes advanced courses in a specialized track. The tracks are bioprocessing, industrial pharmacy, pharmacology, and pharmaceutical analysis, and these include extensive hands-on training in advanced laboratory techniques. Students are required to utilize these skills by conducting a research project within their area of specialization.

At its heart, chemical engineering education "integrates design and analysis, science, and technology with communication skills developed through exposure to the humanities and the social and economic sciences. Chemical engineering organizes these diverse skills into a coherent discipline uniquely suited to the needs of the chemical, biochemical, petroleum, plastics, textile, and pulp and paper industries." In addition, both the chemical engineering biomolecular concentration and the biomanufacturing sciences concentration provide undergraduates with an educational background that is a strong preparation to pursue graduate education in the pharmaceutical sciences.

The Cooperative BS/MS degree programs are designed to educate and train a highly skilled individual who is competent to support and to lead a team for the development of new pharmaceutical products and delivery systems. Furthermore, by combining the NC State BS degree program in chemical engineering – either biomolecular concentration or the biomanufacturing sciences concentration with the Master of Science in Pharmaceutical Science program at Campbell University, interested students will be benefited by their ability to earn the two degrees in a total of five years, which includes one summer term at NC State, instead of the usual six years. Academically, all current NC State course and curriculum requirements will continue to be fulfilled only with NC State coursework, and the chemical engineering degree will be earned after four years, including two summer terms.

Students will normally apply for admission, and be admitted to, the dual degree program during the junior year and will be expected to enroll for classes during the summer following the junior year. Requirements for admission are:

Admissions Requirements

- Bachelor's degree with a minimum GPA of 3.0
- GRE: verbal ≥ 20th percentile, quantitative ≥ 60th percentile, analytical writing ≥ 3.0
- TOEFL: ≥ 80 (internet) or IELTS ≥ 6.5 (if applicable)
- General prerequisites: Physics I & II, General Chemistry I & II, Organic Chemistry I & II, Biochemistry, Analytical Instrumentation (This is satisfied by taking the three designated courses indicated in the curriculum)
- Application deadline is April 1 of the junior year to be eligible for scholarships, and applcations are accepted until July 1.

PHSC courses offered through Campbell are subject to Campbell tuition. Courses in the 5th year are taken at Campbell.

Administration of the Cooperative BS/MS Degree Program in Chemical Engineering and Pharmaceutical Sciences

At NC State, Dr. Henry Lamb and Dr. Robert Kelly will continue to serve as academic advisors for students enrolled in the BS degree program in chemical engineering – biomanufacturing science concentration and the biomolecular concentration, respectively, and as such they will also serve as the academic advisors and primary contacts for students who are admitted to the cooperative degree program.

Dr. Michael Flickinger
Professor
Department of Chemical & Biomolecular Engineering
Box 7905 - NCSU
Raleigh, NC 27695-7905
Phone: (919) 513-8235
e-mail: mcflicki@ncsu.edu

Dr. Robert Kelly
Professor
Department of Chemical & Biomolecular Engineering
Box 7905 - NCSU
Raleigh, NC 27695-7905
Phone: (919) 515-6396
e-mail: rmkelly@eos.ncsu.edu

At Campbell University, the contact for the program is:

Emanuel J. Diliberto, Jr., Ph.D.
Professor and Chair
Department of Pharmaceutical Sciences
Campbell University
P. O. Box 1090
Buies Creek, NC 27506

Cooperative BS/MS Degree Programs in Chemical Engineering and Pharmaceutical Sciences (Campbell) - (Biomolecular Concentration)

Fall Semester		Credits	Spring Semester		Credits
CH 101 (or 103) General Chemistry I[1a]		3	CH 201 (or 203) General Chemistry II[1b]		3
CH 102 (or 104) General Chemistry I Lab[1a]		1	CH 202 (or 204) General Chemistry II Lab		1
E 101	Intro to Engr & Prob Solv[1a]	1	EC 205	Econ (or EC 201 or ARE 201)	3
E 115	Intro to Computing Envir	1	MA 241	Analyt Geom & Calculus II[1a]	4
MA 141	Analyt Geom & Calculus I[1a]	4	PY 205	Physics Engr & Scien I[1a]	3
ENG 101	Academic Writing and Resch [1a]	4	PY 206	Physics Engr & Scien I Lab[1a]	1
HESx (100 or 200 level) Elective*		1	HESx 1**	Health & Phys Fitness	1
		15			**16**
CHE 205	Chemical Process Prin[1b]	4	CHE 225	Chemical Proc Systems[1b]	3
CH 221 (or 225) Organic Chemistry I[1b]		3	CH 223 (or 227) Organic Chemistry II		3
CH 222 (or 226) Organic Chemistry I lab		1	CH 224 (or 228) Organic Chemistry II Lab		1
PY 208	Physics Engr & Scien II	3	MA 341	Applied Differential Eqns[1b]	3
PY 209	Physics Engr & Scien II Lab	1	BIO 183	Intro Biology	4
MA 242	Analyt Geom & Calculus III[1b]	4	GEP Requirement		3
		16			**17**
BCH 451	Intro Biochemistry	4	BIT 464	Protein Purification	2
GEP Requirement		3	CHE 312	Transport Processes II	3
CHE 311	Transport Processes I[1b]	3	CHE 316	Thermo Chem & Phase Eq	3
CHE 315	Chem Process Thermo[1b]	3	CHE 330	CHE Lab I	4
BIT 410 Manipulation of Re DNA		4	CHE 395	Professional Dev. Seminar	1
		17	BIT ***	BIT 467	2
					15
Summer Session:					
BIO 212 Anatomy and Physiology		4			
GEP Requirement		2-3			
GEP Requirement		3			
		7			
GEP Requirement		3	CHE 435	Proc Sys Analy & Control	3
CHE 447	Des & Analy Chem Reac	3	CHE 451	CHE Design II	3
CHE 450	CHE Design I	3	CHE 551	Biochemical Engineering	3
CHE 497	Chem Eng Proj I	3	Bioethics course[3]		3
PHSC 514	Industrial Pharmacy [4]	3	PHSC 574	Biopharmaceutics	3
		15	PHSC 540	Advanced Physical Pharmacy [4]	3
					18
PHSC 412L	Analytical Lab Survey	1	PHSC 542	Adv. Topics in Ind Pharmacy	3
PHSC 510	Pharmacokinetics	2	PHSC 536	MS Seminar II	1
PHSC 512	Fund. of Cell. Pharmacology	4	PHSC 543L	Adv. Industrial Pharmacy Lab	1
PHSC 573	Intro. Multivariate Analysis	1	PHSC 233	Grad. Expt. Design and Biostat	4
PHSC 620	Research Project	4	PHSC 565	Adv Experimental Design	2
PHSC 534	MS Seminar I	1			**11**
PHSC 515L	Industrial Pharmacy Lab	1			
PHSC 508	Drug Dev. and Pharm. Reg.	2			
PHSC 610	Research Proposal	2			
		18			

Minimum Credit Hours Required for BS CHE Graduation **128**[*]
Minimum Credit Hours Required for MS Pharmaceutical Sciences: **164**
PPHSC 610 can be started the summer after the senior year.

Cooperative BS/MS Degree Programs in Chemical Engineering and Pharmaceutical Sciences (Campbell) - (Biomanufacturing Concentration)

Fall Semester		Credits	Spring Semester		Credits
CH 101(or 103) General Chemistry I[1a]		3	CH 201 (or 203) General Chemistry II[1b]		3
CH 102 (or 104) General Chemistry I Lab[1a]		1	CH 202 (or 204) General Chemistry II Lab		1
E 101	Intro to Engr & Prob Solv[1a]	1	EC 205	Econ (or EC 201 or ARE 201)	3
E 115	Intro to Computing Envir	1	MA 241	Analyt Geom & Calculus II[1a]	4
MA 141	Analyt Geom & Calculus I[1a]	4	PY 205	Physics Engr & Scien I[1a]	3
ENG 101	Academic Writing and Resch [1a]	4	PY 206	Physics Engr & Scien I Lab[1a]	1
HESx (100 or 200 level) Elective*		1	HESx 1**	Health & Phys Fitness	1
		15			**16**
PY 208	Physics Engr & Scien II	3	GEP Requirement		3
PY 209	Physics Engr & Scien II Lab	1	CHE 225	Chem. Eng. Analysis[1b]	3
BEC 220	Intro Biomanufacturing	1	CH 223 (or 227) Organic Chemistry II		3
CH 221 (or 225) Organic Chemistry I[1b]		3	CH 224 (or 228) Organic Chemistry II Lab		1
CH 222 (or 226) Organic Chemistry I Lab		1	MA 341	Applied Differential Eqns[1b]	3
CHE 205	Chemical Process Principles[1b]	4	BIO 183	Intro Biology	4
MA 242	Analyt Geom & Calculus III[1b]	4			**17**
		17			
BCH 451	Intro Biochemistry	4	BEC 330	Fund. Downstream Process	2
GEP Requirement		3	CHE 312	Transport Processes II	3
CHE 311	Transport Processes I[1b]	3	CHE 316	Thermo Chem & Phase Eq	3
CHE 315	Chem Process Thermo[1b]	3	GEP Requirement		3
BEC 363	Found Recomb Microorg for Biom	2	BBS 426	Ind. Micro. Bioproc. Lab	2
BEC 463	Ferm of Recomb Org	2			**13**
		17			
Summer Session:					
BIO 212	Anatomy and Physiology	4			
GEP Requirement		2-3			
		6			
BEC 436	Downstream Proc. Biomat.	2	CHE 435	Proc Sys Analy & Control	3
CHE 447	Bioreactor Engineering	3	CHE 451	CHE Design II	3
CHE 450	CHE Design I	3	Bioethics course[3]		3
Biomanufacturing Elective[2]		2	BEC 485	LS Recovery/Purification	2
GEP Requirement		3	PHSC 574	Biopharmaceutics[4]	3
CHE 395	Professional Dev. Seminar	1	PHSC 540	Advanced Physical Pharmacy[4]	3
PHSC 514	Industrial Pharmacy[3]	3			**17**
		17			
PHSC 412L	Analytical Lab Survey	1	PHSC 542	Adv. Topics in Ind Pharmacy	3
PHSC 510	Pharmacokinetics	2	PHSC 536	MS Seminar II	1
PHSC 512	Fund. of Cell. Pharmacology	4	PHSC 543L	Adv. Industrial Pharmacy Lab	1
PHSC 573	Intro. Multivariate Analysis	1	PHSC 233	Grad. Expt. Design and Biostat	4
PHSC 620	Research Project	4	PHSC 565	Adv Experimental Design	2
PHSC 534	MS Seminar I	1			**11**
PHSC 515L	Industrial Pharmacy Lab	1			
PHSC 508	Drug Dev. and Pharm. Reg.	2			
PHSC 610	Research Proposal	2			
		18			

Min. Credit Hrs Required for BS CHE Graduation **128*;**
Min. Credit Hrs Required for MS Pharmaceutical Sciences: **164**
PPHSC 610 can be started the summer after the senior year.

[1a] Must be completed with grade of (C) or higher.

[1b] Must be completed with grade of (C-) or higher.

[2] The biomanufacturing elective course must be selected from the following list:
BEC 480 – Large-Scale Fermentation
BEC 497 – Biomanufacturing Research Projects
BIT 466 – Animal Cell Culture
BIT 470 – Advanced Animal Cell Culture – Bioreactor Culture

[3] The BIT minor bioethics course counts as an H&SS for the Interdisciplinary Perspectives category. The courses include:

IDS 201: Environmental Ethics
STS 302: Cont Science, Technology, and Human Values
IDS 303: Humans and the Environment
STS 304: Ethical Dimensions of Progress
STS 320: Ethics in Engineering
STS(PHI) 325: Bio-Medical Ethics

***General Education Program (GEP) requirements:**
To complete the requirements for graduation and the General Education Program, the following credit hours and co-requisites must be satisfied. University approved GEP course lists for each category can be found at http://www.ncsu.edu/uap/academic-standards/ .

PHYSICAL EDUCATION - 2 hours to be selected from the approved GEP Physical Education list.
a. One fitness and wellness course (any PE 100-level course).
b. One additional credit hour of PE activity courses.
HUMANITIES - 6 credits to be selected in two different disciplines (two different course prefixes) from the approved GEP Humanities list.
SOCIAL SCIENCES - 3 credits to be selected in a discipline other than economics from the approved GEP Social Sciences list. EC 205 (or EC 201 or ARE 201) taken as part of the Major requirements satisfies 3 credit hours of the 6 credit hours needed to fulfill the GEP Social Sciences requirement.
ADDITIONAL BREADTH - 3 credits to be selected from the approved GEP Humanities, Social Sciences or Visual and Performing Arts lists.
INTERDISCIPLINARY PERSPECTIVES - 5 credits to be selected from the approved GEP Interdisciplinary Perspectives list.

Co-requisites:
U.S. Diversity and Global Knowledge co-requisites must be satisfied to complete the General Education

Bachelor of Science in Paper Science & Engineering -- Chemical Engineering Concentration
(Degrees: B.S. in Paper Science & Engineering, B. S. in Chemical Engineering)

Fall Semester	Credit	Spring Semester	Credit
CH 101 (or 103) General Chemistry I[1a]	3	CH 201 (or 203) General Chemistry II[1b]	3
CH 102 (or 104) General Chemistry I Lab[1a]	1	CH 202 (or 204) General Chemistry II Lab	1
E 101 Introduction to Engr & Prob Solv [1a]	1	EC 205 Econ (or EC 201 or ARE 201)*	3
E 115 Intro to Computing Environ	1	MA 241 Calculus II [1a]	4
ENG 101 Academic Writ and Research [1a]	4	PY 205 Physics Engr & Scientists I [1a]	3
MA 141 Calculus I [1a]	4	PY 206 Physics Engr & Scientists I Lab[1a]	1
HESx 1** Fitness & Wellness Course *	1	PSE 201 Pulping & Paper Tech [1b]	3
	15		**18**
CH 221 (or 225) Organic Chemistry I[1b]	3	CH 223 (or 227) Organic Chemistry II	3
CH 222 (or 226) Organic Chemistry I Lab	1	CH 224 (or 228) Organic Chemistry II Lab	1
CHE 205 Chemical Proc Princ [1b]	4	CHE 225 Chemical Proc Systems [1b]	3
MA 242 Calculus III [1b]	4	MA 341 Applied Differential Eq [1b]	3
PSE 212 Paper Properties [1b]	3	PY 208 Physics for Engr & Sci II	3
HESx (100 or 200 level) Elective*	1	PY 209 Physics for Engr & Sci II Lab	1
	16	PSE 371 Pulping Process Analysis [1b]	3
			17
CH 315/316 Quantitative Analysis **OR**	4	CHE 312 Transport Processes II	3
PSE 335 Prin Green Chemistry	4	CHE 316 Thermo of Chem & Phase Eq	3
CHE 311 Transport Processes I [1b]	3	PSE 332 Wood & Pulping Chemistry	3
CHE 315 Chem Process Thermo [1b]	3	PSE 360 Pulp & Paper Unit Proc. II	3
PSE 211 Pulp & Paper Internship [2]	1	GEP Requirement*	3
PSE 322 Wet End/Polymer Chemistry	4		**15**
GEP Requirement*	3		
	18		
PSE 415 Senior Research Projects	3	PSE 416 Project Design and Analysis	3
PSE 417 Process Design & Analy. Lab	3	PSE 465 Paper Physics & Product Design	3
PSE 425 Bioenergy & Biomaterials Engr	3	PSE 472 Paper Process Analysis	3
PSE 475 Process Control	3	GEP Requirement*	3
GEP Requirement*	3	GEP IP Requirement*	2-3
GEP Requirement*	3		**14-15**
	18		
CHE 330 CHE Lab I	4		
CHE 446 or 447 Des & Analy Chem Reac	3		
CHE 450 CHE Design I	3		
ECE 331 Intro Elect Circuits **or**			
MSE 201 Intro Material Sci Engr.	3		
	13		

Minimum Credit Hours Required for Graduation*[I,J,K]: **144**

Major/Program requirements and footnotes:

[1a] Must be completed with grade of (C) or higher.

[1b] Must be completed with grade of (C-) or higher.

[2]. There is one required internship in industry. PSE 211 should be taken the first semester upon returning from that internship.

***General Education Program (GEP) requirements:**

To complete the requirements for graduation and the General Education Program, the following credit hours and co-requisites must be satisfied. University approved GEP course lists for each category can be found at http://www.ncsu.edu/uap/academic-standards/ .

PHYSICAL EDUCATION - 2 hours to be selected from the approved GEP Physical Education list.
a. One fitness and wellness course (any PE 100-level course).
b. One additional credit hour of PE activity courses.
HUMANITIES - 6 credits to be selected in two different disciplines (two different course prefixes) from the approved GEP Humanities list.
SOCIAL SCIENCES - 3 credits to be selected in a discipline other than economics from the approved GEP Social Sciences list. EC 205 (or EC 201 or ARE 201) taken as part of the Major requirements satisfies 3 credit hours of the 6 credit hours needed to fulfill the GEP Social Sciences requirement.
ADDITIONAL BREADTH - 3 credits to be selected from the approved GEP Humanities, Social Sciences or Visual and Performing Arts lists.
INTERDISCIPLINARY PERSPECTIVES - 5 credits to be selected from the approved GEP Interdisciplinary Perspectives list.

