Master of Science
in Chemical Engineering Program

Department of Chemical Engineering

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http://cheme.columbia.edu/master-science-chemical-engineering

Facebook: http://www.facebook.com/cuseas
Twitter: @CUSEAS http://www.twitter.com/cuseas

Instagram: http://instagram.com/columbiaengineering

YouTube: http://www.youtube.com/columbiaseas

COLUMBIA ENGINEERING
The Fu Foundation School of Engineering and Applied Science
... in the Fu Foundation School of Engineering and Applied Science
Columbia University...
... in the City of New York

... “An ever heightening sky for human thought, an ever widening horizon for human knowledge, and absolute truthfulness in the expression of the light within, these are the distinguishing marks of a great university.”

Seth Low, Columbia University President, 1890

(2016 Holiday Card from Columbia University President Lee C. Bollinger)
Outline

- Introduction
- Background and History
- The Chemical Engineering Profession
- Academic Integrity
- Master of Science in Chemical Engineering
  - Goal
  - Time to complete
  - Core Courses
  - Program for Student with BS in ChemE
  - Program for Student without a BS in ChemE - Scientist to Engineer (S2E)
  - Technical Electives
  - Department Colloquium
  - MS Colloquium
  - Advising
  - Applying for Ph.D.
  - Faculty and Staff
  - Research
  - Columbia ChemE Grad Student Life and NYC
  - Employers
  - Housing
  - Questions

- How long does it take to complete the degree?
- What courses must I take?
- What elective courses may I take?
- What colloquium course must I attend?
- How does advising work?
Background- “What exactly does a chemical engineer do?”

“... they use science and mathematics, especially chemistry, biochemistry, applied mathematics and engineering principles, to take laboratory or conceptual ideas and turn them into value added products in a cost effective, safe (including environmental) and cutting edge process. From the development of smaller, faster computer chips to innovations in recycling, treating disease, cleaning water, and generating energy, the processes and products that chemical engineers have helped create touch every aspect of our lives.”

(http://www.aiche.org/resources/careers/career-faqs#cheme accessed 9 Oct 2014)
Background- chemical engineers...

“Design chemical plant equipment and devise processes for manufacturing chemicals and products, such as gasoline, synthetic rubber, plastics, detergents, cement, paper, and pulp, by applying principles and technology of chemistry, physics, and engineering.”

Sample of reported job titles: Process Engineer, Chemical Engineer, Engineer, Scientist, Project Engineer, Development Engineer, Engineering Scientist, Process Control Engineer, Process Development Engineer, Refinery Process Engineer

"Give me lever long enough and somewhere to stand and I will move the world." Archimedes (287-212 B.C.)

Columbia Engineering Mission Statement

“Columbia Engineering, The Fu Foundation School of Engineering and Applied Science at Columbia University in the City of New York, prepares talented students to become innovative, socially responsible leaders in industry, government, and academia. Our education is grounded in the fundamental principles and creative approaches of engineering, while being critically informed by the broader perspective of a distinguished liberal arts education. This interdisciplinary education mission is enriched by a research endeavor focused on expanding the knowledge base of engineering and creating technological solutions that serve society. Columbia students, faculty, and alumni strive to improve the human condition locally, nationally, and globally with their enthusiasm to learn, to question, and to solve some of the world’s most pressing current and future challenges.”

Engineers “...discover, invent, innovate, create...”
The School of Engineering and Applied Science was founded in 1864 as the School of Mines. (2014 was the 150th celebration)

The School was named in 1997 in recognition of Z.Y. Fu, a major benefactor.

In the forefront of collaborative research and teaching Columbia engineers invented the FM radio, long distance telephony, mass production of antibiotics and the first robots and changed transportation with steam engines, railroads, the Panama Canal, and NYC subways.
The Department of Chemical Engineering founded in 1905 (110th anniversary in 2015) largely due to Professor Charles Frederick Chandler.

“…Electrochemistry, Polymers, Bioengineering… Materials, Energy, Environment, Data Sciences…”

“The Mission of the Department of Chemical Engineering at Columbia University is to provide an outstanding academic and research experience to students to prepare them to meet the needs and challenges of the 21st century.”


Professor Elmer Gaden
“Father of Biochemical Engineering”

(Gryte, Carl C. Chemical Engineering at Columbia, Chem Eng Education, ASEE 2006)
(Kumar, Sanat, Dept of Chemical Engineering Alumni Newsletter 2011-2012)
Consider being a part of the Chemical Engineering Profession and your Professional Reputation

(http://www.aiche.org/community/sites/committees/young-professionals accessed 21 Jan 2016)

Consider joining the professional organizations listed on this slide.

Be a part of the Chemical Engineering Profession and your professional reputation

Members of AIChE are expected to uphold the AIChE code of ethics.

The 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 clients, and the public;
- Striving to increase the competence and prestige of the engineering profession;
- Using their knowledge and skill for the enhancement of human welfare.

To achieve these goals, Members shall:

- Hold paramount the safety, health and welfare of the public and protect the environment in performance of their professional duties.
- 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.

- Accept responsibility for their actions, seek and heed critical review of their work and offer objective criticism of the work of others.
- Issue statements or present information only in an objective and truthful manner.
- Act in professional matters for each employer or client as faithful agents or trustees, avoiding conflicts of interest and never breaching confidentiality.
- Treat fairly and respectfully all colleagues and co-workers, recognizing their unique contributions and capabilities.
- Perform professional services only in areas of their competence.
- Build their professional reputations on the merits of their services.
- Continue their professional development throughout their careers, and provide opportunities for the professional development of those under their supervision.
- Never tolerate harassment.
- Conduct themselves in a fair, honorable and respectful manner.

Source: www.aiche.org/about/code-ethics

“R.S.V.P.”

Better to cancel than to be a “no show”.

Quebec Bridge Disaster -- 11 September 1916

“The Quebec Bridge collapsed on 11 September 1916 a second time due to poor design work and materials. The bridge, which was conceived to be one of the most advanced in the world, had already collapsed under similar circumstances in 1907. Eighty-five workers perished in that tragedy prompting a Dominion Royal Commission to investigate the catastrophic failure. The findings of the Commission placed the failure solely on the engineer design and management of the project. To this day, all graduating engineers from Canadian universities receive iron rings to remind them of this event and the social responsibility they have in the proper design and execution of projects.”

The Engineering Profession and Academic Integrity Sources

- National Society of Professional Engineers’ (NSPE) Creed, Adopted Jun 1954
- NSPE provided rights to U.S. Army Engineers to use NSPE Creed, 9 Oct 2013
- Order of the Engineer “Upholding Devotion to the Standards and Dignity of the Engineering Profession” since Jun 1970
- Columbia Engineering Graduate Student Affairs

The Engineering Profession

Engineers' Creed

“As a Professional Engineer, I dedicate my professional knowledge and skill to the advancement and betterment of human welfare. I pledge: To give the utmost of performance; To participate in none but honest enterprise; To live and work according to the laws of man and the highest standards of professional conduct; To place service before profit, the honor and standing of the profession before personal advantage, and the public welfare above all other considerations.

In humility and with need for Divine Guidance, I make this pledge.”

Adopted by National Society of Professional Engineers, June 1954  See more at:

(http://www.order-of-the-engineer.org/?page_id=6 23 Nov 2014)
The Engineering Profession

Order of the Engineer Obligation

“"I am an Engineer. In my profession I take deep pride. To it, I owe solemn obligations.

