

Chemical and Biological Engineering Graduate Program Assessment Plan

The Faculty of the Department of Chemical and Biological Engineering (CBE) are responsible for administering the M.S. Thesis and Non-Thesis Chemical Engineering programs and the Ph.D. Chemical and Biological Engineering program. For each program the CBE Faculty have identify Student Learning Outcomes. To maintain rigor and quality of the graduate programs the CBE Faculty have developed assessment approaches which include: course performance evaluation, evaluation of the oral defense and thesis/dissertation or project (in the case of the Non-Thesis M.S.), a series of student and alumni surveys, journal publications and professional presentations. Collectively these assessment strategies are used by the CBE Faculty to monitor the CBE Graduate Programs and initiate changes to fine-tune and enhance the CBE Graduate Programs.

Graduate Programs Student Learning Outcomes

Chemical Engineering MS Thesis Degree

1. Demonstrate a mastery of engineering and science fundamentals appropriate for the discipline.
2. Demonstrate an in-depth knowledge of technical concepts and state-of-the art literature within the student's chosen field of specialization.
3. Demonstrate the ability to identify, investigate, formulate and solve new problems through the application of original, independent discipline specific research.
4. Demonstrate the ability to effectively communicate technical concepts both orally and in writing.
5. Demonstrate and acts with an understanding of professional and ethical responsibilities.

Chemical Engineering MS Non-Thesis Degree

1. Demonstrate a mastery of engineering and science fundamentals appropriate for the discipline.
2. Demonstrate the ability to critically assess information in the discipline.
3. Demonstrate the ability to effectively communicate technical concepts both orally and in writing.
4. Demonstrates and acts with an understanding of professional and ethical responsibilities.

Chemical and Biological Engineering PhD Degree

1. Demonstrate a mastery of engineering and science fundamentals appropriate for the discipline.
2. Demonstrate an in-depth knowledge of technical concepts and state-of-the art literature within the student's chosen field of specialization.
3. Demonstrate the ability to identify, investigate, formulate and solve new problems through the application of original, independent discipline specific research.
4. Demonstrate the ability to effectively communicate technical concepts both orally and in writing.
5. Demonstrate and acts with an understanding of professional and ethical responsibilities.

MS & PhD degrees								
Objectives	Coursework Grades	Oral defense evaluation	Thesis / project evaluation	Student incoming Survey	Student Exit Survey	Alumni Survey (3yrs Post grad)	Submitted Journals / presentation	Confrence participation (presentation? ?)
1. Demonstrate a mastery of engineering and science fundamentals appropriate for the discipline.	X	X	X	X	X	X	X	X
2. Demonstrate an in-depth knowledge of technical concepts and state-of-the art literature within the student's chosen field of specialization.	X	X	X	X	X	X	X	X
3. Demonstrate the ability to identify, investigate, formulate and solve new problems through the application of original, independent discipline specific research.		X	X	X	X	X	X	X
4. Demonstrate the ability to effectively communicate technical concepts both orally and in writing.		X	X	X	X	X	X	X
5. Demonstrate and act with an understanding of professional and ethical responsibilities.		X	X	X	X	X	X	X
Assessor	Major Prof	Major Prof + Comm	Major Prof + Comm	Prog Coor	Prog Coor	Prog Coor	Major Prof	Major Prof

FIG. 1, Graduate Programs Assessment Measures

Chemical Engineering MS Thesis Degree Assessment Tools & Timelines

6. *Demonstrate a mastery of engineering and science fundamentals appropriate for the discipline.*

- Coursework Grades
 - Evaluated at the Time of POS Filing
 - Evaluated at the Time of Oral Defense
- Oral Defense Evaluation
- Thesis Evaluation
- Student Interim Survey Completed At The Time of POS Filing
- Student Exit Survey Completed with Final Approval for Graduation
- Alumni Survey Completed After At Least 3 Years Post-Graduation

7. *Demonstrate an in-depth knowledge of technical concepts and state-of-the art literature within the student's chosen field of specialization.*

- Coursework Grades

- Evaluated at the Time of POS Filing
- Evaluated at the Time of Oral Defense
- Oral Defense Evaluation
- Thesis Evaluation
- Student Interim Survey Completed At The Time of POS Filing
- Student Exit Survey Completed with Final Approval for Graduation
- Alumni Survey Completed After At Least 3 Years Post-Graduation
- Submission of Peer Reviewed Journal Articles and Proceedings
- Participation in Conferences

8. *Demonstrate the ability to identify, investigate, formulate and solve new problems through the application of original, independent discipline specific research.*

- Oral Defense Evaluation
- Thesis Evaluation
- Student Interim Survey Completed At The Time of POS Filing
- Student Exit Survey Completed with Final Approval for Graduation
- Alumni Survey Completed After At Least 3 Years Post-Graduation
- Submission of Peer Reviewed Journal Articles and Proceedings
- Participation in Conferences

9. *Demonstrate the ability to effectively communicate technical concepts both orally and in writing.*