Co-requisites:

U.S. Diversity and Global Knowledge co-requisites must be satisfied to complete the General Education

CURRICULUM IN CHEMICAL ENGINEERING & TEXTILE ENGINEERING
(Degrees Earned: B.S. Chemical Engineering and B.S. Textile Engineering)

Fall Semester	Credit	Spring Semester	Credit
CH 101 (or 103) General Chemistry I[1]	3	CH 201 (or 203) General Chemistry II[2]	3
CH 102 (or 104) General Chemistry I Lab[1]	1	CH 202 (or 204) General Chemistry II Lab	1
E 101 Introduction to Engr & Prob Solv[1]	1	MA 241 Calculus II[1]	4
E 115 Intro to Computing Environ	1	PY 205 Physics for Engr & Sc I[1]	3
ENG 101 Academic Writing and Research[1]	4	PY 206 Physics for Engr & Sc I Lab[1]	1
MA 141 Calculus I[1]	4	TE 110 Comp Based Model Engineers	3
HESx 1** Fitness & Wellness Course*	1	HESx (100 or 200 level) Elective*	1
	15		**16**
CH 221 (or 225) Organic Chemistry I [2,3]	3	TE 201 Textile Engr. Sci.	4
CH 222 (or 226) Organic Chemistry I Lab	1	MAE 206 Engr Statics OR	
CHE 205 Chemical Proc Prin[2]	4	CE 214 Engr Statics	3
MA 242 Calculus III[2]	4	MA 341 Applied Differential Eq[2]	3
PY 208 Physics Engr & Scientists II	3	CH 223 (or 227) Organic Chemistry II	3
PY 209 Physics Engr & Scientists II Lab	1	CH 224 (or 228) Organic Chemistry II Lab	1
	16	CHE 225 Chemical Proc Systems[2]	3
			17
CH 315 Quantitative Analysis	3	TE 302 Textile Mfg Proc II	4
CH 316 Quantitative Analysis Lab	1	ST 370 Prob & Stat for Engineers	3
TE 301 Engr Textile Structures I	3	CHE 312 Transport Processes II	3
GC 120 Found of Graphics	3	CHE 316 Thermo of Chem & Phase Eq	3
CHE 311 Transport Processes I[2]	3	TE 205 Analog & Digital Circuits[5]	4
CHE 315 Chem Process Thermo[2,4]	3		**17**
CHE 395 Professional Dev Seminar	1		
	17		
CHE 446 Des & Analy Chem Reactors	3	TE 402 Textile Engr Des II[6]	4
CHE 450 CHE Design I	3	TE 404 Six Sigma Quality	3
GEP IP Requirement*	3	TE 424 Tex Engr Qual Impr Lab	1
TE 401 Textile Engr Des I	4	GEP Requirement*	3
EC 205 Econ (or EC 201 or ARE 201)	3	GEP Requirement*	3
	16	GEP Requirement*	3
			17
CHE 330 Chem Engr Lab I	4		
CHE 435 Proc System Analy & Control	3		
PCC 301 Tech of Dyeing & Finish	4		
GEP Requirement*	3		
GEP IP Requirement*	2-3		
	16		

Minimum Credit Hours Required for Graduation*: **147**

Major/Program requirements and footnotes:

[1] Must be completed with grade of C or higher for CODA.
[2] Must be completed with grade of C-or higher for major requirements.
[3] CH 221 will replace TE 200 (in the Textile Engineering curriculum)
[4] CHE 315 will replace TE 303 (in the Textile Engineering curriculum)
[5] TE 402 will replace CHE 451 (in the Chemical Engineering curriculum)
[6] TE 110 is eliminated (TE program) due to similar content embedded in CHE 205 & 225.

* **General Education Program (GEP) requirements:**

To complete the requirements for graduation and the General Education Program, the following credit hours and co-requisites must be satisfied. University approved GEP course lists for each category can be found at http://www.ncsu.edu/uap/academic-standards/gep/courselists/index.html .

PHYSICAL EDUCATION - 2 hours to be selected from the approved GEP Physical Education list.
a. One fitness and wellness course (any PE 100-level course).
b. One additional credit hour of PE activity courses.
HUMANITIES – 6 credits to be selected in two different disciplines (two different course prefixes) from the approved GEP Humanities list.
SOCIAL SCIENCES- 3 credits to be selected in a discipline other than economics from the approved GEP Social Sciences list. EC 205, 201 or ARE 201 taken as part of the Major requirements satisfies 3 credit hours of the 6 credit hours needed to fulfill the GEP Social Sciences requirement.
ADDITIONAL BREADTH - 3 credits to be selected from the approved GEP Humanities, Social Sciences or Visual and Performing Arts lists.
INTERDISCIPLINARY PERSPECTIVES- 5 credits to be selected from the approved GEP Interdisciplinary Perspectives list.

Co-requisites:

U.S. Diversity and Global Knowledge co-requisites must be satisfied to complete the General Education requirements. Choose course(s) that are identified on the approved GEP course lists as meeting the U.S. Diversity and Global Knowledge co-requisites.
Foreign Language proficiency at the FL_102 level will be required for graduation.

CURRICULUM IN CHEMICAL ENGINEERING & CHEMISTRY (BS)
(Degrees earned: B. S. in Chemical Engineering/ B. S. in Chemistry)

Fall Semester			Credits	Spring Semester			Credits
CH	101 (or 103)	General Chemistry I	3	CH	201 (or 203)	General Chemistry II	3
CH	102 (or 104)	General Chemistry I Lab	1	CH	202 (or 204)	General Chemistry II Lab	1
E	101	Intro to Engr. & Prob Solv	1	EC	205	Fund Econ (or EC 201/ARE 201)	3
E	115	Intro to Computing Envir[1]	1	MA	241	Calculus II	4
ENG	101	Academic Writing and Resch	4	PY	205	Physics Engr & Scien I	3
MA	141	Calculus I	4	PY	206	Physics Engr & Scien I Lab	1
HESx	10x	Physical Education	1	HESx (100 or 200 level) elective			1
			15				**16**
CH 221	(or 225)	Organic Chemistry I	3	CH 223	(or 227)	Organic Chemistry II	3
CH 222	(or 226)	Organic Chemistry I lab	1	CH 224	(or 228)	Organic Chemistry II Lab	1
CHE 205		Chemical Process Prin	4	PY 208		Physics Engr & Scien II	3
MA 242		Analyt Geom & Calculus III	4	PY 209		Physics Engr & Scien II Lab	1
GEP Requirement			3	CHE 225		Chemical Proc Systems	3
			15	MA 341		Applied Differential Eqns	3
				GEP Requirement			3
							17
BCH	451	Biochemistry	4	CH	437	Physical Chemistry[3]	4
CHE	311	Transport Processes I	3	CHE	312	Transport Processes II	3
CHE	315	Chem Process Thermo[2]	3	CHE	316	Thermo Chem & Phase Eq	3
GEP Requirement			3	CHE	330	CHE Lab I	4
GEP Requirement			3	CHE	395	Professional Dev Seminar	1
CH	230	Comp Chem Lab I	1				**15**
			17				
CH	315[4]	Quantitative Chemistry	3	CH	401	Inorganic Chem	3
CH	316[4]	Quantitative Chemistry Lab	1	CH	452	Adv. Meas. Tech I	3
CHE	450	CHE Design I	3	CHE	435	Proc Sys Analy & Control	3
CHE	331	CHE Lab II	2	CHE	451	CHE Design II	3
CHE	446	Des & Analy Chem Reac	3	Technical Elective			3
CH	232	Comp Chem Lab II	1				**15**
			13				
CH	442	Adv. Synthetic Techniques	4	CH	444	Adv Synthetic Tech II **OR**	
CH	435	Structure and Bonding	3	CH	454	Adv Measure Tech II	4
ECE	331	Prin Electrical Engr **or**		GEP requirement			2-3
MSE	201	Struct & Prop Engr Matl	3	Chemistry elective[5]			3
Chemistry elective[5]			3	ENG	331	Communication Eng Tech[6]	
Technical Elective			3	GEP Requirement			3
			13				
			16				**15**

Total Hours Required for Graduation **154**

[1] Students completing both degrees can substitute E 115 for CH 106/108.
[2] CHE 315 fulfills the CH 433 requirement
[3] CH 437 fulfills the CH 431 requirement
[4] CH 315/316 fulfills the CH 211 requirement
[5] Chemistry electives include: CH 403 (Systematic Inorganic Chemistry II), CH 415 (Analytical Chemistry II), CH 441 (Forensic Chemistry), CH 463 (Molecular Origins of Life).
[6] ENG 333 could also fulfill this requirement

CURRICULUM IN CHEMICAL ENGINEERING & CHEMISTRY (BA)
(Degrees earned: B. S. in Chemical Engineering/ B. A. in Chemistry)

Fall Semester			Credits	Spring Semester			Credits
CH	101 (or 103)	General Chemistry I	3	CH	201 (or 203)	General Chemistry II	3
CH	102 (or 104)	General Chemistry I Lab	1	CH	202 (or 204)	General Chemistry II Lab	1
E	101	Intro to Engr. & Prob Solv	1	GEP Requirement			3
E	115	Intro to Computing Envir	1	MA	241	Calculus II	4
ENG	101	Acad Writing and Resch	4	PY	205	Physics Engr & Scien I	3
MA	141	Calculus I	4	PY	206	Physics Engr & Scien I Lab	1
HESx (100 or 200 level) elective			1	HESx	10x	Physical Education	1
			15				**16**
CH	221 (or 225)	Organic Chemistry I	3	CH 223 (or 227)		Organic Chemistry II	3
CH	222 (or 226)	Organic Chemistry I lab	1	CH 224 (or 228)		Organic Chemistry II Lab	1
CHE	205	Chemical Process Prin	4	PY 208		Physics Engr & Scien II	3
MA	242	Analyt Geom & Calculus III	4	PY 209		Physics Engr & Scien II Lab	1
GEP Requirement			3	CHE 225		Chemical Proc Systems	3
			15	MA 341		Applied Differential Eqns [1]	3
							14
CH	315	Quantitative Analysis	3	CH	437	Intro Physical Chem	4
CH	316	Quantitative Analysis Lab	1	CHE	330	CHE Lab I	4
CHE	311	Transport Processes I	3	CHE	312	Transport Processes II	3
CHE	315	Chem Process Thermo	3	CHE	316	Thermo Chem & Phase Eq	3
MSE	201	Struct & Prop Engr Mat	3	CHE	395	Professional Dev. Seminar	1
GEP Requirement			3				**15**
			16				
CHE	331	CHE Lab II	2	CH	401	Sys Inorganic Chem	3
CHE	446	Des & Analy Chem Reac	3	CHE	435	Proc Sys Analy & Control	3
CHE	450	CHE Design I	3	CHE	451	CHE Design II	3
GEP Requirement			3	Chemistry elective[3]			3
GEP Requirement			3	Technical Elective			3
			14				**15**
BCH	451	Prin of Biochemistry	4				
ENG	331[2]	Comm for Engr and Tech	3				
GEP IP Requirement			2-3				
GEP Requirement			3				
Technical Elective			3				
			15				
Total Hours Required for Graduation			**135**				

[1]MA 341 fulfills the chemistry requirement for an upper level math elective.
[2] ENG 333 could also fulfill this requirement
[3] Chemistry electives include: CH 403 (Systematic Inorganic Chemistry II), CH 415 (Analytical Chemistry II), CH 441 (Forensic Chemistry), CH 463 (Molecular Origins of Life), CH 499 (Undergraduate Research in Chemistry)

General Education Program (GEP) Requirements in the *Humanities, Social Sciences, Visual & Performing Arts, and Interdisciplinary Perspectives*

A total of ***seven courses (20-21 credit hours)*** from the appropriate GEP category list is required. The requirements may be completed in any order. All must be completed for a letter grade; none of the seven courses may be taken as pass / fail or credit only grading. In addition to the seven categories, two co-requisites must be met: U.S. Diversity (USD) and Global Knowledge (GK).

Students should consider the GEP web site the authoritative source for approved courses and requirements. This document is provided merely as a planning tool.
See https://oucc.dasa.ncsu.edu/general-education-program-gep/gep-category-requirements/

Humanities https://oucc.dasa.ncsu.edu/humanities/ Select **two** courses from **different** disciplines. Special Major Requirements: ME & AE majors may select PHI 214 or PHI 375 to fulfill Ethics requirement **OR** see Interdisciplinary Perspectives requirements MSE majors may select PHI 214, PHI 221, PHI(STS)325 or PHI 375 to fulfill Ethics requirement **OR** see Interdisciplinary Perspectives requirements	_____ _____
Social Sciences https://oucc.dasa.ncsu.edu/social-sciences/ Select an Introductory Economics course (EC 205/EC 201/ARE 201). Select **one** course from Social Sciences **other than** Economics. Special Major Requirements: CON majors select SOC 205, SOC 301, SOC 305/AFS 305 (USD), SOC 310, PS 202, PS 310, PS 312, PS 314, PS 320, LPS 315 ENE majors select PS 336 (GK) or PS 320.	_____ _____
Interdisciplinary Perspectives https://oucc.dasa.ncsu.edu/1096-2/ Select **two** courses. Special Major Requirements BE majors select IDS 201 (GK) or STS 302(GK), STS 304 IE majors select IDS 201 (GK), IDS(NR) 303 or STS 214, STS 302(GK), STS 304, STS 322, STS(PHI) 325 AE & ME majors select STS 302(GK) or STS 304 to fulfill Ethics requirement **OR** see Humanities Requirements MSE majors select IDS 201 (GK), STS 302 (GK), STS 304, STS 325 to fulfill Ethics requirement **OR** see Humanities Requirements	_____ _____
Additional Breadth https://oucc.dasa.ncsu.edu/visual-and-performing-arts/ Select **one** course from Humanities, Social Sciences, or Visual & Performing Arts.	_____
The following requirements must also be met: **US Diversity (USD)** Course from selections above or select an additional course. https://oucc.dasa.ncsu.edu/u-s-diversity/ **Global Knowledge (GK)** Course from selections above or select an additional course. https://oucc.dasa.ncsu.edu/global-knowledge/	_____ _____