Since the Stone Age, human progress has been spurred by the engineering genius. Engineers have made usable nature’s vast resources of material and energy for Humanity’s [Mankind’s] benefit. Engineers have vitalized and turned to practical use the principles of science and the means of technology. Were it not for this heritage of accumulated experience, my efforts would be feeble.

As an Engineer, I pledge to practice integrity and fair dealing, tolerance and respect, and to uphold devotion to the standards and the dignity of my profession, conscious always that my skill carries with it the obligation to serve humanity by making the best use of Earth’s precious wealth.

As an Engineer, [in humility and with the need for Divine guidance,] I shall participate in none but honest enterprises. When needed, my skill and knowledge shall be given without reservation for the public good. In the performance of duty and in fidelity to my profession, I shall give the utmost.”

Note: Brackets indicate the original wording of the Obligation.
Either wording is acceptable, but new certificates have the newer wording.

(www.nspe.org/resources/ethics/code-ethics/engineers-creed accessed 20 Nov 2014)
(www.order-of-the-engineer.org/?page_id=6 23 Nov 2014)
Academic Integrity

Student Conduct

“The continuance of each student upon the rolls of the University, the receipt of academic credits, graduation, and the conferring of the degree are strictly subject to the disciplinary powers of the University.

Although ultimate authority on matters of student discipline is vested in the Trustees of the University, the Dean of the School and his staff are given responsibility for establishing certain standards of behavior for Columbia Engineering students beyond the regulations included in the Statutes of the University and for defining procedures by which discipline will be administered.

We expect that in and out of the classroom, on and off campus, each student in the School will act in an honest way and will respect the rights of others.”

“Academic integrity defines a university and is essential to the mission of education. At Columbia students are expected to participate in an academic community that honors intellectual work and respects its origins. In particular, the abilities to synthesize information and produce original work are key components in the learning process. As such, a violation of academic integrity is one of the most serious offenses a student can commit at Columbia and can result in dismissal.

Students rarely set out with the intent of engaging in violations of academic integrity. But classes are challenging at Columbia, and students will often find themselves pressed for time, unprepared for an assignment or exam, or feeling that the risk of earning a poor grade outweighs the need to be thorough.

Such circumstances lead some students to behave in a manner that compromises the integrity of the academic community, disrespects their instructors and classmates, and deprives them of an opportunity to learn.

In short, they cheat. Students who find themselves in such circumstances should immediately contact their instructor and adviser for advice.”
Academic Integrity

What constitutes a breach in academic integrity?

- The following are the most common breaches of academic integrity. When in doubt, ask a professor if you’re unsure if you are breaching academic integrity:
  - Cheating (of any kind)
  - Representing someone else’s work as your own
  - Not giving appropriate credit (citations) of someone else’s work
  - Collaborating on work when permission was not granted
  - Utilizing library or internet sources without giving credit
  - Using a previous assignment or paper from another class or course
  - Selling notes, exam answers or papers
  - Using some else's papers or assignments as your own

[http://gradengineering.columbia.edu/academic-integrity-1](http://gradengineering.columbia.edu/academic-integrity-1) 23 Nov 2014
Academic Integrity

• “Plagiarism and Acknowledgment of Sources

Columbia has always believed that writing effectively is one of the most important goals a college student can achieve. Students will be asked to do a great deal of written work while at Columbia: term papers, seminar and laboratory reports, and analytic essays of different lengths. These papers play a major role in course performance, but more important, they play a major role in intellectual development. **Plagiarism, the use of words, phrases, or ideas belonging to another, without properly citing or acknowledging the source, is considered one of the most serious violations of academic integrity and is a growing problem on university campuses.**”

One of the most prevalent forms of plagiarism involves students using information from the Internet without proper citation. While the Internet can provide a wealth of information, sources obtained from the web must be properly cited just like any other source. If you are uncertain how to properly cite a source of information that is not your own, whether from the Internet or elsewhere, it is critical that you do not hand in your work until you have learned the proper way to use in-text references, footnotes, and bibliographies. Faculty members are available to help as questions arise about proper citations, references, and the appropriateness of group work on assignments. You can also check with the Undergraduate Writing Program. Ignorance of proper citation methods does not exonerate one from responsibility.

Academic Integrity

“Plagiarism and Acknowledgment of Sources (continued)

- Intentional
- Use others’ intellectual work without quotation or reference to the source:
  - Type I: Direct Copy & Paste
  - Type II: Small Modification by Word Switch
  - Type III: Use Others’ Reasoning Style
  - Type IV: Use Others’ Metaphor
  - Type V: Use Others’ Idea

  - [http://www.valdosta.edu/~cbarnbau/personal/teaching_MISC/plagiarism.htm](http://www.valdosta.edu/~cbarnbau/personal/teaching_MISC/plagiarism.htm) accessed 16 Dec 2014

- Examples may be found at the link below:

"Plagiarism and Acknowledgment of Sources (continued)"

Unintentional

Unintentional plagiarism is plagiarism that results from the disregard for proper scholarly procedures. Examples of Unintentional Plagiarism:

- Failure to cite a source that is not common knowledge.
- Failure to "quote" or block quote author's exact words, even if documented.
- Failure to put a paraphrase in your own words, even if documented.
- Failure to put a summary in your own words, even if documented.
- Failure to be loyal to a source.

"Plagiarism Tutorial. ” Duke University.

https://plagiarism.duke.edu/unintent/

(http://library.columbia.edu/subject-guides/social-sciences/plagiarism.html accessed 16 Dec 2014)
Academic Integrity

Common Knowledge and Facts

• “Common knowledge” does not need to provide citation if:
  • An average educated person knows it;
  • It is easy to look up;
  • It can be found from multiple sources.

Example: HIV is the human immunodeficiency virus that causes AIDS.

• “Facts” that do not open to contention do not need to provide citation.

Example: United States of America has 50 states and 1 district.

• Note: ”Common Knowledge” in one academic area might not be “common” for outsiders, so when you are not sure, cite to be safe or ask your professor for help.

(http://library.columbia.edu/subject-guides/social-sciences/plagiarism.html accessed 16 Dec 2014)
Documentation with “EndNote” a helpful resource available to Columbia Students

EndNote allows users to search, retrieve and store citations from bibliographic databases such as ABI Inform, the Web of Science, Anthropological Literature, the MLA bibliography, or the catalogs of individual libraries. It can generate bibliographies, reading lists, and footnotes in a wide variety of styles, and because it links directly to word-processing programs such as Microsoft Word and WordPerfect, the software enables users to add and format citations to papers as they write.

The Columbia University Libraries purchased an EndNote site license for the Columbia community. You can download the program for free.

Academic Integrity

What are the ramifications of a breach in academic integrity?

Students who violate codes of academic integrity can face academic consequences in the course at the faculty level, department level, and at the school’s level. The following are some common ramifications:

- “F” grade for the paper/exam/assignment in question
- “F” grade for the course
- Documentation at the Department Level
- Academic File Documentation
- Warning
- Probation
- Dismissal
- Academic Probation for Term(s)
- Academic Dismissal from Columbia University

[Accessed 23 Nov 2014]

[Accessed 23 Nov 2014]
MS in Chemical Engineering


- Concentrations in:
  - Science and Engineering of Polymers and Soft Materials
  - Biophysics and Soft Matter Physics
  - Genomic Engineering
  - Bioinductive and Biomimetic Materials
  - Interfacial Engineering and Electrochemistry
### *Columbia Chemical Engineering MS Program*

<table>
<thead>
<tr>
<th>Fall 2017</th>
<th>Spring 2018</th>
<th>Summer 2018</th>
<th>Fall 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep- Dec 17</td>
<td>Jan- May 18</td>
<td>Jun- Aug 18</td>
<td>Sep- Dec 18</td>
</tr>
<tr>
<td><strong>Core</strong></td>
<td><strong>Technical Electives</strong></td>
<td><strong>Time for Summer Internships</strong></td>
<td><strong>Core MS Course</strong></td>
</tr>
<tr>
<td><strong>Scientist to Engineer (S2E) Fundamentals</strong></td>
<td><strong>Elective</strong></td>
<td><strong>Time for Research</strong></td>
<td><strong>Elective</strong></td>
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<tr>
<td><strong>MS Colloquium</strong></td>
<td><strong>Core MS Course</strong></td>
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<td><strong>Elective</strong></td>
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</tbody>
</table>

Note: Scientist to Engineer, “S2E”, students must select 1 course with substantial design content.

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</tr>
</tbody>
</table>

1. Core
2. Scientist to Engineer (S2E) Fundamentals
3. Technical Electives
4. MS Colloquium
5. Research
6. Career Placement

**Goal:** MS in Chemical Engineering active in the job market

MS Degree Requirements: 30 credits beyond BS in chemical engineering
12 credits: graduate core, 18 credits: technical electives
Thesis not required, but Master's Research may be included in the electives.

(Columbia Directory of Classes- http://www.columbia.edu/cu/bulletin/uwb/)
MS in Chemical Engineering Graduate Degree Application and Conferral

All MS Students must apply for their degree based on the deadline requirements listed at the Columbia University Office of the Registrar Degree Application Web Site: http://registrar.columbia.edu/content/graduation-and-diplomas/

Example: In order to complete your studies in **December 2018** and have the degree conferred in **February 2019**, an MS in Chemical Engineering Student must apply at the before mentioned web site not later than **1 November 2018**. See the web site for a specific deadline. If you do not apply for the degree, you will not be approved to graduate.

You must apply for the degree. You will be notified by the department if something is **wrong with your status**. **Degree Audit Reports (DARs) can be inaccurate.** Go with the word from the Chemical Engineering Department and be on your way to degree success.

Refer all other matters about graduation to GSA, see http://gradengineering.columbia.edu/graduation-1 And https://www.cc-seas.columbia.edu/gradzone
Example Graduate Core Courses

CHEN E4235x  Surface Reactions & Kinetics
CHEN E4110x  Transport Phenomena III
CHEN E4010x  Math Methods in Chem Eng
CHEN E4130x  Advanced Chem Eng Thermo
or:
CHAP E4120x  Statistical Mechanics

CHEN E4330y  Advanced Chemical Kinetics
CHEN E4110y  Transport Phenomena III
CHEN E4010y  Math Methods in Chem Eng

Note: x indicates Fall, y indicates Spring
Typical Program
(Students with a BS in ChE)

Fall, Year 1
CHAP E4120x (Stat Mech)
CHEN E4010x (Math Methods)
technical elective
technical elective
CHEN E9001 MS Colloquium

Spring, Year 1
CHEN E4110y (Transport-III)
CHEN E4330y (Adv Kinetics)
technical elective

Fall, Year 2
technical elective
technical elective

CHEN E9001 MS Colloquium is required and 1st year MS students must register for CHEN E9001.
# Possible Program

(Students with a BS in ChE)

## Fall
- CHAP E4120x (Stat Mech)
- CHEN E4010x (Math Methods)
- Technical elective
- Technical elective
- Technical elective
- CHEN E9001 MS Colloquium

## Spring
- CHEN E4110y (Transport-III)
- CHEN E4330y (Adv Kinetics)
- Technical elective
- Technical elective
- Technical elective

CHEN E9001 MS Colloquium is required and 1st year MS students must register for CHEN E9001.
<table>
<thead>
<tr>
<th>UNDERGRADUATE</th>
<th>GRADUATE CORE</th>
<th>GRADUATE ELECTIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MONDAY</td>
<td>TUESDAY</td>
<td>WEDNESDAY</td>
</tr>
<tr>
<td>8:40a - 9:55a</td>
<td>CHEN E4231 Solar Fuels Esposito/West (45)</td>
<td>CHEN E3010 Thermo I Kumar (60)</td>
</tr>
<tr>
<td>10:10a - 11:25a</td>
<td>CHEN E3110 Transport I McNeil (60)</td>
<td>Chemical Engineering Data Analysis Bishop (45)</td>
</tr>
<tr>
<td>11:40a - 12:55p</td>
<td>CHEN E4010 Math Methods Bozic (45)</td>
<td>CHEN E4110 Transport III Durning (45)</td>
</tr>
<tr>
<td>1:10p - 2:25p</td>
<td>CHEN E6543 Res. Meth. Banta (20)</td>
<td>CHEN E4001 Essentials A Banta (45)</td>
</tr>
<tr>
<td>2:40p - 3:55p</td>
<td>CHEN E3020 Analysis West (60)</td>
<td>CHEN E4002 Essential B Banta (45) 1:10pm - 4:00pm Venkat (60)</td>
</tr>
<tr>
<td>4:10p - 5:25p</td>
<td>CHEN E4140 Separations Durning (60)</td>
<td>CHEN E9000 Colloquium 4:00pm - 5:00pm Esposito</td>
</tr>
<tr>
<td>7:00p - 8:00p</td>
<td>CHEN E4020 Protection of Industrial and Intellectual Property Spall (45)</td>
<td>CHAP E4120 Stat Mech O'Shaughnessy (45)</td>
</tr>
<tr>
<td>8:00 - 9:30p</td>
<td>CHEN E4400 Chemical Process Development Mattas (45)</td>
<td>CHEN E4500 Design I Bozic (60)</td>
</tr>
</tbody>
</table>