HUMANITIES

GK	AFS 240	Afr Civilization
USD	AFS 241	Intro to Afr-Am Studies II
USD	AFS/ENG 248	Surv of Afr-Am Lit
GK	AFS/HI 275	Intro to Hist of South & East Africa
GK	AFS/HI 276	Intro to Hist of West Africa
GK	AFS 342	Intro to the Afr Diaspora
GK	AFS 343	African Religions
USD	AFS 344	Leadership in Afr Am Communties
USD	AFS/ARS 346	Black Popular Cult
GK	AFS/ENG 349	Afr Lit in English
USD	AFS/HI 372	Afr-Am Hist Thr the Civil War, 1619-1865
USD	AFS/HI 373	Afr-Am Hist Since 1865
GK	AFS 442	Issues in the Afr Diaspora
USD	AFS/ENG 448	Afr-Am Lit
USD	AFS/HI 455	Hist of the Civil Rights Movement
GK	AFS/HI 475	Hist of the Republic of South Africa
GK	AFS/HI 476	Leadership in Modern Africa
GK	AFS/HI 479	Africa (sub-Saharan) in the 20th Cent
GK	ANT/FLJ 351	Contemporary Culture in Japan
	ARC 242	Hist of West Architecture
GK	CLA 210	Classical Mythology
GK	CLA 215	Ancient World in Modern Media
GK	CLA 320	Masterpieces of Classical Literature
GK	CLA 325	Gender, Ethnicity & Identity
	COM 200	Comm Media in a Changing World
	COM 211	Argumentation & Advocacy
	COM/ENG 395	Studies in Rhetoric & Digital Media
GK, USD	ECD 225	Foundations of Cultural Competence
	ENG 201	Writing Literary Analysis
	ENG 206	Studies In Drama
	ENG 207	Studies in Poetry
	ENG 208	Studies In Fiction
	ENG 209	Intro to Shakespeare
GK	ENG/FL 219	Studies in Great Works of Non-West Lit
GK	ENG/FL 220	Studies in Great Works of West Lit
GK	ENG/FL 221	Lit of the West World I
GK	ENG/FL 222	Lit of the West World II
GK	ENG/FL 223	Contemporary World Lit I
GK	ENG/FL 224	Contemporary World Lit II
	ENG 232	Lit & Medicine
	ENG 233	The Lit of Agriculture
GK	ENG/FL 246	Lit of the Holocaust
USD	ENG 249	Native Am Lit
	ENG 251	Major British Writers
	ENG 252	Major Am Writers
	ENG 261	English Lit I
	ENG 262	English Lit II
USD	ENG 265	Am Lit I
USD	ENG 266	Am Lit II
USD	ENG 267	LGBTQI - Literature in the U.S.
	ENG 283	Intro to Am Folklore
USD	ENG/WGS 305	Women and Literature
	ENG 362	The British Novel of the 18th Cent
	ENG 368	Am Poetry to 1900
	ENG 369	The Am Novel of the 19th Cent
	ENG 370	Early 20th-Cent Fiction
	ENG 371	Late 20th-Cent Fiction
	ENG 372	Early 20th-Cent Poetry
	ENG 373	Late 20th-Cent Poetry
	ENG 377	Fantasy
GK	ENG 380	Modern Drama
	ENG 385	Biblical Backgrounds of English Lit
	ENG 390	Classical Backgrounds of English Lit
GK	ENG/FL 392	Major World Author
GK	ENG/FL 393	Studies in Literary Genre
GK	ENG/FL 394	Studies in World Literature
GK	ENG 398	Contemporary Lit I (1900 to 1940)
GK	ENG 399	Contemporary Lit II (1940 to Present)
GK	ENG/FL 406	Modernism
GK	ENG/FL 407	Postmodernism
	ENG 420	Major Am Author
	ENG 439	17th-Cent English Lit
	ENG 449	16th-Cent English Lit.
	ENG 451	Chaucer
	ENG 460	Major British Author
	ENG 464	British Lit, 1900-1945
	ENG 465	British Lit, Since 1945
	ENG 467	Am Colonial Lit
	ENG 468	Am Romantics
	ENG 469	Am Realism & Naturalism
	ENG 470	Am Lit, 1914-1945
	ENG 471	Am Lit, Since 1945
USD	ENG 476	Southern Lit
	ENG 486	Shakespeare, The Earlier Plays
	ENG 487	Shakespeare, The Later Plays
GK	FLA 318	Egyptian Culture through Film
GK	FLC 351	Modern Chinese Pop Culture
GK	FLF 301	Surv of Fr Lit -Mid Ages Thr the Enlight
GK	FLF 302	Surv of Fr Lit-Rom to the Contemp Period
GK	FLF 315	French Civilization & Cult
GK	FLF 414	Studies in French Prose
GK	FLF 425	Lit, Cinema & Cult of the Franco World
GK	FLG 315	Germanic Civilization & Cult
GK	FLG 320	Intro to German Literature
GK	FLG 323	20th Cent German Lit
GK	FLG 325	German Lyric Poetry
GK	FLI 318	Italian Society Through the Cinema
GK	FLJ 342	Classic Japanese Lit in Trans
GK	FLJ 344	Early Modern Japanese Lit in Trans
GK	FLJ 345	Modern Japanese Lit in Trans
GK	FLN 301	Advanced Hindi: Readings in Lit I
GK	FLN 302	Advanced Hindi: Readings in Lit II
GK	FLN 401	Hindi Lit & South Asian Cult Contexts
GK	FLR 303	Russian Lit in Trans: The 19th Cent
GK	FLR 304	Russian Lit in Trans: The 20th Cent
GK	FLR 318	Russian Cinema and Society
GK	FLS 340	Intro to Hisp Lit and Cult
GK	FLS 341	Lit and Cult of Spain I
GK	FLS 342	Lit and Cult of Spain II
GK	FLS 343	Lit and Cult of Spain III
GK	FLS 351	Lit and Cult of Latin America I
GK	FLS 352	Lit and Cult of Latin America II
GK	FLS 353	Lit and Cult of Latin America III
GK	HA/HI 240	Introduction to Visual Culture
	HI 205	West Civilization Since 1400
GK	HI 207	Ancient Mediterranean World
GK	HI 208	The Middle Ages
GK	HI 209	Europe, Renaiss to Waterloo, 1300-1815
GK	HI 210	Modern Europe 1815-Present
GK	HI 214	Hist & Archaeology of Anc Lat America
GK	HI 215	Latin America to 1826
GK	HI 216	Latin America Since 1826
GK	HI 221	British Hist to 1688
GK	HI 222	Hist of British Cults & Societies
GK	HI 232	The World from 1200-1750
GK	HI 233	The World in the 20th Cent
	HI 251	Early Am Hist
	HI 252	American History II
USD	HI 254	Modern Am Hist
GK	HI 263	Asian Civilization to 1800
GK	HI 264	Modern Asia: 1800 to Present*
GK	HI 270	Modern Middle East
	HI 305	Frauds and Mysteries of the Past (also IP)
GK	HI 307	Jewish History
USD	HI/REL 320	Religion in American History
GK	HI 324	History of Common Law & Constitution
GK	HI 332	Germany and the World Wars
	HI 335	The World at War
GK	HI 338	Empire, War, and Revolution in Russia
USD	HI 346	Intro to Civil War and Reconstruction
	HI 350	Am Military Hist
	HI 351	U.S. Naval Hist
	HI 354	The Rise of the American Empire
USD	HI 360	U.S. Agricultural History
	HI 364	Hist of North Carolina
	HI 365	The Am West
USD	HI 366	Native Am Hist
GK	HI 370	Modern Egypt
GK	HI 371	Modern Japan, 1850 to Present
GK	HI 374	Visual Culture of Modern South Asia
	HI 380	Hist of Nonprofits, Philant, & Soc Change
GK	HI 381	NGO Nonprofits in a Global Context
	HI 400	Civilization of the Ancient Near East
GK	HI/REL 402	Christianity to Time of Eusebius
	HI 403	Ancient Greek Civilization
	HI 404	Rome to 337 A. D.
	HI 405	Hist & Archaeology of the Roman Empire
	HI 406	From Roman Empire to Middle Ages
GK	HI/REL 407	Islamic Hist to 1798
GK	HI/REL 408	Islam in the Modern World
	HI 409	The High Middle Ages
GK	HI 410	Italian Renaissance
GK	HI 411	The Prot & Cath Reform of the 16th Cent
GK	HI 412	The Sexes & Soc in Early-Modern Europe
GK	HI 414	France in the Old Regime
GK	HI 415	The French Revolution
GK	HI 418	Fascist Italy & Nazi Germany
GK	HI 419	Modern European Imperialism
GK	HI 421	European Intellectual Hist: The 18th Cent
GK	HI 422	European Intellectual Hist: The 19th Cent
GK	HI 423	Women in European Enlightenment
GK	HI 425	Tudor & Stuart England
GK	HI 429	20th Cent Britain
GK	HI 430	Modern France
	HI 441	Colonial & Revolutionary U.S.
	HI 443	U. S. Constitutional Hist
	HI 444	U. S. Constitutional Hist Since 1870
	HI 445	Early Am Frontiers
USD	HI 446	Civil War & Reconstruction
USD	HI/WGS 447	Hist of Am Women to 1900
USD	HI/WGS 448	Am Women in the 20th Cent
	HI 449	US Labor History to 1900
	HI 450	US Labor History since 1900
	HI 451	The Vietnam War
	HI 452	Recent America
USD	HI 453	US-Latin Am Relations Since 1823
	HI 454	Hist of US Foreign Rel, 1900-Present
	HI 456	Early Am Thought
	HI 457	20th-Cent U.S. Intellectual Hist
	HI 458	Modern Am Historical Biography
	HI 459	The Early Am Republic
	HI 461	Civilization of the Old South
USD	HI 462	Social Hist of the New South
GK	HI 465	Oil & Crisis in the Gulf
GK	HI 466	Hist of the Palestinian-Israeli Conflict
GK	HI 467	Modern Mexico
GK	HI 469	Latin Am Revolutions in the 20th Cent
GK	HI 471	Revolutionary China
GK	HI 473	Japan's Empire in Asia 1868-1945
GK	HI 474	Modern India
GK	HI 477	Women in the Middle East
GK	HI 478	Islam & Christianity in Sub-Saharan Africa
GK	HI 486	Science and Empire
	HON 202	Inquiry, Discovery, & Lit
	HON 290	Special Topics - Hist
	HON 293	Special Topics - Lit
	HON 294	Special Topics - Philosophy or Rel
	HON 341	Time Travel
GK	HON 342	Issues in Contemporary Rel
	HON 344	Kantian Ethics
	HON 345	On the Human
USD	HON 346	Ethics & Gender
	HON 347	Freedom & the Self
	LAR 221	Intro to Environ & Behav for Designers
	PHI 205	Intro to Philosophy
	PHI 210	Representation, Reason & Reality
	PHI 214	Issues in Business Ethics
	PHI 221	Contemporary Moral Issues
	PHI 300	Ancient Philosophy
	PHI 301	Early Modern Philosophy
	PHI 302	19th Cent Philosophy
	PHI 305	Philosophy of Rel
	PHI 309	Contemporary Political Philosophy
	PHI 310	Existentialism
	PHI 312	Philosophy of Law
	PHI 313	Ethical Problems in Law
	PHI/STS 325	Bio-Medical Ethics
	PHI 330	Metaphysics
	PHI 331	Philosophy of Language
	PHI 332	Philosophy of Psychology
	PHI 333	Theory of Knowledge
	PHI 340	Philosophy of Science
	PHI 375	Ethics
	PHI 376	Hist of Ethics
	PHI 401	Kant's Critique of Pure Reason
	PHI 420	Global Justice
	PHI/PSY 425	Intro to Cognitive Science
	PHI 440	The Scientific Method
	PHI 447	Philosophy, Evolution and Human Nature
	PS 361	Intro to Political Theory
	PS 362	Am Political Thought
GK	REL 200	Intro to the Study of Rel
GK	REL 210	Religious Traditions of the World
GK	REL 230	Asian Religions
	REL/SOC 309	Rel & Society
GK	REL 311	Intro to the Old Testament
GK	REL 312	Intro to the New Testament
GK	REL 314	Intro to Intertestamental Lit
GK	REL 317	Christianity
USD	REL 323	Rel Cults, Sects, & Min Faiths in America
GK	REL 327	Issues in Contemporary Rel
GK	REL 331	The Hindu Tradition
GK	REL 332	The Buddhist Traditions
GK	REL 333	Chinese Rels
GK	REL 334	Japanese Rels
GK	REL 340	Intro to Islam
GK	REL 350	Intro to Judaism
GK	REL 383	Rel, Globalism, & Justice
GK	REL 412	Adv Readings in the Christian Gospels
GK	REL 413	The Life & Letters of the Apostle Paul
USD	REL 423	Religion & Politics in America
	REL/STS 471	Darwinism and Christianity
	REL/WGS 47	Women & Rel
GK	REL 482	Rel & Conflict
GK	REL 489	Interpretations of Rel
USD	WGS 492	Theor Iss in Women's & Gender Studies
	HESM 328	Dance Composition II (also IP)

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SOCIAL SCIENCES

USD	AFS/SOC 305	Racial & Ethnic Relations
	ANT 251	Physical Anthropology
GK	ANT 252	Cultural Anthropology
GK	ANT 253	Unearthing the Past
USD	ANT 254	Lang & Culture
GK	ANT/SOC 261	Tech in Soc & Culture
USD	ANT 310	Native Peoples & Cultures of N America
GK	ANT 315	Aztecs, Maya & Their Predecessors
GK	ANT 325	Andean South America
GK	ANT 330	Peoples & Cultures of Africa
GK	ANT 345	Anthropology of the Middle East
GK	ANT 346	Peoples & Cultures of Southeast Asia
	ANT 370	Intro to Forensic Anthropology
	ANT 389	Fundamentals of Archaeological Res
	ARE 309	Env Law & Economic Policy
	ARE 311	Agricultural Markets
	ARE 433	U.S Agricultural Policy
	AS 321	Air Force Leadership Studies I
	COM 112	Interpersonal Comm
GK, USD	COM/HSS 392	Int'l & Crosscultural Comm
	EDP 304	Educational Psych
	EDP 370	Applied Child Development
	ENG 210	Intro to Lang & Linguistics
	GEO 200	Principles of Geography
GK	GEO/SOC 220	Cultural Geography
	HON 295	Special Topics - Social Sciences
USD	HON 352	Self, Schooling, & the Social Order
GK	HON 353	Code Breakers: Unlocking Hum Lang
	NR 460	Renewable Resource Pol and Mgt
	NS 210	Leadership & Management
	PRT 152	Intro to Parks, Rec & Tourism
	PRT 200	Leisure Behavior, Health & Wellness
	PS 201	Amer Pol & Gov
	PS 202	State & Local Gov
	PS 203	Intro to Nonprofits
	PS 204	Problems of Amer Democracy
	PS 205	Law & Justice
GK	PS 231	Intro to Int'l Relations
GK	PS 236	Issues in Global Pol
GK	PS 241	Intro to Comparative Pol
	PS 301	The Presidency & Congress
	PS 302	Campaigns & Elect in the US Pol Sys
USD	PS 303	Race in U.S. Pol
	PS 305	Justice Sys in the Amer Pol Proc
USD	PS/WGS 306	Gender & Pol in the U. S.
USD	PS 309	Equality & Justice in US Law
	PS 310	Public Policy
	PS 312	Intro to Public Administration
	PS 314	Science, Tech & Public Policy
	PS 315	Public Leadership
	PS 320	U.S. Env Law & Pol
	PS 331	U.S. Foreign Policy
GK	PS 335	Int'l Law
GK	PS 336	Global Env Pol
GK	PS 341	European Pol
GK	PS 342	Pol of China & Japan
GK	PS 345	Govs & Pol in the Middle East
	PSY 200	Intro to Psych
	PSY 311	Social Psych
	PSY 376	Developmental Psych
USD	PSY/WGS 406	Psych of Gender
	SOC 202	Principles of Soc
USD	SOC 203	Current Social Problems
USD	SOC/WGS 204	Sociology of Family
	SOC 205	Jobs & Work
	SOC 206	Social Deviance
GK	SOC/GEO 220	Cultural Geography
	SOC 241	Soc of Agriculture & Rural Soc
	SOC 300	Social Research Methods
	SOC 301	Human Behavior
USD	SOC/WGS 304	Women and Men in Society
USD	SOC/AFS 305	Racial and Ethnic Relations
	SOC 306	Criminology
	SOC/REL 309	Religion and Society
	SOC 310	Managers, Work, & Organizations
	SOC 311	Community Relationships
GK	SOC 342	Int'l Development
	SOC 350	Food and Society
GK	SOC 351	Population & Planning

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VISUAL & PERFORMING ARTS

	ADN 111	Two Dimensional Design
	ADN 112	Three Dimensional Design
	ADN 272	Intro to Printing & Surface Des
GK	ADN 275	Survey of Fibers in Arts & Design
	ADN 311	Basic Visual Laboratories
USD	AFS/MUS 230	Intoduction to African-Amer Mus
USD	AFS/MUS 260	Hist of Jazz
	ARC 140	Experiencing Architecture
	ARC 241	Intro to World Architecture
GK	ARS 251	The Arts of a World Capital: London
GK	ARS 252	Vienna in 1900
	ARS 259	The Arts & Politics
	ARS/MUS 306	Mus Composition with Computers
	ARS 351	Arts, Ideas & Values
GK	ARS 353	Arts & Cross Cultural Contacts
GK	ARS 354	The Arts & the Sacred
	COM 110	Public Speaking
GK	COM/ENG 364	Hist of Film to 1940
GK	COM/ENG 374	Hist of Film From 1940
	D 231	Des Hist for Engineers & Scientists
	DAN 272	Dance Composition
	DS 101	Hist of Des I
GK	ENG 282	Intro to Film
	ENG 292	Writing About Film
GK	ENG/FLM 378	Women & Film
	ENG 382	Film & Lit
	ENG 384	Introduction to Film Theory
GK	FL 216	Art & Soc in France
GK	FLF 318	The Heritage of French Cinema
GK	FLG 318	New German Cinema
GK	FLS 360	Hispanic Cinema
	FTM 400	Major Fashion Designers
	GC 120	Foundations of Graphics
	GD 203	Hist of Graphic Des
	GD 303	Graphic Des Theory & Practice
	HA 201	Hist of Art Anc Greece Thr the Renaiss
	HA 202	Hist of Art Renaiss Thr the 20th Cent
	HA 203	Hist of Amer Art
	HA 401	l9th Cent European Art
	HA 404	Italian Renaissance Art & Matl Cult
	HA 410	Hist of Art & Photography
GK	HESM 322	Dance and Society
USD	HESM 324	Concert Dance History
	HESM 326	Current Trends in Dance
USD	HESM 328	Dance Composition II
	HESD 265	Ballet II
	HESD 280	Jazz Dance II
	HON 299	Special Topics - Visual & Performing Arts
	HON 391	Mus & Social Life
	HS 242	Intro to Small Scale Landscape Design
	LAR 444	Hist of Landscape Architecture
	MUS 103	Music Theory I
	MUS 120	Rudiments of Music
	MUS 180	Intro to Musical Experiences
	MUS 181	Exploring Music Theory
GK	MUS 200	Understanding Mus
GK	MUS 201	Intro to Mus Lit I
GK	MUS 202	Intro to Mus Lit II
	MUS 205	Intro to Mus in Western Soc
USD	MUS 206	America's Mus
	MUS 210	History of Rock I: 1950s - 1970s
	MUS 211	History of Rock I: 1980s - present
	MUS 305	Mus Composition
GK	MUS 310	Mus of the 17th & 18th Centuries
GK	MUS 315	Mus of 19th Cent Europe
GK	MUS 320	Mus of the Twentieth Cent
GK	MUS 330	Mus Drama
GK	MUS 350	World Mus I: Mus of Asia
USD	MUS/WGS 360	Women in Mus
	TDE 351	The Art & Craft of Clay
	THE 103	Intro to the Theatre
	THE 203	Theory & Practice of Acting

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INTERDISCIPLINARY PERSPECTIVES

GK	AEC 380	Global Water Resources
	AEE/ANS/PB 208	Ag Biotech: Issues & Implications
GK	ANT/SOC 261	Technology in Society & Culture
	ARE/EC 336	Intro to Resource & Env Econ
	ARS/STS 257	Tech in the Arts
	BIO 165	Intro to Environmental Res
	BIO 227	Biological Illustration
	BIO 233	Human-Animal Interactions
	BIO 440	Human Animal: Evol Perspective
	BIT 100	Current Topics in Biotechnology
GK	CS 224	Seed, Biotechnology & Societies
GK	CS 230	Introduction to Agroecology
	CSC 281	Found of Interactive Game Design
	D 100	Design Thinking I
	D 101	Design Thinking II
	EI 201	Expl Interdisc. Entrepre Thinking
	EI 331	Interdisc Entrep. Thinking I
	EMA 365	Foundations in Arts Entrepreneurship
	EMA 370	Practical Arts Entrepreneurship
	ENG 232	Lit & Medicine
	ENG 376	Science Fiction
	ENG 425	Analysis of Sci & Tech Writing
GK	ENT 207	Insects and Human Disease
GK	ES/ET 100	Intro to Environmental Science
GK	ES 200	Climate Change & Sustainability
GK	ES 300	Energy & the Environment
	ET 410	Toxic Substance & Soc
GK	FLF 212	French: Lang, Culture & Tech
GK	FLG 212	German Lang, Culture, Science & Tech
GK	FLG 440	Green Germany: Nat & Envin
GK	FLS 212	Spanish, Lang, Tech, Culture
	FOR 220	Urban & Community Forestry
GK	FOR/FW 221	Conservation of Natural Resources
	FOR 248	Forest Hist, Tech & Soc
	FOR 330	North Carolina Forests
GK	FOR 414	World Forestry
USD	CNR 250	Diversity & Environmental Justice
	COS 100	The Science of Change
	E 102	Engineering in the 21st Century
	EMA 110	Intro to Arts Entrepreneurship
	ENT 201	Insects and People
GK	ES 150	Water and the Environment
	GIS 205	Spatial Thinking with GIS
GK	HA/HI 240	Introduction to Visual Culture
	HI 305	Frauds and Mysteries of the Past
	HESM 332	Dance Composition II
	HESM 328	Dance and Technology
	HI 321	Ancient & Medieval Science
	HI 322	Rise of Modern Science
	HI 341	Tech in Hist
	HI 440	Amer Env Hist
	HI 481	Hist of the Life Sciences
	HI 482	Darwinism in Science & Soc
GK	HI 483	Science & Religion in European Hist
GK	HI 484	Science in European Culture
	HI 485	Hist of Amer Tech
	HON 296	Sp Top -H/SS/VPA Persp
	HON 297	Sp Top- Math/Nat Sci Perspective
USD	HON 310	The Creative Process in Science
GK	HON 311	Words Through Space & Time
	HON 341	Time Travel
	HON 345	On the Human
USD	HON 346	Ethics & Gender
	HON 347	Freedom & the Self
	HSS 120	Intro Humanities & Social Sci
	ID 444	History of Industrial Design
GK	IDS 201	Env Ethics
USD	IDS 210	Intro to America Studies
	IDS 211	Eating through Amer Hist
GK, USD	IDS 220	The Science & Art of Happiness
	IDS/NR 303	Humans & the Environment
GK	IDS 310	Animals in the Global Community
GK	IS 200	Intro to International Studies
	LSC 101	Crit & Creative Thinking in Life Sci
GK	MEA 100	Earth Systems Science: Exp the Conn
	MIE 201	Intro to Business Processes
	NR 406	Conservation of Biological Diversity
	PB 213	Plants in Civilization
	PB 219	Plants in Folklore, Myth, and Religion
	PCC 274	Introduction to Forensic Science
	PCC 401	Manuf & Impact on Safety, the Envir, & Soc
	PHI 210	Representation, Reason & Reality
	PHI 312	Philosophy of Law
	PHI 313	Ethical Problems in Law
	PHI/STS 325	Bio-Medical Ethics: Inter Inquiry
	PHI 331	Philosophy of Language
	PHI 332	Philosophy of Psychology
	PHI 340	Philosophy of Science
USD	PHI 422	Philosophical Issues in Env Ethics
	PHI/PSY 425	Into to Cognitive Science
	PHI 440	The Scientific Method
	PHI 447	Philosophy, Evolution and Human Nature
	PO 212	Poultry & People: Why did the Chicken?
	PO 411	Agrosecurity
	PP 241	The Worm's Tale: Parasites in our Midst
GK	PRT 449	Human Dimensions of NR in AU/NZ
GK	PRT 450	Sustaining Nat. Resources in AU/NZ
	PSE 220	Papyrus to Plasma Screens: Paper & Soc
	REL/STS 471	Darwinism and Christianity
	SLC 250	Critical & Creative Decision Making Models
	SMT 201	Sustainable Materials for Green Housing
	SMT 232	Recycling to Create a Sustainable Environ
	SMT 310	Intro to Industrial Ecology
	SOC 381	Soc of Medicine
	SSC 185	Land & Life
USD	STS/WGS 210	Women & Gender in Science & Tech
	STS 214	Tech & Values
	STS 301	Science & Civilization
GK	STS 302	Contemp Sci, Tech & Human Values
	STS 304	Ethical Dimensions of Progress
	STS 322	Technological Catastrophes
GK	STS 323	World Population & Food Prospects
	STS 402	Peace & War in the Nuclear Age
	STS 405	Tech & Amer Culture
USD	SW 260	Intro to Gerontology
	WGS 224	Issues in Ecofeminism
	WGS 330	Women and Health
	WGS 370	Adv Studies of Gender in Science