**Sample CHEN Dept Course Offerings Fall 2017**
# Sample S2E Schedule, Fall 2017

<table>
<thead>
<tr>
<th>Time</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:40a</td>
<td>CHEN E4231 Solar Fuels Esposito/West (45)</td>
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<td>CHEN E3010 Thermo I Kumar (60)</td>
<td>CHEN E4001 &amp; 4002 Essentials A &amp; B 10:00am -11:15am (A) 11:30am -12:45pm (R) Banta</td>
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<tr>
<td>9:55a</td>
<td></td>
<td>CHEN E2100 MEB Banta (60)</td>
<td>CHEN E4235 Surface Rxn and Kinetics Chen (30)</td>
<td>CHEN E2100 MEB Banta (60)</td>
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<td>10:10a</td>
<td>CHEN E3110 Transport I McNeil (60)</td>
<td>CHEN E4110 Transport III Durning (45)</td>
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<td>11:40a</td>
<td>CHEN E4010 Math Methods Bozic (45)</td>
<td>CHEN E4001 Essentials A Banta (45)</td>
<td>CHEN E4500 Design I Bozic (60) 1:00pm - 2:00pm</td>
<td>CHEN E4001 Essentials A Banta (45)</td>
<td>CHEN E4010 Essentials A Banta (45)</td>
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<tr>
<td>12:55p</td>
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<td>CHEN E4300 Controls A 1:00pm - 4:00pm Venkat (60)</td>
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<tr>
<td>1:10p</td>
<td>CHEN E6543 Res. Meth. Banta (20)</td>
<td>CHEN E4402 Essential B Banta (45)</td>
<td>CHEN E3020 Analysis West (60)</td>
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<td>4:10p</td>
<td>CHEN E4140 Separations Durning (60)</td>
<td>CHEN 9000 Colloquium 4:00pm - 5:00pm Esposito</td>
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<td>CHEN E4002 Essential B Banta (45)</td>
</tr>
<tr>
<td>5:25p</td>
<td>CHEN E4140 Separations Durning (60)</td>
<td>CHEN E4850 Contaminant Site Clean Up (35) 4:10pm - 6:40pm Tsiamis</td>
<td>CHEN 9000 Colloquium 4:00pm - 5:00pm Esposito</td>
<td>CHEN E4140 Separations Durning (60)</td>
<td>CHEN E4300 Essentials A Banta (45)</td>
</tr>
<tr>
<td>5:40p</td>
<td>CHEN E4660 Biochem. Eng. Obermeyer (45)</td>
<td>CHEN 9000 Colloquium 4:00pm - 5:00pm Esposito</td>
<td>CHEN E4660 Biochem. Eng. Obermeyer (45)</td>
<td>CHEN 9000 Colloquium 4:00pm - 5:00pm Esposito</td>
<td>CHEN E4300 Essentials A Banta (45)</td>
</tr>
<tr>
<td>6:55p</td>
<td>CHEN E4020 Protection of Industrial and Intellectual Property Spall (45)</td>
<td>CHEN 9000 Colloquium 4:00pm - 5:00pm Esposito</td>
<td>CHEN E4660 Biochem. Eng. Obermeyer (45)</td>
<td>CHEN 9000 Colloquium 4:00pm - 5:00pm Esposito</td>
<td>CHEN E4300 Essentials A Banta (45)</td>
</tr>
<tr>
<td>7:00p</td>
<td>CHAP E4120 Stat Mech O'Shaughnessy (45)</td>
<td>CHEN E4700 Genomic Technology Ju (60)</td>
<td>CHEN E4130 Advanced Thermo O'Shaughnessy (60)</td>
<td>CHEN E4400 Chemical Process Development Mattas (45)</td>
<td></td>
</tr>
<tr>
<td>8:00p</td>
<td>CHEN E4020 Protection of Industrial and Intellectual Property Spall (45)</td>
<td>CHAP E4120 Stat Mech O'Shaughnessy (45)</td>
<td>CHEN E4700 Genomic Technology Ju (60)</td>
<td>CHEN E4400 Chemical Process Development Mattas (45)</td>
<td></td>
</tr>
<tr>
<td>8:30p</td>
<td>CHEN E4020 Protection of Industrial and Intellectual Property Spall (45)</td>
<td>CHAP E4120 Stat Mech O'Shaughnessy (45)</td>
<td>CHEN E4700 Genomic Technology Ju (60)</td>
<td>CHEN E4400 Chemical Process Development Mattas (45)</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- **Faculty Talks:** (September Only) 12:00pm - 1:00pm
- **CHAP E4120 Stat Mech O'Shaughnessy (45)**
- **CHEN E4700 Genomic Technology Ju (60)**
- **CHEN E4400 Chemical Process Development Mattas (45)**
Students without a BS in Chemical Engineering Scientist to Engineer (S2E) Program

An intensive, accelerated consideration of the essential chemical engineering principles from the undergraduate program

- CHEN E4001x Essentials of Chem Eng – A
- CHEN E4002x Essentials of Chem Eng – B
- A graduate-level course with substantial design content (also counts as a technical elective)
Essentials of Chemical Engineering A & B

- Arranged to be 6 credits to minimize costs for students, but content/workload far exceed 6 credits

  *6 credits cannot count toward MS degree, so S2E students need 36 credits total to graduate*

- Each course consists of 4 modules, each taught by a different faculty member and covering essentials of an undergraduate course in intensive, accelerated way

- Each module will last ~3 weeks and include 6 lectures, 2 recitation classes, 2 homeworks, and an exam
Essentials of Chemical Engineering A & B

CHEN E4001 Essentials A
1. Introduction to Chemical Engineering
2. Transport Phenomena I
3. Transport Phenomena II
4. Chemical Engineering Control

CHEN E4002 Essentials B
1. Reaction Kinetics & Reactor Design
2. Thermodynamics I
3. Thermodynamics II
4. Chemical & Biochemical Separations
S2E Design Requirement

S2E students must select one of these courses to meet the design course requirement:

Fall
• CHEN E4400x Chemical Process Development

Spring
• CHEN E4610y Chemical Product Design
• CHEN E4501y Chemical Engineering Process Safety

Take one of these courses after completing CHEN E4001 and CHEN E4002
Typical Program
(Students in S2E Program)

Fall, Year 1
CHEN E4001x (Essen ChE-A)
CHEN E4002x (Essen ChE-B)
technical elective
technical elective
CHEN E9001 MS Colloquium

Spring, Year 1
CHAP E4130y (Adv Kinetics)
CHEN E4010y (Math Methods)
CHEN E4501y (design elective)
technical elective

Fall, Year 2
CHEN E4330x (Adv Thermo)
CHEN E4110x (Transport-III)
technical elective
technical elective

CHEN E9001 MS Colloquium is required and 1st year MS students must register for CHEN E9001.
Technical Electives

- Courses at 4000 or 6000 level
- With advisor approval MS students may select up to 6 points of the required 30 from outside the Department.
- May include up to 6 credits of MS Research (CHEN E9400), with written approval of research advisor. (Maximum of 3 points per academic term)
- Should not be equivalent to courses already taken as an undergraduate
- Approved in writing by a graduate program advisor
- Check Alphabetic listing of class times, locations, instructor and course descriptions: http://www.columbia.edu/cu/bulletin/uwb/
### University of Rochester
#### Chemical Engineering Graduate Courses Fall 2017

<table>
<thead>
<tr>
<th>Course #</th>
<th>Course title</th>
<th>Day</th>
<th>Start Time</th>
<th>End Time</th>
<th>Professor</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHAP E4120</td>
<td>STAT MECH</td>
<td>T</td>
<td>7:00 PM</td>
<td>9:30 PM</td>
<td>O'Shaughnessy</td>
</tr>
<tr>
<td>CHEN E4001</td>
<td>ESSENTIALS OF CHEM ENG A</td>
<td>TR</td>
<td>1:10 PM</td>
<td>2:25 PM</td>
<td>Banta</td>
</tr>
<tr>
<td>CHEN E4001</td>
<td>ESSENTIALS OF CHEM ENG A R01</td>
<td>F</td>
<td>10:00 AM</td>
<td>11:15 AM</td>
<td>Banta</td>
</tr>
<tr>
<td>CHEN E4002</td>
<td>ESSENTIALS OF CHEM ENG B</td>
<td>TR</td>
<td>2:40 PM</td>
<td>3:55 PM</td>
<td>Banta</td>
</tr>
<tr>
<td>CHEN E4002</td>
<td>ESSENTIALS OF CHEM ENG B R02</td>
<td>F</td>
<td>11:30 AM</td>
<td>12:45 PM</td>
<td>Banta</td>
</tr>
<tr>
<td>CHEN E4010</td>
<td>MATH METHODS</td>
<td>MW</td>
<td>11:40 AM</td>
<td>12:55 PM</td>
<td>Bozic</td>
</tr>
<tr>
<td>CHEN E4020#</td>
<td>PROTECT INTEL PROP</td>
<td>M</td>
<td>7:00 PM</td>
<td>9:30 PM</td>
<td>Spall</td>
</tr>
<tr>
<td>CHEN E4670#</td>
<td>CHEMICAL ENGINEERING DATA ANALYSIS</td>
<td>M,W</td>
<td>10:10 AM</td>
<td>11:25 AM</td>
<td>Bishop</td>
</tr>
<tr>
<td>CHEN E4110</td>
<td>TRANSPORT III</td>
<td>TR</td>
<td>11:40 AM</td>
<td>12:55 PM</td>
<td>Durning</td>
</tr>
<tr>
<td>CHEN E4130</td>
<td>ADV CHEM ENG THERMO</td>
<td>W</td>
<td>7:00 PM</td>
<td>9:30 PM</td>
<td>O'Shaughnessy</td>
</tr>
<tr>
<td>CHEN E4231#</td>
<td>Solar Fuels</td>
<td>MW</td>
<td>8:40 AM</td>
<td>9:55 AM</td>
<td>Esposito/West</td>
</tr>
<tr>
<td>CHEN E4235</td>
<td>SURFACE REACTIONS AND KINETEICS</td>
<td>TR</td>
<td>10:10 AM</td>
<td>11:25 AM</td>
<td>Chen</td>
</tr>
<tr>
<td>CHEN E4400</td>
<td>CHEMICAL PROCESS DEVELOPMENT</td>
<td>R</td>
<td>7:00 PM</td>
<td>9:30 PM</td>
<td>Mattas</td>
</tr>
<tr>
<td>CHEN E4660#</td>
<td>BioChemical Engineering</td>
<td>TR</td>
<td>5:40 PM</td>
<td>6:55 PM</td>
<td>Obermeyer</td>
</tr>
<tr>
<td>CHEN E4700#</td>
<td>PRINCIPLES OF GENOMIC TECH</td>
<td>W</td>
<td>7:00 PM</td>
<td>9:30 PM</td>
<td>Ju</td>
</tr>
<tr>
<td>CHEN E4850</td>
<td>CONTAMINTED SITE CLEAN UP</td>
<td>M</td>
<td>4:10 PM</td>
<td>6:40 PM</td>
<td>Tsiamis</td>
</tr>
<tr>
<td>CHEN E9001</td>
<td>MASTERS COLLOQUIUM</td>
<td>F</td>
<td>2:10 PM</td>
<td>3:25 PM</td>
<td>Bozic</td>
</tr>
</tbody>
</table>

S2E Recitation periods are highlighted in yellow. S2E Students must attend recitation periods, but do not need to register for the CHEN E4001 and CHEN E4002 recitation periods.

** MECE E4320 will count as in the department.

*Courses in red count toward the S2E Student design requirement. S2E students must fulfill the design requirement after successful completion of CHEN E4001 and CHEN E4002

#S2E students are eligible to take this elective during the first semester and count the course as within the department of chemical engineering
Example Other Fall 2017 Electives (3 pts each)

These are Common Elective Courses Outside of the Department of Chemical Engineering (With advisor approval MS students may select up to 6 points of the required 30.)

Other Electives of Interest to Chemical Engineering Graduate Students

<table>
<thead>
<tr>
<th>Mechanical Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>MECE E4211  ENERGY SOURCES AND CONVERSION</td>
</tr>
<tr>
<td>MECE E4320**  INTRO TO COMBUSTION</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Earth/Environmental Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAEE E4003    INTRO TO AQUATIC CHEMISTRY</td>
</tr>
<tr>
<td>EAEE E4163    SUSTAINABLE WATER TREATMENT</td>
</tr>
<tr>
<td>EAEE E4550    CATALYSIS OF EMISSIONS CONTROL</td>
</tr>
<tr>
<td>EAEE E6212#   CARBON SEQUESTRATION</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Biomedical Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMEN E4001    QUANTITATIVE PHYSIOLOGY I</td>
</tr>
<tr>
<td>BMEN E4501    TISSUE ENGINEERING I</td>
</tr>
</tbody>
</table>

S2E Recitation periods are highlighted in yellow. S2E Students must attend recitation periods, but do not need to register for the CHEN E4001 and CHEN E4002 recitation periods.

** MECE E4320 will count as in the department.

*Courses in red count toward the S2E Student design requirement. S2E students must fulfill the design requirement after successful completion of CHEN E4001 and CHEN E4002.

#S2E students are eligible to take this elective during the first semester and count the course as within the department of chemical engineering.

These are Common Elective Courses Outside of the Department of Chemical Engineering, (With advisor approval MS students may select up to 6 points of the required 30.)
<table>
<thead>
<tr>
<th>Time</th>
<th>UNDERGRADUATE</th>
<th>GRADUATE CORE</th>
<th>GRADUATE ELECTIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Monday</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8:40a - 9:55a</td>
<td>CHEN E3120 Transport II Bishop (60)</td>
<td>CHEN E3210 Transport II Bishop (60)</td>
<td>CHEN E3120 Transport II Bishop (60)</td>
</tr>
<tr>
<td>10:10a - 11:25a</td>
<td>CHEN E4330 Advanced Kinetics Esposito (45)</td>
<td>CHEN E4230 Reaction Kinetics and Reactor Design Chen (45)</td>
<td>CHEN E4330 Advanced Kinetics Esposito (45)</td>
</tr>
<tr>
<td>1:10p - 2:25p</td>
<td>CHEN E4110 Transport III Durning (45)</td>
<td>CHEN E4110 Transport III Durning (45)</td>
<td>CHEN E4501 Safety Bozic (50)</td>
</tr>
<tr>
<td>2:40p - 3:55p</td>
<td>CHEN E3810 Lab 1:00p - 5:00p Ju (60)</td>
<td>CHEN E3810 Lab 1:00p - 5:00p Ju (60)</td>
<td>CHEN E4501 Safety Bozic (50)</td>
</tr>
<tr>
<td>4:10p - 5:25p</td>
<td>CHEN E4900 Topics in Chemical Engineering 6:10 - 8:40p Prof. Henze</td>
<td>CHEN E4900 Topics in Chemical Engineering 6:10 - 8:40p Prof. Henze</td>
<td></td>
</tr>
<tr>
<td>5:40p - 6:55p</td>
<td>CHEN E4600 Topics in Chemical Engineering 6:10 - 8:40p Prof. Henze</td>
<td>CHEN E4600 Topics in Chemical Engineering 6:10 - 8:40p Prof. Henze</td>
<td>CHEN E4890 Biopharm. Product Dev. 4:10p - 6:40p Hartounian (50)</td>
</tr>
<tr>
<td>6:10p - 7:25p</td>
<td>CHEN E4800 Topics in Soft Materials Durning (45)</td>
<td>CHEN E4320 Molecular Phenomena in Chemical Engineering (45) Prof. McNeil 1:10 - 3:40pm</td>
<td>CHEN E4600 Topics in Chemical Engineering 6:10 - 8:40p Prof. Henze</td>
</tr>
<tr>
<td>7:40p - 8:55p</td>
<td>CHEN E4110 Topics in Chemical Engineering 6:10 - 8:40p Prof. Henze</td>
<td>CHEN E4320 Molecular Phenomena in Chemical Engineering (45) Prof. McNeil 1:10 - 3:40pm</td>
<td>CHEN E4600 Topics in Chemical Engineering 6:10 - 8:40p Prof. Henze</td>
</tr>
<tr>
<td><strong>Tuesday</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Wednesday</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Thursday</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Friday</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sample CHEN Dept Course Offerings, Spring 2017
Example Spring **2017** Electives in the Department of Chemical Engineering (3 pts each)