The current University-approved list is available at: https://oucc.dasa.ncsu.edu/1096-2/ Retrieved 6.8.2016

GLOBAL KNOWLEDGE (GK)

Humanities

AFS 240	Afr Civilization
AFS/HI 275	Intro to Hist of South & East Africa
AFS/HI 276	Intro to Hist of West Africa
AFS 342	Intro to African Diaspora
AFS 343	African Religions
AFS/ENG 349	African Literature in English
AFS 442	Issues in the Afr Diaspora
AFS/HI 475	Hist of the Republic of South Africa
AFS/HI 476	Leadership in Modern Africa
AFS/HI 479	Africa (sub-Saharan) in the 20th Cent
ANT/FLJ 351	Contemporary Culture in Japan
CLA 210	Classical Mythology
CLA 215	Ancient World in Modern Media
CLA 320	Masterpieces of Classical Literature
CLA 325	Gender, Ethnicity & Identtity
ENG 380	Modern Drama
ENG 398	Contemporary Lit I (1900 to 1940)
ENG 399	Contemporary Lit II (1940 to Present)
ENG/FL 219	Studies in Great Works of Non-West Lit
ENG/FL 220	Studies in Great Works of West Lit
ENG/FL 221	Lit of the West World I
ENG/FL 222	Lit of the West World II
ENG/FL 223	Contemporary World Lit I
ENG/FL 224	Contemporary World Lit II
ENG/FL 246	Literature of the Holocaust
ENG/FL 392	Major World Author
ENG/FL 393	Studies in Literary Genre
ENG/FL 394	Studies in World Lit
ENG/FL 406	Modernism
ENG/FL 407	Postmodernism
FLC 351	Modern Chinese Pop Culture
FLF 301	Surv of Fr Lit -Mid Ages Thr the Enlight
FLF 302	Surv of Fr Lit-Rom to the Contemp Period
FLF 315	French Civilization & Cult
FLF 414	Studies in French Prose
FLF 425	Lit, Cinema & Cult of the Franco World
FLG 315	Germanic Civilization & Cult
FLG 320	Intro to German Literature
FLG 323	20th Cent German Lit
FLG 325	German Lyric Poetry
FLI 318	Italian Society Through the Cinema
FLJ 342	Classic Japanese Lit in Trans
FLJ 344	Early Mod Japanese Lit in Trans
FLJ 345	Modern Japanese Lit in Translation
FLN 301	Advanced Hindi: Readings in Lit I
FLN 302	Advanced Hindi: Readings in Lit II
FLN 401	Hindi Lit & South Asian Cult Contexts
FLR 303	Russian Lit in Trans: The 19th Cent
FLR 304	Russian Lit in Trans: The 20th Cent
FLR 318	Russian Cinema and Society
FLS 340	Intro to Hispanic Lit and Cultures
FLS 341	Lit & Cult of Spain I
FLS 342	Lit & Cult of Spain II
FLS 343	Lit & Cult of Spain III
FLS 351	Lit & Cult of Latin America I
FLS 352	Lit & Cult of Latin America II
FLS 353	Lit & Cult of Latin America III
HA/HI 240	Introduction to Visual Culture
HI 207	Ancient World to 180 AD
HI 208	The Middle Ages
HI 209	Europe, Renaiss to Waterloo, 1300-1815
HI 210	Modern Europe 1815-Present
HI 214	Hist & Archaeology of Anc Lat America
HI 215	Latin America to 1826
HI 216	Latin America Since 1826
HI 221	British Hist to 1688
HI 222	Hist of British Cults & Societies
HI 232	The World from 1200-1750
HI 233	The World in the 20th Cent
HI 263	Asian Civilization to 1800
HI 264	Modern Asia: 1800 to Present*
HI 270	Modern Middle East

Humanities (cont'd)

HI 307	Jewish History
HI 324	History of Common Law & Constitution
HI 332	Germany and the World Wars
HI 338	Empire, War, and Revolution in Russia
HI 370	Modern Egypt
HI 371	Modern Japan, 1850 to Present
HI 374	Visual Culture of Modern South Asia
HI 381	NGO Nonprofits in a Global Context
HI 410	Italian Renaissance
HI 411	The Prot & Cath Reform of the 16th Cent
HI 412	The Sexes & Soc in Early-Modern Europe
HI 414	France in the Old Regime
HI 415	The French Revolution
HI 418	Fascist Italy & Nazi Germany
HI 419	Modern European Imperialism
HI 421	European Intellectual Hist: The 18th Cent
HI 422	European Intellectual Hist: The 19th Cent
HI 423	Women in European Enlightenment
HI 425	Tudor & Stuart Engl&
HI 429	20th Cent Britain
HI 430	Modern France
HI 465	Oil & Crisis in the Gulf
HI 466	Hist of the Palestinian-Israeli Conflict
HI 467	Modern Mexico
HI 469	Latin Am Revolutions in the 20th Cent
HI 471	Revolutionary China
HI 473	Japan's Empire in Asia 1868-1945
HI 474	Modern India
HI 477	Women in the Middle East
HI 478	Islam & Christianity in Sub-Saharan Africa
HI 486	Science and Empire
HI/REL 402	Early Christianity to Time of Eusebius
HI/REL 407	Islamic Hist to 1798
HI/REL 408	Islam in the Modern World
HON 342	Issues in Contemporary Religion
REL 200	Intro to the Study of Rel
REL 210	Religious Traditions of the World
REL 230	South Asian Religious Traditions
REL 311	Intro to the Old Testament
REL 312	Intro to the New Testament
REL 314	Intro to Intertestamental Lit
REL 317	Christianity
REL 327	Issues in Contemporary Rel
REL 331	The Hindu Tradition
REL 332	The Buddhist Traditions
REL 333	Chinese Rels
REL 334	Japanese Rels
REL 340	Islam
REL 350	Intro to Judaism
REL 383	Rel, Globalism, & Justice
REL 412	Adv Readings in the Christian Gospels
REL 413	The Life & Letters of the Apostle Paul
REL 482	Rel & Conflict
REL 489	Interpretations of Rel

Social Sciences

ANT 252	Cultural Anthropology
ANT 253	Introduction to Prehistory
ANT/SOC 261	Technology in Society and Culture
ANT 315	Aztecs, Maya & Their Predecessors
ANT 325	Andean South America
ANT 330	Peoples and Cultures of Africa
ANT 346	Peoples & Cultures of Southeast Asia
COM/HSS 392	Int'l & Crosscultural Comm
GEO/SOC 220	Cultural Geography
HON 353	Code Breakers: Unlocking Hum Lang
PS 231	Introduction to International Relations
PS 236	Issues in Global Politics
PS 241	Introduction to Comparative Politics
PS 335	International Law
PS 336	Global Environmental Politics
PS 341	European Politics
PS 342	Politics of China and Japan
PS 345	Govs & Pol in the Middle East
SOC 342	International Development
SOC 351	Population and Planning

Visual & Performing Arts

ADN 275	Survey of Fibers in Arts & Design
ARS 251	The Arts of a World Capital: London
ARS 252	Vienna in 1900
ARS 353	Arts and Cross Cultural Contacts
ARS 354	The Arts and the Sacred
COM/ENG 364	History of Film to 1940
COM/ENG 374	History of Film From 1940
ENG 282	Introduction to Film
ENG/FLM 378	Women & Film
FL 216	Art and Society in France
FLF 318	The Heritage of French Cinema
FLG 318	New German Cinema
FLS 360	Hispanic Cinema
MUS 200	Understanding Music: Global Perpectives
MUS 201	Introduction to Music Literature I
MUS 202	Introduction to Music Literature II
MUS 310	Music of the 17th and 18th Centuries
MUS 315	Music of 19th Century Europe
MUS 320	Music of the Twentieth Century
MUS 330	Music Drama
MUS 350	World Music I: Music of Asia

Interdisciplinary Perspectives

ANT/SOC 261	Technology in Society and Culture
BIO 380	Water Resources
CS 224	Seeds, Biotechnology & Societies
CS 230	Introduction to Agroecology
ENT 207	Insects and Human Disease
ES/ET 100	Intro to Environmental Science
ES 200	Climate Change & Sustainability
ES 300	Energy & the Environment
FLF 212	French: Lang, Culture & Tech
FLG 212	German Lang, Culture, Science & Tech
FLG 440	Green Germany: Nat and Environ
FLS 212	Spanish, Lang, Tech, Culture
FOR 414	World Forestry
FOR/FW 221	Conservation of Natural Resources
HA/HI 240	Introduction to Visual Culture
HI 483	Science and Religion in European History
HI 484	Science in European Culture
HON 311	Words Through Space & Time
IDS 201	Environmental Ethics
IDS 310	Animals in the Global Community
IS 200	Intro to International Studies
MEA 100	Earth Systems Science: Exp the Conn
PRT 449	Human Dimensions of NR in Australia
PRT 450	Sustaining Nat. Resources in Australia
STS 302	Contemp Sci, Tech & Human Values
STS 323	World Population and Food Prospects

Global Knowledge Co-Requisite Only

Courses that have a "co-req only" indicator will only satisfy the co-requisite requirement and these courses are not listed on any other GEP course list. Any course taken in a study abroad context may satisfy the GEP Global Knowledge requirement.

The current University-approved list is available at: https://oucc.dasa.ncsu.edu/global-knowledge/ **Retrieved 6.08.2016**

U. S. DIVERSITY (USD)

Humanities

AFS 241	Intro to Afr-Am Studies II
AFS 344	Leadership in Afr Am Communties
AFS/ARS 346	Black Popular Cult
AFS/ENG 248	Surv of Afr-Am Lit
AFS/ENG 448	African-American Literature
AFS/HI 372	Afr-Am Hist Thr the Civil War, 1619-1865
AFS/HI 373	Afr-Am Hist Since 1865
AFS/HI 455	Hist of the Civil Rights Movement
ECD 225	Foundations of Cultural Competence
ENG 249	Native Am Lit
ENG/WGS 305	Women & Lit
ENG 265	Am Lit I
ENG 266	Am Lit II
ENG 267	LGBTQI - Literature in the U.S.
ENG/WGS 305	Women & Lit
ENG 476	Southern Lit
HI 254	Modern Am Hist
HI/REL 320	Religion in American History
HI 346	Intro to Civil War and Reconstruction
HI 360	U.S. Agricultural History
HI 366	Native Am Hist
HI 446	Civil War & Reconstruction
HI/WGS 447	Hist of Am Women to 1900
HI/WGS 448	Am Women in the 20th Cent
HI 453	US-Latin Am Relations Since 1823
HI 462	Social Hist of the New South
HON 346	Ethics & Gender
REL 323	Rel Cults, Sects, & Min Faiths in America
REL 423	Religion & Politics in America

Social Sciences

AFS/SOC 305	Racial & Ethnic Relations
ANT 254	Lang & Culture
ANT 310	Native Peoples & Cultures of N America
COM/HSS 392	Int'l & Crosscultural Comm
PS 303	Race in U.S. Pol
PS 309	Equality & Justice in US Law
PSY/WGS 406	Psych of Gender
SOC 203	Current Social Problems
SOC/WGS 204	Soc of Family
SOC/WGS 304	Women & Men in Soc

Visual & Performing Arts

AFS/MUS 230	Intoduction to African-Amer Mus
AFS/MUS 260	Hist of Jazz
MUS 206	America's Music
MUS/WGS 360	Women in Mus

Interdisciplinary Perspectives

IDS 210	Intro to America Studies
HON 346	Ethics & Gender
PHI 422	Philosophical Issues in Env Ethics
STS/WGS 210	Women & Gender in Science & Tech

US Diversity Co-Requisite Only: See on line list
The current University-approved list is available at:
https://oucc.dasa.ncsu.edu/u-s-diversity/

ACADEMIC POLICIES AND PROCEDURES

ACADEMIC MISCONDUCT - Any student charged with and found guilty of committing any act of academic misconduct is subject to disciplinary action. Academic misconduct includes all forms of academic dishonesty wherever committed, including, but not limited to cheating, plagiarism, fabrication, giving or receiving aid on an examination or quiz, copying another student's exam, term paper, report, problem or laboratory report, etc., theft or attempted theft of examinations and/or exam answers, etc., receipt of stolen examinations and/or exam answers, etc., facilitating academic dishonesty. The Department of Chemical and Biomolecular Engineering pursues enforcement of sanctions against academic misconduct to the maximum extent specified under the NCSU Code of Student Conduct.

ADVISOR ASSIGNMENT – When you CODA into Chemical and Biomolecular Engineering, you receive an advisor who will serve in that capacity until you graduate. Advisors are assigned using the following process:

Bullard	Engineering First Year-CHE Intent, Double Majors, Honors Program, MSCHE, CHE Minor
Parsons/Dickey	Nanoscience Concentration
Peretti/Li	Sustainable Engineering, Energy, and the Environment Concentration
Rao, Haugh, Kelly	Biomolecular Engineering Concentration
Flickinger/Menegatti	Biomanufacturing Science Concentration
All other faculty	Standard CHE Curriculum (assigned to an advisor such that the faculty advising load is well balanced)

If there is a problem with your assigned advisor, or if your advisor is unavailable, you may see Dr. Bullard for assistance.

Responsibilities of the Student

Students have the primary responsibility for planning their individual programs and meeting graduation requirements. This involves: (1) keeping up-to-date with University, College, and departmental curricular requirements through materials available from the faculty advisers or departmental coordinator of advising; (2) keeping informed of academic deadlines and changes in academic policies; and (3) consulting with the faculty adviser or departmental coordinator of advising during each registration period, following notification of academic status or probationary status, and at other times as needed and required by academic policy.

Responsibilities of the Adviser

Although students have the primary responsibility for planning their programs, faculty advisers are expected to: (1) be available for conferences at appropriate times and places about which their advisees have been informed; (2) provide accurate information about academic regulations and procedures, course prerequisites, and graduation requirements; (3) assist students in planning academic programs suited to their interests and abilities and their career objective; (4) discuss with their advisees appropriate course choices in fulfilling curriculum requirements as well as possible consequences of various alternative course choices; (5) inform their advisees when their proposed course selections conflict with University academic or curricular regulations; (6) assist advisees with

following proper procedures for such things as exceptions to the course drop deadlines, auditing a course before or after taking it for credit, taking a course under the credit by examination policy, registering for 19 or more credit hours, registering for CRC inter-institutional courses, or repeating a course previously passed; (7) refer their advisees for special testing or counseling as needed; (8) assist their advisees in considering the appropriateness of academic adjustments where these become necessary in cases of serious injury or illness.

Responsibilities of the Coordinator of Advising

Each college or department has a coordinator of advising who is responsible for: (1) assigning, training, and supervising faculty advisers; (2) providing up-to-date, printed course and curriculum information for advisers and students; (3) reassigning to another adviser any student who so requests; and (4) assisting any student who wants to major in the coordinator's area of study but is ineligible at the time to transfer into it. Students in this category keep their adviser in the department in which they are enrolled but consult additionally with the coordinator of advising for the department offering the curriculum in which they wish to enroll. Whenever appropriate, the coordinator will advise students that they should consider alternative curricula.

ADDING AND DROPPING COURSES

Students may add courses without permission during the first five (5) days of fall or spring terms and during the first two (2) days of summer terms. Students must have permission of the instructor to enroll in a course during days six (6) through ten (10) of fall or spring terms and during the third (3rd) day of summer terms. After the census date, students must have permission of the instructor of the course and their college dean to enroll in a course.

Except in cases of withdrawal, courses may be dropped until the census date without permission. However, in order to receive financial aid, students must meet the minimum course load requirements of the appropriate funding agency. Dropping below full-time enrollment could impact financial aid, housing and insurance eligibility. Students are expected to complete all courses for which they are enrolled as of the census date. Except as noted below, students may self-drop from a course from census through the first eight (8) weeks (40 days) of regular fall and spring terms and during the first thirteen (13) days of summer terms. Undergraduate student course drops after census date are considered to be course withdrawals and will result in a W grade on the transcript. Course withdrawals that would result in full-time undergraduate students falling below the minimum full-time course load requirements will not be allowed except for documented medical reasons or other verified, unforeseen grounds of personal or family hardship. Undergraduate students will be limited to a maximum of sixteen (16) hours of course withdrawals over their academic career. All hours from course withdrawals will count as attempted hours for course repeats, determining eligibility to continue enrollment, determining eligibility to receive financial aid, and for calculating undergraduate tuition surcharge.

After the University deadlines have passed, the College of Engineering will consider exceptions to the University drop policy (drop, change to audit, or change to credit-only grading) **only for documented medical reasons or other verified, unforeseen grounds of personal or family hardship**. *Changing majors, job demands or planning to change majors are not sufficient justification.*

Students who feel that they have justification for a drop after the deadline should first contact the Coordinator of Advising and be prepared to provide documentation to verify the circumstances associated with their drop request. All requests for exceptions to the add/drop policies require a

letter from the student, a recommendation from the Coordinator of Advising, input from the instructor, and approval by the Assistant Dean for Academic Affairs in the College of Engineering.