<table>
<thead>
<tr>
<th>Course #</th>
<th>Course title</th>
<th>Day(s)</th>
<th>Start Time</th>
<th>End Time</th>
<th>Professor</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEN E4010</td>
<td>Math Methods in Chemical Engineering</td>
<td>TR</td>
<td>10:10 AM</td>
<td>11:25 AM</td>
<td>Venkatsubramaniam</td>
</tr>
<tr>
<td>CHEN E4110</td>
<td>Transport III</td>
<td>MW</td>
<td>1:10 PM</td>
<td>2:25 PM</td>
<td>Durning</td>
</tr>
<tr>
<td>CHEN E4320</td>
<td>MOELECUALR PHENOMENA IN CHEMICAL</td>
<td>T</td>
<td>1:10 PM</td>
<td>3:40 PM</td>
<td>McNeil</td>
</tr>
<tr>
<td>CHEN E4330</td>
<td>ADV CHEMICAL KINETICS</td>
<td>TR</td>
<td>8:40 AM</td>
<td>9:55 AM</td>
<td>Esposito</td>
</tr>
<tr>
<td>CHEN E4501</td>
<td>CHEMICAL ENGINEERING PROCESS SAFETY</td>
<td>TR</td>
<td>1:10 PM</td>
<td>2:25 PM</td>
<td>Bozic</td>
</tr>
<tr>
<td>CHEN E4600</td>
<td>ATMOSPEHERIC AEROSOLS</td>
<td>R</td>
<td>1:10 PM</td>
<td>3:40 PM</td>
<td>McNeil</td>
</tr>
<tr>
<td>CHEN E4610</td>
<td>CHEMICAL PRODUCT DESIGN</td>
<td>W</td>
<td>6:10 PM</td>
<td>8:40 PM</td>
<td>Joback</td>
</tr>
<tr>
<td>CHEN E4610</td>
<td>CHEMICAL PRODUCT DESIGN</td>
<td>W</td>
<td>6:10 PM</td>
<td>8:40 PM</td>
<td>Joback</td>
</tr>
<tr>
<td>CHEN E4630</td>
<td>CHEN E4630 TOPICS IN SOFT MATERIALS</td>
<td>MW</td>
<td>10:10 AM</td>
<td>11:25 AM</td>
<td>Durning</td>
</tr>
<tr>
<td>CHEN E4660</td>
<td>BIOCHEMICAL ENGINEERING</td>
<td>TR</td>
<td>11:40 AM</td>
<td>12:55 PM</td>
<td>Obermeyer</td>
</tr>
<tr>
<td>CHEN E4800</td>
<td>PROTEIN ENGINEERING</td>
<td>MW</td>
<td>11:40 AM</td>
<td>12:55 PM</td>
<td>Banta</td>
</tr>
<tr>
<td>CHEN E4890</td>
<td>Biopharmaceutical Product Development and Chemical Engineering</td>
<td>R</td>
<td>4:10 PM</td>
<td>6:40 PM</td>
<td>Hartounian</td>
</tr>
<tr>
<td>CHEN E8100</td>
<td>TOPICS IN BIOLOGY</td>
<td>R</td>
<td>4:10 PM</td>
<td>6:40 PM</td>
<td>Oshaunessy</td>
</tr>
</tbody>
</table>

*Courses in red counts toward elective requirement for S2E students*
Example Spring **2017** Electives in the Department of Chemical Engineering (3 pts each)

<table>
<thead>
<tr>
<th>Cross-Listed Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chemical Engineering &amp; Earth/Environmental Engineering</strong></td>
</tr>
<tr>
<td>CHEE E4530</td>
</tr>
<tr>
<td>CHEE E6252</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other Electives of Interest to Chemical Engineering Graduate Students</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mechanical Engineering</strong></td>
</tr>
<tr>
<td>MECE E4211</td>
</tr>
<tr>
<td>MECE E4302</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Earth/Environmental Engineering</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>EAEE E4150</td>
</tr>
<tr>
<td>EAEE E4160</td>
</tr>
<tr>
<td>EAEE E6150</td>
</tr>
</tbody>
</table>

*Courses in red count toward the S2E Student design requirement. S2E students must fulfill the design requirement after successful completion of CHEN E4001 and CHEN E4002*
MS Student Course Registration/Advising

Graduate student must register during the designated registration period or risk loss of student status. Registration for classes is done through student services on line: https://ssol.columbia.edu/ Graduate student course registration dates are dictated by the CU Registrar Office and posted at the Columbia Academic Calendar site. http://registrar.columbia.edu/event/academic-calendar

“Advising of MS students is currently the responsibility of the Masters Committee. Each incoming MS student will be assigned an advisor who will approve courses.” (2015-2016 Columbia Chemical Engineering Graduate Student Handbook: http://cheme.columbia.edu/masters-program-2)

MS student advising takes place close to the registration period. Typical advising weeks are the week prior to classes starting for entering students and the week prior to the academic calendar registration dates for each subsequent Spring or Fall semester. Students will be informed of advising dates via Columbia email. Students are required to meet with their academic advisor during that time. Students are informed at orientation of core and suggested elective courses. All course selections must be approved by an academic advisor. Student will be informed of course options via email or other means for subsequent semesters.
MS Student Course Registration/Advising

Prior to meeting with an academic advisor, an MS student must record all current and requested courses and grades on the academic advising sheet in order to inform the advisor of the current program structure. This is done to save the student time as evaluation of student progress in the program is needed prior to making changes. See example advising sheet below:

<table>
<thead>
<tr>
<th>CHEMICAL ENGINEERING MS PROGRAM*</th>
<th>Fall 2016 Admission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Name: Ima True Cheme</td>
<td>Uni: Id9241</td>
</tr>
<tr>
<td><strong>Semester One:</strong> Fall 2016</td>
<td></td>
</tr>
<tr>
<td>Course</td>
<td>Pts</td>
</tr>
<tr>
<td>Math Core</td>
<td>CHEN E4110</td>
</tr>
<tr>
<td>C2H E3210</td>
<td></td>
</tr>
<tr>
<td>Kinetics Core</td>
<td>CHEN E4330</td>
</tr>
<tr>
<td>Transport Core</td>
<td>CHEN E4110</td>
</tr>
<tr>
<td>Thermo Core</td>
<td>CHEN E4130 or CHAP E4120</td>
</tr>
<tr>
<td>Masters Colloquium</td>
<td>CHEN E9001</td>
</tr>
<tr>
<td>Tech Elect 1**</td>
<td>CHEN E4020</td>
</tr>
<tr>
<td>Intellectual Property</td>
<td></td>
</tr>
<tr>
<td>Tech Elect 2</td>
<td>CHEN E4400</td>
</tr>
<tr>
<td>Chem Process Develop</td>
<td></td>
</tr>
<tr>
<td>Tech Elect 3</td>
<td>CHEN E4501 Chem Eng Process Safety</td>
</tr>
<tr>
<td>Tech Elect 4</td>
<td>CHEN E4231 Solar Fuels</td>
</tr>
<tr>
<td>Tech Elect 5</td>
<td>CHEN E4650 Contam Site Clean Up</td>
</tr>
<tr>
<td>Tech Elect 6</td>
<td>CHEN E4700 Genomic Tech</td>
</tr>
<tr>
<td>Advisor Comments</td>
<td>May change elective. Student will email full list of courses and set appointment for approval if changes are made.</td>
</tr>
</tbody>
</table>

*This form is for planning only for students with a BS degree in Chemical Engineering. Refer to the Graduate Student Handbook for a description of degree requirements. Final approvals are made by the MS advisor.

**All first year MS Students must register for and attend CHEN E9001 MS Chemical Engineering Colloquium.

***Technical electives must be approved by advisor and course numbers must be 4000 level or above. No more than 2 courses may be technical electives outside of the Chemical Engineering Department. 30 points are required to graduate. Most courses are 3 points.