Any schedule revision, including a late drop, is not complete until the schedule revision form with all approvals has been submitted to Registration and Records in Harris Hall. Retain a copy of your revised schedule until the change has been posted to your permanent record.

Note that no schedule changes (including changing to audit or credit only) are accepted during the last two weeks of the semester – no exceptions.

The MyPack portal system closes at 5:00 p.m. on the last day to add a class. Students who wish to make modifications to their schedules after that time (within the published deadlines) may do so by presenting their student identification card at Room 1000 Harris Hall.

COURSE LOAD-Students who are employed on a regular basis or who have time-consuming extracurricular activities are advised to reduce their course loads to a manageable level. **Note that 12 credit hours is the minimum course load for full-time status**. Check for tax, insurance, dormitory, financial aid, and other benefits and privileges which may depend upon full-time status.

Student's GPA	Recommended Credit Hours
1.8	12
2.0	14
2.2	15
2.5	16
3.0	17
3.5	18

For 19, 20, or 21 credit hours, approval of your faculty advisor is required

Adjustments for part-time job or other regular obligation or commitment:

Job (or other) Hours/Week	Recommend Reduce Course Load by
5	2 credit hours
10	3 " "
15	4-5 " "
20	6 " "
25	6-8 " "
30	7-9 " "
35	8-10 " "

COURSE PREREQUISITE ENFORCEMENT - All prerequisites in chemical engineering courses are strictly enforced. **Failure to complete prerequisites prior to enrolling in a CHE course may result in the student's administrative disenrollment after the deadline to enroll in other courses has passed.**

COURSE REPEATS - Students are not permitted to take a course more than twice without receiving permission from the Dean of Engineering. The permission request to the Dean must be processed through the CBE Director of Undergraduate Studies and include documentation that describes circumstances leading to the request. In general, exceptions are approved only for documented medical reasons, documented emotional problems or crisis situations, or statement of documented hardship. A grade of S/U, W, or a letter grade less than C- are all counted as unsuccessful attempts.

CREDIT-ONLY GRADING - Students may select credit-only grading for physical education and foreign language (proficiency) courses. Excluding PE and other courses authorized to be graded on

an S/U basis (e.g. E 490 and E 115), courses taken as credit-only will **not** satisfy graduation requirements. Students may not select credit-only grading for Military Science and Aerospace Studies courses. The deadline for changing course grading to credit only is six weeks from the beginning of a regular semester and eleven class days from the beginning of a summer session.

The grades in credit-only courses are "S" and "U." These grades have no effect on the grade point average; however, the course and its grade are counted in the cumulative hours attempted. Students are encouraged to select credit-only grading for PE courses.

DOUBLE MAJORS - Students who intend to earn degrees in chemical engineering and a second major must fulfill all graduation requirements for both degrees. Where overlap between degree requirements occurs, the same courses can normally be used to satisfy graduation requirements in both curricula. In order to minimize the number of courses that must be completed, double major students should prepare a plan of work and review the plan with an academic advisor in each department as early as possible. In subsequent semesters, the student should consult with both advisors during the registration advising period.

Double major students whose second degree is chemical engineering and who wish to receive transfer credits for courses completed at other institutions must receive permission to do so from the Chemical and Biomolecular Engineering Coordinator of Advising (Dr. Bullard) prior to enrolling at the outside institution. **Receipt of transfer credit through another college at NCSU does not guarantee approval of those credits by the College of Engineering**.

ELIGIBILITY TO CONTINUE ENROLLMENT

Academic status will be calculated at the end of every fall, spring and summer term according to the rules established below:

Good Standing

Students must maintain a cumulative grade point average (GPA) of at least 2.0 or be on Academic Warning or Academic Probation status in order to continue enrollment. Students are considered to be in Good Standing if they are eligible to continue enrollment.

Academic Warning

Students with a cumulative GPA less than 2.0 and a grade point deficit of 15 or less will be placed on Academic Warning and allowed to continue enrollment. Grade point deficit is defined as the number of grade points below the required 2.0 minimum GPA. The deficit reflects the number of hours of B (3.0) grades necessary in the future to raise the GPA to the 2.0 minimum. Students with a cumulative GPA above 2.0 and a term GPA below 1.0 will be placed on Academic Warning and allowed to continue enrollment. Students on Academic Warning must maintain a term GPA of at least 2.0 for every subsequent fall, spring and summer term of enrollment, until they achieve a cumulative GPA of at least 2.0.

Academic Suspension

Students with a cumulative GPA less than 2.0 and a grade point deficit greater than 15 will be placed on Academic Suspension at the end of any fall, spring or summer term. Students on Academic Warning or Academic Probation who fail to maintain a term GPA of at least 2.0 for every subsequent fall, spring or summer term or fail to achieve a cumulative GPA of at least 2.0 will be placed on Academic Suspension. Students on Academic Suspension with a grade point deficit of 15

or less may choose to enroll in NC State summer terms in an effort to improve their status. Suspended students enrolled for summer will have their suspension deferred and their fall schedule maintained until the end of their summer enrollment. Students on suspension deferral for summer must raise their cumulative GPA to at least a 2.0 or pass at least 6 hours with a cumulative summer GPA of 2.0. Failure to do so will result in the student being returned to Academic Suspension status. Students on Academic Suspension may submit an appeal to continue enrollment for the next term. (See RUL 02.66.01 - Undergraduate Readmission and Appeals for information on appealing Academic Suspension). Students who remain on Academic Suspension will have all future term enrollments canceled and may not re-enroll.

Academic Probation
Students will be placed on Academic Probation for one term after a successful appeal to return from Academic Suspension. Students on Academic Probation who earn a term GPA of at least 2.0 during their Probation term will move to Academic Warning and will be subject to the continuation criteria described above. Students on Academic Probation who fail to earn a term GPA of at least 2.0 will be suspended.

Timely Advising
Students on Academic Warning or Academic Probation are required to meet with their academic advisers during the first four (4) weeks of the fall or spring terms to discuss their plan for academic success.

FOREIGN LANGUAGE REQUIREMENT – Requirements are listed at
http://sasw.chass.ncsu.edu/fl/place.htm

Freshmen may satisfy this requirement **before** entering NC State in one of the following ways:

- Score of 510 or above on the College Board Foreign Language Achievement Test (SAT II)
- Advanced placement score of 3 or above (College Entrance Examination Board AP Test)
- Obtaining an average grade of C for two years of high school study of the same language

Proficiency at the FL 102 level **after** entering NC State may be demonstrated as follows:

- Completion of FL 102 course with a passing grade of S, D or better (note: in addition to PE, foreign language is the only class that can be taken for credit only)
- Transfer credit equivalent to FL 102 from an accredited institution or university-approved study abroad program
- Placement into FL 201 or higher on the placement tests in the languages offered by the Department of Foreign Languages and Literatures

If you have not met the requirement, please take the placement tests as soon as possible after enrolling. Taking the placement exam two or three years after entering will probably not produce the best results. If you don't pass, then you will have plenty of time to take the required course here or elsewhere.

The "Placement Tests" are offered in the Laundry Building M-F from 8-5. This is a computerized test. The student can take the test ***only once***. If you place into FL 201, then you have satisfied the foreign language proficiency requirement. If you fail to place into the 201 level, then you need to take FL 102 here at NCSU or the equivalent elsewhere.

You can tell whether you have satisfied the requirement by looking at your degree audit. A student who has not yet fulfilled the requirement looks like this:

GRP 211 FOREIGN LANG PROFICI COREQ 090700

A student who has fulfilled the requirement looks like this:

FLF 100 HIGH SCHOOL FRENCH COREQ 8/03 MET 050800

GPA CALCULATIONS - The semester and overall grade point averages are based on a weighted-average calculation. In computing the average, the credit hours associated with each course are multiplied by a weighting factor which depends on the course grade (See chart below). The results of this multiplication are **quality points**, which are summed and then divided by the hours attempted in order to calculate the GPA. **The credit hours associated with courses in which the grade earned is CR, TR, S, U, IN or LA, are not included in the GPA calculation**.

For instance, the grade point average earned during the semester which appears below is 2.12:

COURSE	CREDIT HRS	GRADE	MULTIPLIER	QUALITY POINTS
CH 101	3	B+	3.33	9.99
CH 102	1	A-	3.67	3.67
MA 141	4	C	2.0	8
E 115	1	S	0	0
PE 107	1	S	0	0
ENG 251	3	F	0	0
EC 205	3	B-	2.67	8.01
TOTAL	16			29.67

Semester GPA = 29.67/14= 2.12 (2.119)

Note that, since the grades in PE 107 and E 115 were S, the total credit hours **for purposes of the GPA calculation** equals 14 instead of 16.

Continuing the example, for the next semester the student plans to enroll in the following courses and is wondering what GPA must be earned in order to have an overall grade point average of 2.5 following the second semester:

CH 201	3	PE 241	1
CH 202	1	MA 241	4
ENG 251	3	PY 205/206	4
Total Hours = 16			

The student will take the PE course on a credit-only basis, and will use one of the allowed course repeats on the ENG 111 grade from the first semester. By using the course repeat, the **first** semester total hours for the GPA calculation will be reduced to 11. Furthermore, the **second** semester hours for the GPA calculation equal 15, and the total GPA hours after two semesters will equal 26. Therefore, obtaining the 2.5 GPA after two semesters requires a total of 65 quality points (26 X 2.5), and 35.33 of those must be earned during the spring semester. This means the second semester GPA must be 35.33/15 = 2.35.

SEMESTER DEAN'S LIST - A full-time undergraduate student, who earns a semester average of (a) 3.5 or better on 12 to 14 credit hours of course work for which grade points are earned; or (b) 3.25 or better on 15 or more credit hours of course work for which grade points are earned, is on the Dean's List for that semester. Students are not eligible for the Dean's List in any semester in which they receive an F or IN grade. When IN grades are resolved, however, students who are otherwise eligible will be added retroactively to the Dean's List for that semester. Dean's List recognition is noted on the student's semester grade report and permanent academic record.

GRADE EXCLUSION POLICY - Undergraduate students may select up to two NC State courses with posted letter grades of C- or below to be excluded from calculation of their cumulative grade point average. Unsuccessful audits or credit-only attempts are not eligible for exclusion. The form can be found at http://www.ncsu.edu/registrar/forms/pdf/gradeexclusion.pdf

- Grades excluded under previous university regulations (such as First Year Course Repeat or Course Repeat Without Penalty) count toward the maximum two courses allowed for exclusion.
- Once a grade exclusion is applied to a course, the grade points and the credit hours attempted and earned on the course will be removed from the calculation of the cumulative grade point average and from the calculation of the total hours attempted.
- The course title and grade for the course will be shown on the official record with a notation to indicate the grade was excluded from the computation of the cumulative grade point average.
- Excluded courses cannot be used to satisfy degree requirements.
- Grade exclusions must be posted prior to a student applying for graduation. Grade exclusions cannot be invoked after a baccalaureate degree has been conferred upon the student by NC State.
- *Grade exclusions cannot be applied to courses in which the student was found to have committed academic dishonesty.*

GRADUATION REQUIREMENTS - Students are eligible for graduation when they have satisfactorily completed all academic requirements of their degree program. The course requirements for graduation appear on the Automated Degree Audit (ADA) form for all engineering students who have CODA'd. Furthermore, competency in a foreign language at the 102 level is a graduation requirement for all students at NCSU. Students are not eligible to graduate if they have any late (LA) or incomplete (IN) grades.

NCSU requires that, in addition to other University, College and departmental requirements, all students must earn a grade point average of at least 2.0, based on all courses attempted at NCSU, in order to be eligible to receive a baccalaureate degree. Furthermore, all baccalaureate degree programs in engineering have the graduation requirement of at least a 2.0 GPA for all courses attempted in the student's major, or the alternative graduation requirement of a C- or better in all required courses in the student's major. For this purpose, the required major courses are defined as including only those courses offered by the major department, or courses which are substituted for the required major courses.

June or August graduates may participate in May graduation with a memo from the department to the bookstore to allow them to pick up a cap and gown. Students who are double majors should notify Registration and Records where they want both diplomas sent. If the student does not, each respective college receives the appropriate diploma and the student must arrange to get the one they

did not pick up. University information regarding graduation is on the web at http://www2.ncsu.edu/ncsu/reg_records/grad_inf.htm.

Requirements for graduation with academic honors:

- *Cum Laude* - for grade point averages of 3.25 through 3.499;
- *Magna Cum Laude* - for grade point averages of 3.5 through 3.749; and
- *Summa Cum Laude* - for grade point averages of 3.75 and above

At least 48 of the last 60 hours towards a degree must be taken at NCSU. Here is the link to the policy: http://www.ncsu.edu/provost/hat/current/ch06/08.html. To be eligible for degree honor designations, students must have completed at least two semesters and at least 30 credit hours at NC State.

GRIEVANCES IN GRADING

Grievances related to a grade in a course should first be discussed with the instructor, then with your advisor, and then with the head of the department offering the course. If you feel that the response of these individuals is unsatisfactory, you may pursue a more formal complaint through the college council, grievance committee, or Department Head or Dean for Academic Affairs in your college.

HONORS COURSES IN CHEMICAL ENGINEERING - Eligible students (minimum GPA = 3.5) may complete designated CHE courses for Honors credit, even if those students are not in the CHE Honors Program. Students in the Engineering Scholars program may request Scholars Option enrollment for CHE courses in semesters where no Honors sections are scheduled.

PLAN OF WORK – Each student must complete a plan of work, to be approved by his or her advisor. This is done through MyPack portal.

PLUS/MINUS GRADING SYSTEM-A plus/minus grading became effective in the fall of 1994 for students who entered in summer 1994 or later. Students who were taking courses through the Lifelong Education Program at NCSU prior to being admitted to the University for summer 1994 (or later) are considered NEW. Under the plus/minus system the quality points earned for each credit hour of a given course are:

A+ = 4.33	B+ = 3.33	C+ = 2.33	D+ = 1.33	F = 0
A = 4.0	B = 3.0	C = 2.0	D = 1.0	
A- = 3.67	B- = 2.67	C- = 1.67	D- = 0.67	

SATISFACTORY ACADEMIC PROGRESS

Progress Towards Degree

Students are expected to be in a degree granting major before entering their fifth term (fall or spring). Students are encouraged to maintain continuous enrollment in a minimum of 15 hours toward a degree every fall and spring term, the pace which leads to graduation from a 120 hour degree program in four years.

Satisfactory academic progress (SAP) will be evaluated for all students, including part-time students, at the end of each academic year (May). Students admitted mid-year (January) and those who attend only one term for the year will also be evaluated in May each year. Satisfactory academic progress is measured by meeting the following three standards:

- **Pace of Completion:** Students must pass at least 2/3 of all hours attempted each academic year (summer term – spring term). Attempted hours include all hours enrolled for credit as of census date plus hours added after census. Hours dropped after census, withdrawn or excluded through Grade Exclusion (REG 02.20.16) also count as attempted hours.
- **Maximum Timeframe:** Students must graduate before attempting more than 150% of the hours required for their degree program (e.g. 180 hours for a 120 hour degree program).
- **Degree Status:** Students must have an academic standing that allows for continued enrollment.

Progress Deficiency

Students failing to make satisfactory academic progress will have a Progress Deficiency hold placed on their record preventing enrollment and will have future term enrollments (summer, fall or spring) canceled. Students meeting SAP but failing to make reasonable progress toward degree may be placed on Progress Deficiency by their College. Reasonable progress may be defined as completing courses required for the student's major in a timely manner, maintaining the expected GPA for the major, or making timely progress toward degree completion. Students placed on Progress Deficiency may submit an appeal to retain their schedule and continue enrollment in the next term. (For information about appeals, see RUL 02.66.01 Undergraduate Readmission and Appeals). Students with successful appeals will be placed on Progress Probation for one term (summer, fall or spring) and required to meet the satisfactory academic progress standards described above.

SCHOLARSHIPS FOR CHEMICAL AND BIOMOLECULAR ENGINEERING STUDENTS

The scholarship program for students in chemical engineering is generally divided into four levels:
1) **University-level merit scholarships.** These scholarships are awarded in a campus-wide competition coordinated by the NCSU Caldwell Programs and the Park Scholars Office. Many of these scholarships (i.e. the Park and Caldwell Fellow Scholarships) are typically highly competitive. The Park Scholarship is awarded to incoming freshmen, while the Caldwell Fellow Scholarships are usually awarded to students who have completed one semester of studies at NCSU.

2) **College of Engineering scholarships.** Through its Scholarship Committee, the College of Engineering (COE) awards a number of scholarships each year to students in all engineering programs in the college. The selection criteria for these scholarships are established by the donors who provide the financial support for the scholarships. Many of these scholarships are targeted to recognize strong academic performance by minority or female engineering students. Other scholarships are provided for students with strong academic records and demonstrable financial need.

Financial need has typically been assessed by the scholarship committee based on information supplied by the NCSU Financial Aid Office. In addition to scholarly excellence at NC State, examples of other criteria which are required by some donors in the selection of scholarship recipients include evidence of leadership skills and geographic location of the scholar's home. To assist in the evaluation of a student's suitability as a recipient of a particular scholarship, the COE mails each Spring, to all students above a minimum target GPA, scholarship information forms to be

completed by the student and returned to the COE. If you have not received and completed a scholarship information form and wish to do so, these forms may be completed by any student on-line at http://www.engr.ncsu.edu/academics/undergrad/scholarships/current. The information in these forms, along with overall academic records and financial aid information, is used in selecting the candidate who most closely matches the profile specified by the donor of a particular scholarship. These forms are due on **March 1** of each year and should be updated every year in order for the student to be eligible for these scholarships.

Most COE-level scholarship selections are made in the late Spring, typically in late April or early May, and recipients are notified by mail shortly thereafter. A few scholarships will usually be available for award in the Fall semester, and the recipients are notified by mail.

3) **Chemical and Biomolecular Engineering Department Scholarships.** The Department offers a small number of highly competitive scholarships which are reserved for chemical engineering students. The selection criteria for these scholarships are similar to those for the COE scholarships (i.e. academic merit, financial need, minority status, female students, etc.) Most ChE scholarship decisions are made in the Fall.

Many of the ChE scholarships are provided by corporate sponsors who have typically hired chemical engineers from NC State. Most of the ChE scholarships are targeted by the donors for junior and senior level students. In this regard, the ChE department offers no scholarships for incoming freshmen. The information used to match students with scholarships includes academic records, financial aid information, and additional information on the COE scholarship information form. Dr. Bullard coordinates the scholarship program in the Department, and students are encouraged to contact her if they have questions regarding the scholarship program.