This form may be obtained at: http://cheme.columbia.edu/ms-advising
Chemical Engineering Colloquium CHEN 9000x/y

- Tuesdays 4PM in 825 Mudd (check website for schedule) cheme.columbia.edu/colloquia
- Attendance is optional for MS students
MS Colloquia
Masters Colloquium CHEN E9001 (Fall Semester Only):

• Fridays 2:10PM-3:25PM
• Guest lecturers from Industry, including alumni, adjunct faculty, etc AND Career Placement Requirements

• All first year MS students must register for CHEN E9001.

• 1. Career Placement Requirements: All first year MS students must complete career placement requirements.

• 2. Attendance Requirement: All first year MS Students must attend MS Colloquium.
Course Objectives: (The following course objectives were developed from the Fall 2014 MS Colloquium and from the Columbia University Department of Chemical Engineering Program Objectives 1 and 4 and Outcomes 6, 8, 9 and 10.)

1. Learn about careers in industries that require technical expertise in chemical engineering. (Department Program Objective #1)
2. Strengthen a foundation to pursue alternative career paths, especially careers in business, management, finance, law, medicine or education. (Department Program Objective #4)
3. Understand more about the impact of engineering solutions in a global, economic, environmental, and societal context. (Department Program Outcome #8)
4. Continue to learn about the recognition of the need for, and an ability to engage in life-long learning. (Department Program Outcome #9)
5. Enhance knowledge of contemporary issues. (Department Program Outcome #10)
6. Develop an understanding of professional and ethical responsibility (Department Program Outcome #6) (Suggested new topic for Fall 2015)

(Department objectives and outcomes can be found at http://cheme.columbia.edu/undergraduate-program-4/30 Dec 2014)
All first year MS students must complete career placement requirements.

All Requirements Support Course Objectives: 1,2,4,5,6. The Chem Show also supports objective 3.
Master of Science Colloquium 2017

Thursday 31 Aug 2017 #Resume Writing – 10:00 AM – 11:00 AM Irina Khenkin (Columbia University) (Career Placement Requirement)

Thursday 31 Aug 2017 #Business Writing – 11:00 AM – 12:00 PM Irina Khenkin (Columbia University) (Career Placement Requirement)

Friday 8 Sep 2017 Program Welcome! - Scott Banta (Columbia University) #Networking Class - Irina Khenkin (Columbia University) Career Placement Requirement

Life as a Graduate Student – TBA (CheGO)

Friday 15 Sep 2017 Internships, Resumes and Corporate Recruiting – Meg Levy + Recruiting Team (Johnson & Johnson) Location is 301 Pupin. This location is a change from the regular classroom in order to support a larger colloquium class. Plan accordingly so that you are seated on time.

Friday 22 Sep 2017 Lifelong Learning through AIChE: The Global Home of Chemical Engineers – Monica Stowe (American Institute of Chemical Engineers- AIChE) (NJIT PhD Recruiting- TBD)

#- #- Indicates a career placement requirement. Direct all questions for Career Placement Requirements to the Career Placement Officer, Irina Khenkin.
Master of Science Colloquium 2017

Friday 29 Sep 2017 Center for Career Education - Vyju Manian (Columbia University)

Friday 6 Oct 2017 #Graduate School Career Fair (No MS Colloquium Class) (Career Placement Requirement)

Friday 13 Oct 2017 #Engineering Career Fair (No MS Colloquium Class) (Career Placement Requirement)

Friday 20 Oct 2016 A Historical Perspective of Chemical Engineering - Robert Bozic (Columbia University)
#Interviewing Class- Irina Khenkin (Columbia University) (Career Placement

Tues 31 Oct 2017 – Tur 2 Nov 2017 #Chem Show at the Javits Center NYC (Career Placement Requirement)
#
- Indicates a career placement requirement. Direct all questions for Career Placement Requirements to the Career Placement Officer, Irina Khenkin.
Friday 3 Nov 2017 *The Engineer in the Catalyst Industry* - Robert Farrauto (Columbia University)

Friday 10 Nov 2017 *Chemical Engineering in the Pharmaceutical Industry* - Elias Mattas (Bristol-Meyers Squibb)

Friday 17 Nov 2017 *Design of Mild Surfactants for Personal Care* - Euen Gunn (Johnson & Johnson)

Friday 1 Dec 2017 *The role of Lipids in Skin Health* - Apostolos Pappas (Johnson & Johnson)

Friday 8 Dec 2017 MS Colloquium Make Up Period.

# Indicates a career placement requirement. Direct all questions for Career Placement Requirements to the Career Placement Officer, Irina Khenkin.
Applying to the Ph.D. Program

- Must formally apply if you are interested
- No guarantees; in competition with all other applicants
- Opportunity to impress faculty with grades and/or performance in a research group
- You will also be well prepared for doctoral programs in other universities
Columbia Chemical Engineering
Faculty

Scott Banta
Protein and Metabolic Engineering

Kyle Bishop
Colloidal Materials and Machines

Chris Boyce
Fluid Mechanics, Magnetic Resonance Imaging, Clean Energy

Robert Bozic
Process Safety EC Sensors and Fuel Cells

Michael P. Burke
Combustion, Multi-Scale Uncertainty, Qualification, Nonequilibrium Kinetics

Jingqiang Chen
Catalysis and Sustainable Energy

Christopher Durning
Polymer Physical Chemistry

Daniel Esposito
Solar Fuels and Sustainable Energy

Oleg Gang
Soft Matter, Programmable self-assembly

Jingyue Ju
Genomics

Jeffrey Kohansein
Polymers, Biomaterials, Surfaces, Membranes

Sanat Kumar
Synthetic and Natural Polymers, Nanomaterials

Edward Leonard
Artificial Organs, Transport Phenomena

V. Faye McNeil
Atmospheric Chemistry, Aerosols

Allie Obemeyere
Protein-based materials and immunoengineering

Ben O'Shaughnessy
Cellular Mechanisms, Quantitative Biology

Ah-Hyung Allissa Park
Sustainable Energy, Carbon Capture and Storage, Particulate Technology

VenKata Venkatasubramanian
Risk Management, Complexity, Self-Organization, Materials Design, Informatics

Alan West
Electrochemical Engineering
Experienced industry professionals who teach focused courses

Adjunct Faculty

A. A. Bedrossian-Omer
K. G. Joback
J. Porcelli
C. Tsiamis
E. Mattas
C. B. Rosas
K. Spall
H. Hartounian
Masters Committee

Robert G. Bozic  Jingyue Ju  Scott A Banta

Responsible for admissions and approving programs
Chemical Engineering Staff

Rezarta Binaj
Business Manager

(Irina Khenkin)
Career Placement Officer

Michele McCormack
Administrative Assistant

Kathy Marte
Director of Finance and Operations

Ariel Sanchez
IT Manager
Faculty Research Themes

• Catalysis
• Molecular Dynamics
• Polymers/Materials
• Electrochemical Engineering
• Biological & Medical Engineering
• Informatics & Large Data Systems
• Sustainable Energy & the Environment

Non-Research Themes

• Chemical Product Design
• Chemical Process Engineering
Joining a Research Group

- Not required of MS Students
- Maximum of 3 points per semester.
- Maximum of 6 points towards the degree.
- Research course may be selected for the second and/or the third semester
- Take advantage of the Chem Eng Poster session
- Approach faculty and express interest in the research
- Limited number of opportunities, and you will be in competition with other students, so sell yourself!
Columbia ChemE Grad Student Life

“Welcome to CU ChemE BBQ!” Aug 2014

MS Program Orientation Aug 2014

COLUMBIA ENGINEERING
The Fu Foundation School of Engineering and Applied Science
Chemical Engineering Graduate Organization (CheGO)

Organization Functions

1. Act as a liaison between the graduate student population and the department on issues of concern to the student body

2. Organize and run activities which enrich the academic and social experience of graduate students within the department

3. Assist in the management of the newly created chemical engineering community outreach program

4. Aide in the planning and running of miscellaneous departmental activities (e.g., open house, orientation, graduate student breakfasts, etc.)
ChemE Community Outreach

- Fredrick Douglas Academy II located Harlem, NY
- In class experiments and lectures with middle school and high school students
- Mentoring and judging a science fair
ChemE Community Outreach

• Monthly breakfasts for graduate students, faculty and staff

• Happy hours and social events with other departments

• Hosted the NYC Intercollegiate Chemistry and Chemical Engineering (NICChE) Conference

• Young professor/professional talks with Q & A discussions
Student Organizations of Campus

• Engineering Graduate Student Council (EGSC)
• American Institute of Chemical Engineers (AIChE)
• Association for Computing Machinery (ACM)
• American Society of Civil Engineers (ASCE)
• American Society of Mechanical Engineers (ASME)
• Columbia Science Review (CSR)
• American Institute of Aeronautics and Astronautics (cuAIAA)
• Engineers Without Borders (EWB)
• Entrepreneurship, Leadership and Consulting Club
• Institute of Electrical and Electronics Engineers (IEEE)
• Society of Automotive Engineers (SAE)
• Scientists & Engineers for a Better Society (SEBS)
• Society of Women Engineers (SWE)

And many more!
New York City Advantage

• Campus in the Morningside Heights neighborhood of Manhattan
• NYC: major player in high-tech research & development, financial and other industries
• Vibrant Columbia alumni network

• Long tradition of collaboration with private industry and public sector
  internships, networking, job search
## Employers

- Accenture
- Amex
- Apple
- Bain Capital
- Bain & Company
- Bank of America
- Barclays Capital
- Bloomberg
- BNP Paribas
- Boeing
- Boston Consulting Group
- Booz Allen
- BP
- Chevron
- Credit Suisse
- Dell
- Deutsche Bank
- EMC
- Exxon
- Fedex
- General Electric
- Goldman Sachs
- Google
- HSBC
- HP
- IBM
- ITT Corp
- Johnson & Johnson
- JP Morgan
- Louis Vuitton
- Mars
- Mayo Clinic
- Microsoft
- Morgan Stanley
- Murex
- NASA
- Pfizer
- Proctor & Gamble
- RBS
- SocGen
- Texas Instruments
- UBS
- United Nations
- United Technologies
- Walmart
- Yahoo
- and many more....

*Data from Graduation Exit Survey for School of Engineering*
• University Apartment Housing (UAH)
http://facilities.columbia.edu/housing/

• International House
http://www.ihouse-nyc.org

• The Off-Campus Housing Assistance Office (OCHA)-
http://www.columbia.edu/cu/ire/ocha/

• Alternative Housing List:
Contact The Office of Graduate Student Services
“NOCELAC!”

“No One Can Engineer Like A Columbian”
Columbia Chemical Engineering Questions?

http://cheme.columbia.edu/
http://gradengineering.columbia.edu/frequently-asked-questions-2
Back Up Slides Start Here

http://cheme.columbia.edu/
http://gradengineering.columbia.edu/frequently-asked-questions-2
### Columbia Chemical Engineering MS Program at a glance

<table>
<thead>
<tr>
<th></th>
<th>Fall 2017 Sep- Dec 17</th>
<th>Spring 2018 Jan- May 18</th>
<th>Summer 2018 Jun- Aug 18</th>
<th>Fall 2018 Sep- Dec 18</th>
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<tbody>
<tr>
<td><strong>CHEN E4001 Essentials A</strong></td>
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<td>Core MS Course</td>
<td>Time for Summer Internships</td>
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<td>CHEN E4002 Essentials B</td>
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<td>Core MS Course</td>
<td>Time for Research</td>
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Note: Scientist to Engineer, “S2E”, students must select 1 course with substantial design content.

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**Goal:** MS in Chemical Engineering active in the job market

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**MS Degree Requirements:** 30 credits beyond BS in chemical engineering
12 credits: graduate core, 18 credits: technical electives
Thesis not required, but Master's Research may be included in the electives.

(Columbia Directory of Classes- http://www.columbia.edu/cu/bulletin/uwb/)
<table>
<thead>
<tr>
<th>Time</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
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<tbody>
<tr>
<td>8:40a</td>
<td>CHEN E4330 Adv. Kinetics Esposito (45)</td>
<td>CHEN E3010 Thermo I Kumar (60)</td>
<td>CHEN E4330 Adv. Kinetics Esposito (45)</td>
<td>CHEN E3010 Thermo I Kumar (60)</td>
<td>CHEN E4235 Surface Rxn and Kinetics Chen (30)</td>
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<td>10:10a</td>
<td>CHEN E3110 Transport I McNeil (60)</td>
<td>CHEN E2100 Transport I McNeil (60)</td>
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<td>CHEN E2100 Transport I McNeil (60)</td>
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<td>11:40a</td>
<td>CHEN E4010 Math Methods Bozic (45)</td>
<td>CHEN E4110 Transport III Durning (45)</td>
<td>CHEN E4010 Math Methods Bozic (45)</td>
<td>CHEN E4110 Transport III Durning (45)</td>
<td>Faculty Talks (September Only) 12:00 - 1:00p</td>
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<td>1:10p</td>
<td>CHEN E4500 Design I Bozic (60)</td>
<td>CHEN E4001 Essentials A Banta (30)</td>
<td>CHEN E4300 Controls A 1:10p - 2:00p</td>
<td>CHEN E4500 Essentials A Banta (30)</td>
<td>CHEN E4300 Controls A 1:10p - 4:00p</td>
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<td>2:40p</td>
<td>CHEN E3020 Analysis West (60)</td>
<td>CHEN E4002 Essential B Banta (30)</td>
<td>CHEN E3020 Analysis West (60)</td>
<td>CHEN E4002 Essential B Banta (30)</td>
<td>CHEN E49001 MS Colloquium 2:10p - 3:25</td>
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<td>4:10p</td>
<td>CHEN E4140 Separations Durning (60)</td>
<td>CHEN 9000 Colloquium 4:00p - 5:00pm Esposito</td>
<td>CHEN E4130 Advanced Thermo 4:10p - 6:40p Koberstein (45)</td>
<td>CHEN E4140 Separations Durning (60)</td>
<td>CHEN E4400 Chemical Process Development Mattas (45)</td>
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<td>7:00p</td>
<td>CHEN E4020 Protection of Industrial and Intellectual Property Spall (35)</td>
<td>CHAP E4120 Stat Mech O'Shaughnessy (25)</td>
<td>CHEN E4700 Genomic Technology Ju (45)</td>
<td>MECH E4320 Combustion Burke (45)</td>
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<td>1:10p - 2:25p</td>
<td>CHEN E6543 Res. Meth.</td>
<td>CHEN E4001 Essentials A</td>
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<td>CHEN E3020 Analysis West</td>
<td>CHEN E4002 Essential B</td>
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<td>CHEN E4850 Contaminate Site Clean Up</td>
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Sample S2E Schedule, Fall 2016