4) **Other Sources of Scholarships**. In addition to the three sources of scholarships mentioned above, some chemical engineering students will have scholarships from other sources. These sources include but are not limited to: grants and loans from the Financial Aid Office to qualified students, scholarships from other departments for students pursuing more than one degree (i.e. double majors in Polymer and Color Chemistry and Chemical Engineering), and scholarships from external sources (i.e. National Merit Scholarships, some companies offer scholarships to children of employees, etc.).

Because the Air Force needs a large number of engineers, the Air Force ROTC has a number of programs designed to help engineering students get through college, including the two types of scholarship programs. Over 70% of Air Force scholarships are awarded to engineering students. To learn more about the programs at available at NCSU, stop by Room 133A in Reynolds Coliseum or call the Air Force ROTC Unit Admissions Officer 515-8777.

TRANSFER CREDIT - Students who wish to take courses at another institution should obtain prior approval from Dr. Bullard in order to insure that the transfer credits will apply toward fulfilling specific graduation requirements. Information about transfer course equivalencies at a large number of institutions appears at: https://www.acs.ncsu.edu/scripts/ugadmiss/trnsfcrs.

TUTORING - A number of tutoring programs are available on campus. Students are encouraged to seek tutoring help for subjects in which they are weak. It is very important that the student not wait until late in the semester to start with a tutor for two reasons:

1) There are a limited number of tutors available on campus.

2) The later it is, the more material will have to be covered to catch up.

NC State maintains a central Tutorial Services website at http://www.ncsu.edu/tutorial_center/. This is probably the best starting point if you are seeking tutorial assistance. There are many campus resources to help you if you would like academic assistance:

- **Academic Advising Services --** http://advising.ncsu.edu/
- **Counseling Center --** http://healthcenter.ncsu.edu/counseling-center/ - 2nd floor, Student Health Center
- **Disability Services --** http://dso.dasa.ncsu.edu/ - 2221 Student Health Center
- **Online Writing Lab --** http://www.ncsu.edu/ncsu/grammar/
- **Physics Tutorial Center --** http://www.physics.ncsu.edu/classes/tutor.php 319A Riddick
- **Supplemental Instruction (SI) --** http://www.ncsu.edu/tutorial_center/si/
- **Undergraduate Tutorial Center --** http://tutorial.dasa.ncsu.edu/ - 101 Park Shops

UNDERGRADUATE RESEARCH PROJECTS - Students who plan to attend graduate school should consider completing an undergraduate research project under the supervision of a faculty advisor. Projects normally require at least one semester to complete, and the student is normally required to prepare oral and written reports that document and present their work. To receive academic credit for the research project work, students must enroll in either CHE 497 (3 credits) or CHE 498 (1-3 credits). Before enrolling in either of these courses, you should consult with Dr. Bullard to understand the requirements. Typically 10/hrs week or 150 hours total over the course of the semester are required along with a written technical report and an oral presentation to the research group.

ON-LINE LEARNING STYLE QUESTIONNAIRE:
http://www.engr.ncsu.edu/learningstyles/ilsweb.html

LEARNING STYLES AND STRATEGIES

Richard M. Felder
Hoechst Celanese Professor of Chemical Engineering
North Carolina State University

Barbara A. Soloman
Coordinator of Advising, First Year College
North Carolina State University

ACTIVE AND REFLECTIVE LEARNERS

- Active learners tend to retain and understand information best by doing something active with it--discussing or applying it or explaining it to others. Reflective learners prefer to think about it quietly first.
- "Let's try it out and see how it works" is an active learner's phrase; "Let's think it through first" is the reflective learner's response.
- Active learners tend to like group work more than reflective learners, who prefer working alone.
- Sitting through lectures without getting to do anything physical but take notes is hard for both learning types, but particularly hard for active learners.

Everybody is active sometimes and reflective sometimes. Your preference for one category or the other may be strong, moderate, or mild. A balance of the two is desirable. If you always act before reflecting you can jump into things prematurely and get into trouble, while if you spend too much time reflecting you may never get anything done.

How can active learners help themselves?

If you are an active learner in a class that allows little or no class time for discussion or problem-solving activities, you should try to compensate for these lacks when you study. Study in a group in which the members take turns explaining different topics to each other. Work with others to guess what you will be asked on the next test and figure out how you will answer. You will always retain information better if you find ways to do something with it.

How can reflective learners help themselves?

If you are a reflective learner in a class that allows little or no class time for thinking about new information, you should try to compensate for this lack when you study. Don't simply read or memorize the material; stop periodically to review what you have read and to think of possible questions or applications. You might find it helpful to write short summaries of readings or class notes in your own words. Doing so may take extra time but will enable you to retain the material more effectively.

SENSING AND INTUITIVE LEARNERS

- Sensing learners tend to like learning facts, intuitive learners often prefer discovering possibilities and relationships.
- Sensors often like solving problems by well-established methods and dislike complications and surprises; intuitors like innovation and dislike repetition. Sensors are more likely than intuitors to resent being tested on material that has not been explicitly covered in class.
- Sensors tend to be patient with details and good at memorizing facts and doing hands-on (laboratory) work; intuitors may be better at grasping new concepts and are often more comfortable than sensors with abstractions and mathematical formulations.
- Sensors tend to be more practical and careful than intuitors; intuitors tend to work faster and to be more innovative than sensors.
- Sensors don't like courses that have no apparent connection to the real world; intuitors don't like "plug-and-chug" courses that involve a lot of memorization and routine calculations.

Everybody is sensing sometimes and intuitive sometimes. Your preference for one or the other may be strong, moderate, or mild. To be effective as a learner and problem solver, you need to be able to function both ways. If you overemphasize intuition, you may miss important details or make careless mistakes in calculations or hands-on work; if you overemphasize sensing, you may rely too much on memorization and familiar methods and not concentrate enough on understanding and innovative thinking.

How can sensing learners help themselves?

Sensors remember and understand information best if they can see how it connects to the real world. If you are in a class where most of the material is abstract and theoretical, you may have difficulty. Ask your instructor for specific examples of concepts and procedures, and find out how the concepts apply in practice. If the teacher does not provide enough specifics, try to find some in your course text or other references or by brainstorming with friends or classmates.

How can intuitive learners help themselves?

Many college lecture classes are aimed at intuitors. However, if you are an intuitor and you happen to be in a class that deals primarily with memorization and rote substitution in formulas, you may have trouble with boredom. Ask your instructor for interpretations or theories that link the facts, or try to find the connections yourself. You may also be prone to careless mistakes on test because you are impatient with details and don't like repetition (as in checking your completed solutions). Take time to read the entire question before you start answering and be sure to check your results.

VISUAL AND VERBAL LEARNERS

Visual learners remember best what they see--pictures, diagrams, flow charts, time lines, films, and demonstrations. Verbal learners get more out of words--written and spoken explanations. Everyone learns more when information is presented both visually and verbally.

In most college classes very little visual information is presented: students mainly listen to lectures and read material written on chalkboards and in textbooks and handouts. Unfortunately, most people are visual learners, which means that most students do not get nearly as much as they would if more visual presentation were used in class. Good learners are capable of processing information presented either visually or verbally.

How can visual learners help themselves?

If you are a visual learner, try to find diagrams, sketches, schematics, photographs, flow charts, or any other visual representation of course material that is predominantly verbal. Ask your instructor, consult reference books, and see if any videotapes or CD-ROM displays of the course material are available. Prepare a concept map by listing key points, enclosing them in boxes or circles, and drawing lines with arrows between concepts to show connections. Color-code your notes with a highlighter so that everything relating to one topic is the same color.

How can verbal learners help themselves?

Write summaries or outlines of course material in your own words. Working in groups can be particularly effective: you gain understanding of material by hearing classmates' explanations and you learn even more when you do the explaining.

SEQUENTIAL AND GLOBAL LEARNERS

- Sequential learners tend to gain understanding in linear steps, with each step following logically from the previous one. Global learners tend to learn in large jumps, absorbing material almost randomly without seeing connections, and then suddenly "getting it."

- Sequential learners tend to follow logical stepwise paths in finding solutions; global learners may be able to solve complex problems quickly or put things together in novel ways once they have grasped the big picture, but they may have difficulty explaining how they did it.

Many people who read this description may conclude incorrectly that they are global, since everyone has experienced bewilderment followed by a sudden flash of understanding. What makes you global or not is what happens before the light bulb goes on. Sequential learners may not fully understand the material but they can nevertheless do something with it (like solve the homework problems or pass the test) since the pieces they have absorbed are logically connected. Strongly global learners who lack good sequential thinking abilities, on the other hand, may have serious difficulties until they have the big picture. Even after they have it, they may be fuzzy about the details of the subject, while sequential learners may know a lot about specific aspects of a subject but may have trouble relating them to different aspects of the same subject or to different subjects.

How can sequential learners help themselves?

Most college courses are taught in a sequential manner. However, if you are a sequential learner and you have an instructor who jumps around from topic to topic or skips steps, you may have difficulty following and remembering. Ask the instructor to fill in the skipped steps, or fill them in yourself by consulting references. When you are studying, take the time to outline the lecture material for yourself in logical order. In the long run doing so will save you time. You might also try to strengthen your global thinking skills by relating each new topic you study to things you already know. The more you can do so, the deeper your understanding of the topic is likely to be.

How can global learners help themselves?

If you are a global learner, it can be helpful for you to realize that you need the big picture of a subject before you can master details. If your instructor plunges directly into new topics without bothering to explain how they relate to what you already know, it can cause problems for you. Fortunately, there are steps you can take that may help you get the big picture more rapidly. Before you begin to study the first section of a chapter in a text, skim through the entire chapter to get an overview. Doing so may be time-consuming initially but it may save you from going over and over individual parts later. Instead of spending a short time on every subject every night, you might find it more productive to immerse yourself in individual subjects for large blocks. Try to relate the subject to things you already know, either by asking the instructor to help you see connections or by consulting references. Above all, don't lose faith in yourself; you will eventually understand the new material, and once you do your understanding of how it connects to other topics and disciplines may enable you to apply it in ways that most sequential thinkers would never dream of.

STUDENT CHAPTER OF THE AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

The American Institute of Chemical Engineers (AIChE) is the national professional organization for chemical engineers. The primary objective of the student chapter of AIChE is to promote the professional development of the members by programs and relations with other student chapters. Secondly, the chapter contributes to the development of chemical engineering at NCSU through activities involving the faculty and student members. While membership is extended only to those students in chemical engineering, other interested engineering students are heartily invited to the chapter's programs. Chemical engineering freshmen are urged to join the chapter. The chapter helps to give each student an understanding of their future, in school as well as after graduation.

Student Lounge: EB1 2013

Mission: To promote the development and reputation of our members and the department in industry and academia.

Membership: Membership is open to all undergraduate and graduate students enrolled in chemical engineering or chemical engineering undesignated. Dues are $20 per year or $10 per semester if participating in the co-op program. There is also a discount for sophomores and freshman ($10/year in past years) as an incentive to join.

Activities/Benefits: The student chapter schedules several luncheons, usually two per week, mostly during the fall semester. These luncheons are funded by companies that actively recruit chemical engineers from N.C. State, and are open to all AIChE members. The sponsoring company provides food and information about its operations, recruiting, career opportunities, benefits, etc. Regular sponsors of the luncheons include Alcoa, Procter & Gamble, ExxonMobil, Hoffman-LaRoche, Merck, Monsanto, International Paper, Shell, and several others.

The chapter prepares a resume book in the fall for those seeking full-time, co-op, or internship positions. Copies of the resume book are distributed to various companies through the department head and to all companies sponsoring luncheons. The resume book is a very successful recruiting tool.

For students interested in graduate school, AIChE sponsors an information session conducted by several chemical engineering faculty members. The information session covers topics including applications, requirements, graduate schools, graduate studies and more.

The chapter also attends the national and regional annual conferences. The national conference is usually held in November, and the regional conference is in March or April. Some previous conference sites have included San Francisco, St. Louis, Tallahassee, Miami, and New Orleans. The conferences provide the opportunity to learn more about the chemical engineering profession and current research efforts, and gives exposure to other schools and companies. It's also a great opportunity to meet other ChE's and have a lot of fun.

Social events are scheduled throughout the year. During homecoming weekend, members are encouraged to join N.C. State Chemical Engineering alumni for the football game and a pre-game picnic. Other social events may include Durham Bulls baseball, Raleigh Icecaps hockey, Charlie Goodnight's comedy club, etc. The chapter may also organize fundraisers to assist departmental

projects or charitable causes. Depending on participation, the chapter sponsors intramural teams (basketball, volleyball, softball, etc.).

- **Leadership/Organization**: The chapter is lead and managed by a group of officers, with the help of several committee members and the guidance of a faculty advisor. Every spring, the chapter members nominate and elect officers to lead the chapter in the following school year. At the beginning of the fall semester, the new officers recruit members to serve on various committees that help manage the chapter's activities.

How to Join: If you're interested in joining the student chapter of AIChE, attend any of the luncheons or chapter meetings announced in class or via email. The web site for more information is http://www.che.ncsu.edu/aiche/

OMEGA CHI EPSILON: THE CHEMICAL ENGINEERING HONOR SOCIETY

Omega Chi Epsilon is an organization created to support the academic life of students in chemical engineering.

Mission: The mission of Omega Chi Epsilon is the following:

1. To recognize the achievements of outstanding chemical engineering students.
2. To promote academic pursuits within chemical engineering.
3. To create awareness of chemical engineering among other disciplines.

Membership: The membership of Omega Chi Epsilon is currently restricted to the top 20% of the junior class and the top 25% of the senior class in chemical engineering.

Activities: Members of Omega Chi Epsilon are expected to take an active role in the organization by assisting the Society in its mission within the department. Some of the activities that are planned include:

- Graduate School Information Session: A session is planned to bring faculty and students together for a lively discussion of going to graduate school. Faculty and graduate students will discuss questions such as, "How do I apply," "When should I start applying?" and "Why should I pursue graduate study?"
- Open House: The organization will assist the department in preparing for the College of Engineering Open House. Most of the recruiting of students into the CHE curriculum occurs at this very important event.
- Undergraduate Research: We are compiling a list of faculty members who need students to work in their research programs.

How to Join: If you are eligible based on the criteria for membership, you will be contacted by the secretary of the honor society in the spring. If you are interested and have not been contacted, please email Dr. Bullard or one of the officers for a membership application.

THE INTERNATIONAL SOCIETY FOR PHARMACEUTICAL ENGINEERING

The NC State student chapter of the International Society for Pharmaceutical Engineering (ISPE) was founded in the fall semester of the 1995-96 school year. ISPE is a national organization which supports engineers working in the pharmaceutical industry. Each month, the N.C. State student chapter hosts luncheons featuring speakers from the pharmaceutical industry. The speakers focus on their specific work experiences within the industry as well as featured technical topics. These technically-based luncheons complement many of the recruiting-oriented luncheons featured by AICHE. In addition to the luncheons, students are invited to attend two tours of pharmaceutical facilities each semester. These tours are sponsored by the professional Carolina Chapter of ISPE and offer great opportunities to see the actual work environment and to network with professional engineers. See http://ispencsu.weebly.com/ for more information.

PRE-LAW – Students who are interested in attending law school should consult the Pre-Law Services web site at http://www.ncsu.edu/prelaw/

PRE-MED – Students who are interested in attending medical, dental, pharmacy, or other health-related professional program should utilize to the on-line “Health Professions Advising Center" at http://harvest.cals.ncsu.edu/health_pac/index.cfm?pageID=815

STUDY ABROAD - Students interested in Study Abroad opportunities should go to the Study Abroad office and fill out an application packet. In that packet will be a "Request for NC State Academic Approval" form, which the student should take to Brian Koehler (118 Page Hall) to complete and sign. The web site for more information is http://www2.ncsu.edu/ncsu/stud_affairs/study_abroad/ .

COOPERATIVE ENGINEERING EDUCATION PROGRAM
(OFFICE – 300 CLARK HALL)

The cooperative education program enhances and broadens the student's academic experience by alternating periods of academic study with periods of employment. It is a five-year plan with the freshman year on campus. Students alternate semesters of school and work, with a minimum of 12 months of work experience. A typical schedule is illustrated below.

	1st Year			2nd Year			3rd Year			4th Year			5th Year	
	Fa	Sp	Su	Fa	Sp	Su	Fa	Sp	Su	Fa	Sp	Su	Fa	Sp
Student A	S	S	W	S	W	S	W	S	W	S	W	S	S	S
Student B	S	S	S	W	S	W	S	W	S	W	S	W	S	S

S=School W=Work

A student may begin the first co-op work period as late as the second semester of the junior year. In this case, the student's graduation may be extended in order to complete twelve months work experience required for program completion.

BACKGROUND

A sound curriculum that combines theoretical and practical training in chemical engineering principles and design coupled with professional work experience is the basis of NC State's Cooperative Education Program. The Cooperative Education Program at NC State provides outstanding undergraduates with terms of full-time study interspersed with up to five semesters and summer sessions of full-time engineering-related employment.

During the past year, 73 chemical engineering majors participated in the Co-op program. The students are full-time employees of the sponsoring company during their terms of work. During 2015-16, the average monthly salary for Co-op chemical engineers during their first work rotation was $3,338. The students worked for twenty-four different companies at twenty-seven different locations, mostly in the south and southwest US. A high percentage of Co-op students receive offers of professional employment after graduation. Co-op employers include:

AMGEN
AVID SOLUTIONS
BEKAERT
BIOGEN IDEC
BOEHME FILATEX
BOWATER
CIRRUS PHARMACEUTICAL
CLOSURE MEDICAL
COGNIS
CURTIS PAPER
DOMTAR INDUSTRIES
DOW CHEMICAL
DSM PHARMACEUTICAL
DUPONT
EASTMAN CHEMICAL
EXXONMOBIL
FMC CORPORATION
FUJI FILM
GE
GEORGIA PACIFIC
GILEAD SCIENCE
GLAXOSMITH KLINE
HERSHEY
HONEYWELL
INTERNATIONAL PAPER
INVISTA
KIMBERLY CLARK
MARRANCA ENGINEERING
MEAD WESTVACO
MILLIKEN
NASA KENNEDY
NATIONAL GYPSUM
NATIONAL STARCH
NOVOZYMES
O'BRIEN AND GERE ENGINEERS
PCA
PERFORMANCE FIBERS
PHILIP MORRIS
PROGRESS ENERGY
ROBERT E. MASON
ROVISYS
SEALED AIR CORPORATION
SHAW INDUSTRIES
UNC ENERGY SERVICES

ADVANTAGES FOR CO-OP STUDENTS

1. Co-op provides for career exploration and confirmation of career choice.
2 The co-op job is a learning laboratory that often provides state-of-the-art equipment that universities cannot afford to purchase.
3. The co-op job provides students the opportunity to develop their human relations and communication skills while working in unique situations with professionals in their field.
4. The co-op experience enhances the marketability of students at graduation.
5. The co-op engineering students (75% of all co-ops) had substantial earnings that helped defray their educational expenses.
6. The NCSU Co-op Program is accredited by ABET. This allows students to use the work experience toward meeting requirements to obtain a license as a professional engineer.
7. NCSU co-op students have a higher rate of graduation than non co-ops.

ENTRY REQUIREMENTS

The applicant must be enrolled as a full-time student in the College of Engineering, must complete the department admission requirements prior to the first scheduled work period, must have a minimum overall grade point average of 2.25/4.00, and should have enough semesters remaining prior to graduation to arrange for a minimum of twelve months work experience. The student should apply at the co-op office early in the semester prior to the first work period. To remain in the program, students must maintain a minimum grade point average of 2.0/4.0 and perform satisfactorily for the employer. Some companies require a higher GPA.

EMPLOYERS--WHO AND WHERE

Employers may be private industry, federal or state agencies, or any firm requiring engineering talent. Geographically, the employers may be anywhere in the USA or even in a foreign country if it can be arranged. Students who are willing to accept co-op jobs outside of North Carolina will find that they have a larger choice of companies and opportunities and less competition for positions than in the Triangle.

EMPLOYER SELECTION

When students make application for the co-op plan, the Co-op Coordinator ascertains the student's interests and strives to match those interests with employer needs, also taking into consideration geographic preferences when possible. Resumes are sent to employers chosen by the student and the coordinator. Interested employers will arrange interviews when feasible. Offers are made and students with more than one offer have a choice. Students are free to suggest employers even though they may not be among those listed with the co-op office.

REGISTRATION

Students going on a co-op job the next semester must register for that semester (as a co-op) during the usual registration period and are considered full-time students while on the job. No academic credit is given for the work period, but a grade of "satisfactory" or "unsatisfactory" is recorded on the student's transcript.

HOUSING

Students are responsible for obtaining housing. Employers are helpful and a few have housing arrangements for their co-ops.

GENERAL

Each student is required to complete a brief work report, and the employer's evaluation of each work period is discussed with the student following the work semester. When co-op students graduate, they are under no obligation to work for their co-op employers, and the employers are under no obligation to offer jobs to the graduating students. A certificate is awarded to graduating students who have satisfactorily completed twelve or more months of co-op work experience and who have submitted a subsequently approved work report for each co-op session. Also, a notation is made on the permanent record for these students indicating the months of work experience obtained.

PROFESSIONAL DEVELOPMENT TOPICS

ELECTRONIC ETIQUETTE

Why do you need email etiquette? (1)

A company needs to implement etiquette rules for the following three reasons:

- Professionalism: by using proper email language your company will convey a professional image.
- Efficiency: emails that get to the point are much more effective than poorly worded emails.
- Protection from liability: employee awareness of email risks will protect your company from costly law suits.

What are the etiquette rules?

There are many etiquette guides and many different etiquette rules. Some rules will differ according to the nature of your business and the corporate culture. Below we list what we consider as the 32 most important email etiquette rules that apply to nearly all companies. (Note: Items 1-32 are all from source 1).

1. Be concise and to the point.

Do not make an e-mail longer than it needs to be. Remember that reading an e-mail is harder than reading printed communications and a long e-mail can be very discouraging to read.

2. Answer all questions, and pre-empt further questions.

An email reply must answer all questions, and pre-empt further questions – If you do not answer all the questions in the original email, you will receive further e-mails regarding the unanswered questions, which will not only waste your time and your customer's time but also cause considerable frustration. Moreover, if you are able to pre-empt relevant questions, your customer will be grateful and impressed with your efficient and thoughtful customer service. Imagine for instance that a customer sends you an email asking which credit cards you accept. Instead of just listing the credit card types, you can guess that their next question will be about how they can order, so you also include some order information and a URL to your order page. Customers will definitely appreciate this.

3. Use proper spelling, grammar & punctuation.

This is not only important because improper spelling, grammar and punctuation give a bad impression of your company, it is also important for conveying the message properly. E-mails with no full stops or commas are difficult to read and can sometimes even change the meaning of the text. And, if your program has a spell checking option, why not use it? [Note: avoid using common IM acronyms unless you are writing to a close friend – many in the older generation will be clueless as to what you are trying to say].

1 http://www.emailreplies.com/#why

4. Make it personal.

Not only should the e-mail be personally addressed, it should also include personal i.e. customized content. For this reason auto replies are usually not very effective. However, templates can be used effectively in this way, see next tip.

5. Use templates for frequently used responses.

Some questions you get over and over again, such as directions to your office or how to subscribe to your newsletter. Save these texts as response templates and paste these into your message when you need them. You can save your templates in a Word document, or use pre-formatted emails. Even better is a tool such as ReplyMate for Outlook (allows you to use 10 templates for free).

6. Answer swiftly.

Customers send an e-mail because they wish to receive a quick response. If they did not want a quick response they would send a letter or a fax. Therefore, each e-mail should be replied to within at least 24 hours, and preferably within the same working day. If the email is complicated, just send an email back saying that you have received it and that you will get back to them. This will put the customer's mind at rest and usually customers will then be very patient!

7. Do not attach unnecessary files.

By sending large attachments you can annoy customers and even bring down their e-mail system. Wherever possible try to compress attachments and only send attachments when they are productive. Moreover, you need to have a good virus scanner in place since your customers will not be very happy if you send them documents full of viruses!

8. Use proper structure & layout.

Since reading from a screen is more difficult than reading from paper, the structure and layout is very important for e-mail messages. Use short paragraphs and blank lines between each paragraph. When making points, number them or mark each point as separate to keep the overview.

9. Do not overuse the high priority option.

We all know the story of the boy who cried wolf. If you overuse the high priority option, it will lose its function when you really need it. Moreover, even if a mail has high priority, your message will come across as slightly aggressive if you flag it as 'high priority'.

10. Do not write in CAPITALS.

IF YOU WRITE IN CAPITALS IT SEEMS AS IF YOU ARE SHOUTING. This can be highly annoying and might trigger an unwanted response in the form of a flame mail. Therefore, try not to send any email text in capitals. [Likewise, do not eliminate all capital letters unless you're e.e. cummings].

11. Don't leave out the message thread.

When you reply to an email, you must include the original mail in your reply, in other words click 'Reply', instead of 'New Mail'. Some people say that you must remove the previous message since

this has already been sent and is therefore unnecessary. However, I could not agree less. If you receive many emails you obviously cannot remember each individual email. This means that a 'threadless email' will not provide enough information and you will have to spend a frustratingly long time to find out the context of the email in order to deal with it. Leaving the thread might take a fraction longer in download time, but it will save the recipient much more time and frustration in looking for the related emails in their inbox!

12. Add disclaimers to your emails.

It is important to add disclaimers to your internal and external mails, since this can help protect your company from liability. Consider the following scenario: an employee accidentally forwards a virus to a customer by email. The customer decides to sue your company for damages. If you add a disclaimer at the bottom of every external mail, saying that the recipient must check each email for viruses and that it cannot be held liable for any transmitted viruses, this will surely be of help to you in court. Another example: an employee sues the company for allowing a racist email to circulate the office. If your company has an email policy in place and adds an email disclaimer to every mail that states that employees are expressly required not to make defamatory statements, you have a good case of proving that the company did everything it could to prevent offensive emails.

13. Read the email before you send it.

A lot of people don't bother to read an email before they send it out, as can be seen from the many spelling and grammar mistakes contained in emails. Apart from this, reading your email through the eyes of the recipient will help you send a more effective message and avoid misunderstandings and inappropriate comments.

14. Do not overuse Reply to All.

Only use Reply to All if you really need your message to be seen by each person who received the original message.

15. Mailings > use the Bcc: field or do a mail merge.

When sending an email mailing, some people place all the email addresses in the To: field. There are two drawbacks to this practice: (1) the recipient knows that you have sent the same message to a large number of recipients, and (2) you are publicizing someone else's email address without their permission. One way to get round this is to place all addresses in the Bcc: field. However, the recipient will only see the address from the To: field in their email, so if this was empty, the To: field will be blank and this might look like spamming. You could include the mailing list email address in the To: field, or even better, if you have Microsoft Outlook and Word you can do a mail merge and create one message for each recipient. A mail merge also allows you to use fields in the message so that you can for instance address each recipient personally. For more information on how to do a Word mail merge, consult the Help in Word.

16. Take care with abbreviations and emoticons.

In business emails, try not to use abbreviations such as BTW (by the way) and LOL (laugh out loud). The recipient might not be aware of the meanings of the abbreviations and in business emails these are generally not appropriate. The same goes for emoticons, such as the smiley :-). If you are not sure whether your recipient knows what it means, it is better not to use it.

17. Be careful with formatting.

Remember that when you use formatting in your emails, the sender might not be able to view formatting, or might see different fonts than you had intended. When using colors, use a color that is easy to read on the background.

18. Take care with rich text and HTML messages.

Be aware that when you send an email in rich text or HTML format, the sender might only be able to receive plain text emails. If this is the case, the recipient will receive your message as a .txt attachment. Most email clients however, including Microsoft Outlook, are able to receive HTML and rich text messages.

19. Do not forward chain letters.

Do not forward chain letters. We can safely say that all of them are hoaxes. Just delete the letters as soon as you receive them.

20. Do not request delivery and read receipts.

This will almost always annoy your recipient before he or she has even read your message. Besides, it usually does not work anyway since the recipient could have blocked that function, or his/her software might not support it, so what is the use of using it? If you want to know whether an email was received it is better to ask the recipient to let you know if it was received.

21. Do not ask to recall a message.

Biggest chances are that your message has already been delivered and read. A recall request would look very silly in that case wouldn't it? It is better just to send an email to say that you have made a mistake. This will look much more honest than trying to recall a message.

22. Do not copy a message or attachment without permission.

Do not copy a message or attachment belonging to another user without permission of the originator. If you do not ask permission first, you might be infringing on copyright laws.

23. Do not use email to discuss confidential information.

Sending an email is like sending a postcard. If you don't want your email to be displayed on a bulletin board, don't send it. Moreover, never make any libelous, sexist or racially discriminating comments in emails, even if they are meant to be a joke.

24. Use a meaningful subject line, and include an address and closing.

Try to use a subject that is meaningful to the recipient as well as yourself. For instance, when you send an email to a company requesting information about a product, it is better to mention the actual name of the product, e.g. 'Product A information' than to just say 'product information' or the company's name in the subject.

An email should have an opening, typically “Dear Dr. Bullard” – don’t just dive into the body of the message. “Hey Dr. Bullard” is not professional. Similarly, you should close the email with “Sincerely”, “Thank you”, “Regards”, another appropriate closing, followed by your name.

25. Use active instead of passive voice.

Try to use the active voice of a verb wherever possible. For instance, 'We will process your order today', sounds better than 'Your order will be processed today'. The first sounds more personal, whereas the latter, especially when used frequently, sounds unnecessarily formal.

26. Avoid using URGENT and IMPORTANT.

Even more so than the high-priority option, you must at all times try to avoid these types of words in an email or subject line. Only use this if it is a really, really urgent or important message.

27. Avoid long sentences.

Try to keep your sentences to a maximum of 15-20 words. Email is meant to be a quick medium and requires a different kind of writing than letters. Also take care not to send emails that are too long. If a person receives an email that looks like a dissertation, chances are that they will not even attempt to read it!

28. Don't send or forward emails containing libelous, defamatory, offensive, racist, or obscene remarks.

By sending or even just forwarding one libelous, or offensive remark in an email, you and your company can face court cases resulting in multi-million dollar penalties.

29. Don't forward virus hoaxes and chain letters.

If you receive an email message warning you of a new unstoppable virus that will immediately delete everything from your computer, this is most probably a hoax. By forwarding hoaxes you use valuable bandwidth and sometimes virus hoaxes contain viruses themselves, by attaching a so-called file that will stop the dangerous virus. The same goes for chain letters that promise incredible riches or ask your help for a charitable cause. Even if the content seems to be bona fide, the senders are usually not. Since it is impossible to find out whether a chain letter is real or not, the best place for it is the recycle bin.

30. Keep your language gender neutral.

In this day and age, avoid using sexist language such as: 'The user should add a signature by configuring his email program'. Apart from using he/she, you can also use the neutral gender: "The user should add a signature by configuring the email program'.

31. Don't reply to spam.

By replying to spam or by unsubscribing, you are confirming that your email address is 'live'. Confirming this will only generate even more spam. Therefore, just hit the delete button or use email software to remove spam automatically.

32. Use cc: field sparingly.

Try not to use the cc: field unless the recipient in the cc: field knows why they are receiving a copy of the message. Using the cc: field can be confusing since the recipients might not know who is supposed to act on the message. Also, when responding to a cc: message, should you include the other recipient in the cc: field as well? This will depend on the situation. In general, do not include

the person in the cc: field unless you have a particular reason for wanting this person to see your response. Again, make sure that this person will know why they are receiving a copy.

33. Remember that email is not always the best form of communication. (2)

There are many subjects that are too sensitive to discuss over email mainly because misinterpretation could have serious consequences. Some topics that should generally be resolved outside of email are:

- Disciplinary action
- Conflicts about grades or personal information
- Concerns about fellow classmates/workmates
- Complaints

When it appears that a dialogue has turned into a conflict, it is best to suggest an end to the swapping of email and for you to talk or meet in person. If you receive a flaming email try to respond in a short and simple response. If that does not appease the flamer, then make contact with him or her outside the virtual realm.

33. For your personal accounts, use a user ID that comes across as professional.

A potential employer who is trying to contact you regarding a position will not be impressed if they are sending their email to thicnspicy@hotmail.com or amishburrito@aol.com. Choose a user name that would not be offensive or childish to a potential employer.

And finally, two very important items to remember:

34. Never send an email when you are angry.

Don't send an angry or sarcastic message without first giving yourself a few hours or overnight to make sure you really want to send it. Remember that an email can be forwarded to your boss or others or used as evidence in court!

This is closely followed by:

35. Remember that email is a public document. (3)

Stop right where you are and set aside a couple of brain cells for the following statement: there is no such thing as a private e-mail. The reason? Keep reading.

With some e-mail systems, the e-mail administrator has the ability to read any and all e-mail messages. If this is the case where you are located, you better hope that there is an honest and respectable person in that position.

Some companies monitor employee e-mail (as well as internet usage). The reasons for this obtrusive behavior range from company management wanting to make sure users are not wasting time on frivolous messages to making sure that company secrets are not being leaked to unauthorized sources.

E-mail software is like all software in that occasionally things go wrong. If this happens, you may end up receiving e-mail meant for another person or your e-mail may get sent to the wrong person. Either way, what you thought was private is not private anymore.

2 http://owl.english.purdue.edu/handouts/pw/p_emailett.html#flame
3 http://www.iwillfollow.com/email.htm

So where does this leave us. First: there is no such thing as a private e-mail. Got it? Second, don't send anything by e-mail that you would not want posted on the company bulletin board. If it's safe enough for the bulletin board, it's safe enough for e-mail. Finally, if you are debating whether or not to send something personal by e-mail, either deliver it by hand or send it by snail mail.

Voice Mail Etiquette (4)

Voice mail is this decade's answering machine. It is an efficient way to communicate valuable information. Statistics show that only 70% of phone calls are ever completed on the first try, therefore voice mail is an important communication tool. Here are eight tips to ensure that your voice mail messages are effective and do not create professional problems for you.

- Yes, it's basic, but…don't forget to give your name and phone number.
- Keep messages short and to the point.
- Never leave a harsh or negative message on voice mail. This can lead to major problems. Unlike a conversation the receiver can redirect it to other people.
- Don't record anything that can be misinterpreted or is confidential.
- If you find yourself reading a prepared memo or announcement over the phone stop. It is better to just send the memo out.
- Always be prepared to leave a message. Statistics show that 70% of the time the individual you wish to speak with will not be available.
- Avoid flippant messages, even in jest.
- Remember to check your voice mail at least twice a day, especially if you receive time sensitive messages.
- Don't leave messages from noisy restaurants, parties are bars, background noise can be heard clearly.

4 http://www.minoritycareernet.com/newsltrs/95q3voice.html

American Institute of Chemical Engineers (AIChE) Code of Ethics

Members of the American Institute of Chemical Engineers shall uphold and advance the integrity, honor, and dignity of the engineering profession by: being honest and impartial, and serving with fidelity their employers, their client, and the public; striving to increase the competence and prestige of the engineering profession; and using their knowledge and skill for the enhancement of human welfare.

To achieve these goals, members shall:

1. Hold paramount the safety, health and welfare of the public in performance of their professional duties.
2. Formally advise their employers or clients (and consider further disclosure, if warranted) if they perceive that a consequence of their duties will adversely affect the present or future health or safety of their colleagues or the public.
3. Accept responsibility for their actions and recognize the contributions of others; seek critical review of their work and offer objective criticism of the work of others.
4. Issue statements or present information only in an objective and truthful manner.
5. Act in professional matters for each employer or client as faithful agents or trustees, and avoid conflicts of interest.
6. Treat all colleagues and coworkers fairly, recognizing their unique contributions and capabilities.
7. Perform professional services only in areas of their services.
8. Build their professional reputations on the merits of their services.
9. Continue their professional development throughout their careers, and provide opportunities for the professional development of those under their supervision.

RESUMES AND COVER LETTERS

Characteristics of a resume that gets results

- Professional in appearance
- Clear, concise, and well-organized
- One page preferred, two pages only if extensive work experience
- White or off-white paper
- 10-12 pt. font size
- Tailored for the organization or position
- Career-related projects, skills, and interests
- Relevant paid and unpaid experiences
- Demonstrated accomplishments
- Involvement on campus or in the community

RESUME TIPS (5)

- **CONTACT INFORMATION:** Don't forget to list a reliable email address and phone number, and include you're your school address and permanent home address. Some employers may need to contact you after you leave campus for a summer position. Note: if you don't use your unity email address, make sure that your personal email address sounds professional (see electronic etiquette article, above) and have a professional message on your voicemail.
- **What's the FASTEST way to improve a resume?** Remove everything that starts with "responsibilities included ..." and replace it with on-the-job ACCOMPLISHMENTS.
- **What the COMMONEST MISTAKE made by resume writers?** Leaving out their Job Objective! (Equivalent to: Somebody knocks on your door. You open it and say, "Hello, what do you want?" They say, "Duh ...")
- **What's the FIRST STEP in writing a resume?** Decide on a job target (or "job objective") that can be stated in about 5 or 6 words. Anything beyond that is "fluff" and indicates lack of clarity and direction.
- **HOW FAR BACK should you go in your Work History?** Far enough; and not TOO far. College students should list high school work experience, but the high school items will probably drop off after college graduation.
- **Don't include "Hobbies" on a resume…**UNLESS the activity is somehow relevant to your job objective. OR it clearly reveals a characteristic that supports your job objective. (A hobby of Sky Diving (adventure, courage) might seem relevant to some job objectives (Security Guard?) but not to others.)
- **Employers HATE parchment paper and pretentious brochure-folded resume "presentations."** They think they're phony, and toss them out.
- **Don't fold a laser-printed resume right along a line of text.** The "ink" could flake off along the fold.
- **What if you don't have any EXPERIENCE in the kind of work you want to do?** GET SOME! Find a place that will let you do some VOLUNTEER work right away. You only need a brief, concentrated period of volunteer training (for example, 1 day/week for a month) to have at least SOME experience to put on your resume. Also, look at some of the volunteer work you've done in the past and see if any of THAT helps document some skills you'll need for your new

5 http://jobstar.org/tools/resume/yana24.php

job.

- **What if you have GAPS in your work experience?** You could start by LOOKING at it differently. If you were doing ANYTHING valuable (though unpaid) during those so-called "gaps," you could just insert THAT into the work-history section of your resume to fill the hole--for example: "1993-95 Full-time parent" or "1992-94 Maternity leave and family management" or "Travel and study," or "Full-time student," or, "Parenting plus community service."
- **What if you have a fragmented, scrambled-up work history, with lots of short-term jobs?** To minimize the job-hopper image, combine several similar jobs into one "chunk," for example:
  1993-1995 Secretary/receptionist - Jones Bakery; Micro Corp.; Carter Jewelers.
  OR
  1993-95 Waiter/Busboy - McDougal's Restaurant; Burger-King; Traders Coffee Shop.
  ALSO you can just DROP some of the less-important or briefest jobs. But DON'T drop a job, even when it lasted a short time, if that was where you acquired important skills or experience.
- **Students can make their resume look neater by listing seasonal jobs very simply.** Use something such as "Spring 2006" or "Summer 2006" rather than 6/06 to 9/06. (The word "Spring" can be in very tiny letters, say 8-point in size.)
- **What if your job title doesn't reflect your actual level of responsibility?** When you list it on the resume, either REPLACE it with a more appropriate job title (say "Office Manager" instead of "Administrative Assistant" if that's more realistic) OR use "their" job title AND your fairer one together "Administrative Assistant (Office Manager)".
- **Got your degree from a different country?** You can say: "Degree equivalent to U.S. Bachelor's Degree in Economics; Tehran, Iran."
- **What if you don't have your degree yet?** You can say "BS Degree in Chemical Engineering, expected date May, 2009."
- **What if you have several different job objectives you're working on at the same time?** Or you haven't narrowed it down yet to just one job target? Write a different resume for EACH different job target. A targeted resume is much, much stronger than a generic resume.
- **Want to impress an employer?** Fill your resume with "PAR" statements. PAR stands for Problem-Action-Results, in other words, first you state the problem that existed in your workplace, then you describe what YOU did about it, and finally you point out the beneficial results.
    - Here's an example:
        - "Transformed a disorganized, inefficient warehouse into a smooth-running operation by totally redesigning the layout; this saved the company $250,000 in recovered stock."
    - Another Example:
        - "Improved an engineering company's obsolete filing system by developing a simple but sophisticated functional-coding system. This saved time and money by recovering valuable, previously lost, project records."
- **What if you never had any "real" paid mainstream jobs - just self-employment or odd jobs?** Give yourself credit, and create an accurate, fair job-title for yourself. For example, "A&S Hauling & Cleaning (self-employed)" or "Household Repairman--Self-employed," or "Child-Care--Self-employed." Be sure to add "Customer references available on request" and then be prepared to provide some very good references of people you worked for.

TIPS ON COVER LETTERS (6)

Who Needs a Cover Letter?

Everyone who sends out a resume does! Even if the cover letter never "came up" in conversation or wasn't mentioned in an advertisement, it's expected that you will write one. It is regarded as a sign of laziness (sorry about that) to send out a cover letter that is not tailored to the *specific* company. In the days before word processors, you could *maybe* get away with it. Not anymore.

Yes, it adds to the wear and tear of looking for a job! But the good news is: the cover letter gives you **another** chance to emphasize what you have to contribute to the company or organization. Don't give the person screening the resumes a second to entertain the thought: **"But how can this person help US?"** Your cover letter will answer that question in your own words. Your resume will also answer that question but in a somewhat more rigid format.

What makes a *Good* Cover Letter?

1. **No spelling or typing errors.** Not even one.

2. **Address it to the person who can hire you.** Resumes sent to the personnel department have a tougher time of it. If you can find out (through networking and researching) exactly who is making the hiring decision, address the letter to that person. Be sure the name is spelled correctly and the title is correct. A touch of formality is good too: address the person as "Mr.," "Ms.," "Mrs.," "Miss," "Dr.," or "Professor." (Yes, life is complicated.)

3. **Write it in your own words** so that it sounds like you--not like something out of a book. Employers are looking for knowledge, enthusiasm, focus.

4. **Being "natural" makes many people nervous.** And then even **more** nervous because they are trying to avoid spelling errors and grammatical mistakes. If you need a little help with grammar (do they still teach grammar?)--check out the classic work on simple writing, Strunk & White's **Elements of Style**, published in 1918 and now online. A good place to begin is "Chapter 5: Words and Expressions Commonly Misused."

5. **Show that you know something about the company and the industry.** This is where your research comes in. Don't go overboard--just make it clear that you didn't pick this company out of the phone book. You know who they are, what they do and *you* have chosen them!

6. **Use terms and phrases that are meaningful to the employer.** (This is where your industry research and networking come in.) If you are applying for an advertised position, use the requirements in the ad and put them in **BOLD** type. For example: the ad says--

   *"2 years' experience processing magnetic media (cartridge, tape, disc); interface with benefit plan design, contracts and claims**;** and business background with strong analytical & technical skills--dBase, Excel, R&R, SQL."*

Make sure your cover letter contains each of these requirements and shows how you measure up.

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6 http://jobstar.org/tools/resume/cletters.php

INTERVIEW TIPS FOR STUDENTS (7)

What to Expect in a Typical On-Campus Interview

- Interviews are usually 30 minutes in length – arrive 10 minutes early so the interview can begin promptly.
- The interviewer will usually spend a few minutes at the beginning introducing himself/herself and giving some information about the company and job openings – it is fine for you to take notes.
- The interviewer will ask questions based on the student's resume – he/she will want to hear specific examples of behaviors from past experiences, not hypothetical or vague answers.
- Time will be left at the end for your questions – be sure to have specific questions about the job openings or location, etc.
- If you want to highlight or point out something you've accomplished that didn't come out in the interview, mention it to the interviewer at the end if there is time.
- Ask for the interviewer's business card if he/she hasn't already given you one.

Do's and Don'ts

- Answer questions honestly, thoroughly, and sincerely – if you don't know the answer, indicate that.
- Do not try to tell the interviewer what you think he/she wants to hear.
- Don't be afraid to discuss your successes and most positive traits.
- Be careful about saying negative things about past experiences (e.g. insult a company that you interned with).
- Don't display a negative or arrogant attitude.
- Be polite, tactful, and sincere – eye contact is also important.
- Be neatly and appropriately dressed in professional business attire (conservative, not trendy).
- Do not be late unless there is an emergency!

How to Prepare Ahead of Time

- Confirm the date, time, and location for your interview with Career Services or via their online information.
- Review the company's website and any literature you've obtained – know the latest "news" about the company.
- Talk to any students on campus that has interned/co-oped with the company (Career Services or the co-op office can tell you).
- Generate quality questions to ask about the company based on what you've read and heard – don't just ask questions for the sake of asking them – make them count.
- Review your resume again to make sure everything is accurate and that you're prepared to answer any questions pertaining to it.
- If for any reason you must cancel or withdraw from an interview, contact the company and/or Career Services promptly – don't be a "no-show".
- If the company needs an employment application or other forms filled out before the interview, do this as soon as you receive them and submit them by the deadline.

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7 www.eastman.com

- Find out whether you need to bring your transcripts to the interview (Career Services should be able to tell you).
- Even though the interviewer already has your resume, bring an extra copy to the interview just in case he/she needs another one.

Follow-up

- Email or write a "thank-you" note to the interviewer – email is perfectly acceptable.
- Provide the interviewer with updated contact information if it's changed since you last communicated with him/her.
- If you are receiving other offers/have deadlines and need to hear back from the company, contact the interviewer to get an updated status and explain your timeframe.
- If you think of any questions that you forgot to ask during the interview, don't hesitate to email them to the interviewer!

Final Notes

Many companies have a team that will be responsible for 'researching' information on candidates via phone screens, Facebook, MySpace, etc. Depending on the subject matter, it is safe to say that the impact could play a role in whether or not someone is viewed as being the type of employee we would want on our team. Pictures of groups, outings, friends, etc. - all well and good. Those that would probably not be so helpful - well, we know what those look like.

Last Spring we had a group of candidates that were on a plant tour, and a couple of the candidates let their guard down and were trying to be either funny or the center of attention, not realizing that the tour guide provided input to the interview team. This behavior was viewed as immature and not someone that we would want to hire. Students should realize that their interactions with Company employees, be it the assistant that makes and confirms their travel plans, to the Staffing Reps, to the dinner hosts, all the way up to the Hiring Manager, are constantly trying to make a hiring decision given a short amount of time with the candidate . Their interactions with all of these people add up to an impression. Even the company's drivers who take you to and from the airport provide feedback.

INTERVIEW PREP SHEET (8)

This is a document you prepare before important interviews. It is a personal briefing to you, from you. It helps you remember key facts, such as your major accomplishments, and serious questions or concerns. You don't read from the sheet, but you do keep it handy, and if convenient, you may want to review it as your interview is ending to be certain you didn't forget anything critical.

Day and Date:

Meeting With:

Name
Title
Company
City, State Zip
Telephone
FAX
Mobile/Pager
E-mail

Major Accomplishments:

1.
2.
3.
4.
5.
6.

My Work Style:

1.
2.
3.
4.
5.
6.

Things You Need to Know About Me:

1.
2.
3.
4.

Answers to Difficult Questions:

1.
2.
3.
4.

8 http://www.careerlab.com/art_cheatsheet.htm

My Strengths/Weaknesses:

1.
2.
3.

Questions to Ask Interviewer:

1.
2.
3.
4.
5.
6.

Things I Can Do For You:

1.
2.
3.
4.
5.
6.

INTERVIEW CHECKLIST (9http://niefs.net/intvw_b.htm)

Preparation - Two to three days before the interview

- ☐ I have collected information about the business.
- ☐ I know the first and last name of the person(s) who will be interviewing me.
- ☐ I know why I want to work for this company.
- ☐ I have prepared some answers to common interview questions. I know how I am going to answer these questions and/or I have created a cheat sheet.
- ☐ I have prepared a list of questions that I would like to ask the interviewer.
- ☐ I have an up-to-date resume with complete references ready to take to the interview.
- ☐ I know exactly where the interview will take place and how long it will take me to get there.
- ☐ I have decided what to wear to the interview.
- ☐ I have scheduled a full night's sleep before the interview.

The Day of the Interview

- ☐ I have a copy of my resume and names of my references.
- ☐ I have paper and pen for notes.
- ☐ I have my cheat sheet and/or my list of questions.
- ☐ I have paid special attention to personal hygiene and my choice of clothing.

The Interview - Travel time and Arrival

- ☐ I am leaving early in case of traffic jams or unforeseen problems. I do not arrive more then 10 minutes early.
- ☐ I am relaxed, friendly and business-like with everyone I meet.
- ☐ I introduce myself to the receptionist, and confirm my appointment.

The Interview - Setting the scene

- ☐ I greet the interviewer by name and shake their hand.
- ☐ I maintain positive body language. e.g. I don't cross my arms and I maintain eye contact

The Interview - Exchanging Information

☐ I stay on topic and ask for clarification where necessary and when appropriate.

☐ I use specific examples rather than general statements when giving information about my education, training, transferable skills, and work experience.

The Interview - Conclusion

☐ I ask any suitable questions that have not already been answered.

☐ I summarize, with enthusiasm, my interest in the position and the business.

☐ I state my appreciation for the interview.

☐ I confirm, if already noted, their response date. If this date is not definite, I make arrangements to contact them.

☐ I shake hands if appropriate and say goodbye.

Interview - Follow-up

☐ I keep my cell phone with me the day they said they would call.

☐ If I have arranged to call them back on a certain date, I make sure that I have reviewed my telephone protocol.

☐ I write and send the interviewer(s) a thank-you letter.

☐ If offered a position I give them a written answer (whether it be to accept or to decline) within the week, or by their stated deadline.

EXAMPLES OF INTERVIEW QUESTIONS (10)

Samples of Traditional Interview Questions

- Tell me about yourself.
- What are your strengths and weaknesses?
- What kind of work environment do you like best?
- Why did you apply for this job?
- What jobs have you enjoyed the most? The least? Why?
- What have you done that shows initiative and willingness to work?
- What are your short-range and long-range goals?
- Why did you choose your area of study?
- Do you prefer working with others or by yourself?
- What do you know about our company?
- What qualifications do you have that make you think that you will be successful?
- What have you learned from participation in extracurricular activities?
- What academic subjects do you like the best? Least?

Samples of Behavior Description Interview Questions

- Give me an example of a time when you did more than was required in your job. What was the result?
- Describe the most stressful situation you have encountered. How did you handle it? What was the outcome?
- How do you set priorities?
- Describe a situation where you wished that you had behaved differently. What was the outcome?
- We've all had to work with someone who was difficult. Tell me about the most difficult situation that you have experienced and how you handled it. What was the result?
- How do you define doing a good job?
- Tell me about a time when you did not meet your own standards of performance. What did you do to change that?
- Tell me about the most enjoyable job you've had. What was there about it that made you feel this way?
- Describe a position where you felt that you learned a lot. What advantage was that to you? How have you used those skills?
- Describe the ideal job for you. What tasks would be required?
- Tell me about a situation that occurred as a result of a lack of communication.
- Have you ever had to rely on information given verbally in order to carry out your task? Give some examples. Did this ever cause a problem?
- Describe a situation where you had to change your work plan very quickly in order to accommodate a more urgent situation. How did you feel about that?
- Do you find yourself taking charge of situations? How?

10 http://coopcommunity.sfu.ca/index.php?module=ContentExpress&file=index&func=display&ceid=260&meid=277

Tips for Students on Attending Career Fairs

Why You Should Attend

- Provides an opportunity to meet and interact with a large number of companies at one time
- Provides an opportunity to market your knowledge, skills, and abilities to a targeted group of employers
- You will be able to meet and talk to people who already work for the companies you are interested in
- Contacts as career fairs can serve as a starting point for you to develop relationships with companies

What Companies are Looking For

- Solid GPA
- Relevant work experience (co-op/internship)
- Strong communication skills
- Demonstrated leadership abilities
- Involvement in extra-curricular activities
- Track record of achievement

What to Expect

- Spend significant time at the event
- Pace yourself
- Distribute a large number of résumés
- Manage what you carry

Preparation Checklist

- Visit Career Services website & office
- Know your target companies
- Buy the proper attire
- Rehearse your introduction
- Create a polished résumé(s)
- Develop a plan for follow-up

Do Your Homework

- Know which companies are attending
- Know which companies <u>are</u> hiring your major
- Know which companies <u>are not</u> hiring your major
- Prepare for a career fair as if you were going to an interview

What to Wear

- Two-piece matched business suit
- Navy, black, or dark gray
- Pants or skirt acceptable for females
- Conservative blouse for females/conservative tie for males
- Comfortable shoes

Introduction

- Be proactive if the recruiter doesn't start the conversation
- Tell the recruiter your name, class, major, and type of position you're seeking
- Practice – but don't sound like you're reading a script

Follow-up

- Follow-up within 48 hours with recruiters from companies you are interested in
- Email or handwrite a thank-you note
- Customize your note to each recruiter, drawing on some memorable aspect of your conversation
- Ask a follow-up question

USEFUL WEB SITES

http://www.che.ncsu.edu/	NCSU CHE Department
http://registrar.ncsu.edu/	Records and Registration
https://www.acs.ncsu.edu/scripts/ugadmiss/trnsfcrs.pl	Course Equivalency Database
http://www.engr.ncsu.edu/	COE Degree Info
http://www.ncsu.edu/co-op_ed/	Co-op Program
http://careers.ncsu.edu/	Career Center
http://www2.ncsu.edu/ncsu/stud_affairs/study_abroad/	Study Abroad Program
http://studyabroad.ncsu.edu/	On-Campus Tutoring
http://fll.chass.ncsu.edu/academics/placement.php	Foreign Language Requirement
http://registrar.ncsu.edu/academic-resources/graduation/	NCSU Graduation Information
http://www.gre.org/	GRE Information
http://www.mba.com/us	GMAT Information
http://hpac.dasa.ncsu.edu/	Pre-med Information
http://studentconduct.ncsu.edu/	Office of Student Conduct
http://registrar.ncsu.edu/faq/transcript.html	Transcript Request Form
http://www.ncsu.edu/provost/ugcat/front/index.htm	Undergraduate Catalog
http://www2.acs.ncsu.edu/reg_records/crs_cat/directory.html	Course Catalog
http://www.nsf.gov/crssprgm/reu/	NSF Research for Undergrads
http://www.aiche.org/careers/	Careers in CHE
http://www.ncbels.org/	NC Engineering Board (FE Exam)
http://csleps.dasa.ncsu.edu/	Center for Student Leadership, Ethics, & Public Service
http://www.graduatingengineer.com/	Graduating Engineer magazine
http://www.careerkey.org/	Career Key
http://maps.ncsu.edu/#/	NCSU Campus Map
http://www.aiche.org/	AIChE (National)
http://ncsu.orgsync.com/org/aiche/	AIChE (NCSU Student Chapter)