- Oral Defense Evaluation
- Thesis Evaluation
- Student Interim Survey Completed At The Time of POS Filing
- Student Exit Survey Completed with Final Approval for Graduation
- Alumni Survey Completed After At Least 3 Years Post-Graduation
- Submission of Peer Reviewed Journal Articles and Proceedings
- Participation in Conferences

10. *Demonstrate and acts with an understanding of professional and ethical responsibilities.*

- Oral Defense Evaluation
- Thesis Evaluation
- Student Interim Survey Completed At The Time of POS Filing
- Student Exit Survey Completed with Final Approval for Graduation
- Alumni Survey Completed After At Least 3 Years Post-Graduation

*Rubric for CBE/ChE MS Non-Thesis Defense; Student Name:

Date:

*This form is to be completed by the Major Professor, in collaboration with the student's Graduate Committee, and returned to the Chemical and Biological Engineering Graduate Program Coordinator. This form is to be used for program assessment only.

	Highly Competent (3 Points)	Competent (2 Points)	Marginally Competent (1 Point)	Not Competent (0 pts)	Score
General Technical Knowledge	Exhibited highly effective use of critical thinking skills; incorporated content knowledge to identify new solutions/ideas relevant to professional practice; used content appropriate to situation and audience; cited information sources accurately	Demonstrated critical thinking skills; incorporated content knowledge to identify new solutions/ideas relevant to professional practice; made connection between support and main points	Displayed poor or ineffective use of basic critical thinking skills; marginally incorporated content knowledge in the development of solutions to professional problems; provided little support for main ideas	Displayed lack of use of basic critical thinking skills; failed to incorporate content knowledge in the development of solutions to professional problems; provided no support for main ideas	
Knowledge and Application to Chosen Field	Demonstrated original thinking; applied specific scientific theory and/or knowledge from courses and literature to analyze, synthesize, and evaluate data and conduct research	Evidenced some application of specific scientific theory and/or knowledge from courses and literature to analyze, synthesize, and evaluate data and conduct research	Displayed little to no use of appropriate application of specific scientific theory and/or knowledge from courses and literature to analyze, synthesize, and evaluate data and conduct research	Displayed lack of use of appropriate application of specific scientific theory and/or knowledge from courses and literature to analyze, synthesize, and evaluate data and conduct research	
Technical Communications Oral	Used professional terminology; evidenced precise and vivid language; defined unfamiliar terms; varied sentence structure consistently; displayed confidence and poise; clearly organized; graphics used appropriately and effectively	Produced some varied sentence structure and word choice; used professional terminology without prompting; displayed appropriate standards of usage for situation and audience; inspires reasonable confidence; adequately organized; graphics used appropriately and effectively with some errors.	Displayed marginal standards of usage; marginal variance in sentence structure, professional word choice, and professional terminology limited;; marginally organized; some confidence; some errors in use of graphics	Displayed lack of standards of usage; repeated sentence structure, professional word choice, and professional terminology not used (even when prompted); divulged slang words or other inappropriate language for situation and audience; disorganized; little confidence; inappropriate use of graphics	
Technical Communications Written	Used professional terminology; evidenced precise and vivid language; defined unfamiliar terms; varied sentence structure consistently; clearly organized; graphics used appropriately and effectively	Produced some varied sentence structure and word choice; used professional terminology without prompting; displayed appropriate standards of usage for situation and audience; adequately organized; graphics used appropriately and effectively with some errors.	Displayed marginal standards of usage; marginal variance in sentence structure, professional word choice, and professional terminology limited;; marginally organized; some confidence; some errors in use of graphics	Displayed lack of standards of usage; repeated sentence structure, professional word choice, and professional terminology not used (even when prompted); divulged slang words or other inappropriate language for situation and audience; disorganized; little confidence; inappropriate use of graphics	

Ethics and Professionalism	Member of multiple professional organizations; leadership in student organizations; communicates regularly with advisor and Committee; knows policies and requirements; completes tasks promptly; treats colleagues with respect; has highest integrity with scientific research and reporting of results	Member of one professional organization; participates in student organizations; communicates as needed with advisor and Committee; needs some guidance and policies and requirements; needs few reminders to complete tasks; usually treats colleagues with respect; has highest level of integrity with scientific research and reporting of results	Member of one professional organization or a student organization; communicates sporadically with advisor and Committee; needs extensive guidance and policies and requirements; needs many reminders to complete tasks; usually treats colleagues with respect; has average level of integrity with scientific research and reporting of results	Not a member of any professional organizations; does not participate in student organizations; communicates infrequently with advisor and Committee; ignores policies; makes little progress without significant pushing; sometimes treats colleagues with respect; has minimal level of integrity with scientific research and reporting of results.	
TOTAL SCORE					

Overall Impression and Additional Comments:

*Rubric for CBE/ChE Dissertation/Proposal/Thesis Defense; Student Name:

Date:

Circle Which Applies: Ph.D. Dissertation Ph.D. Proposal M.S. Thesis

*This form is to be completed by the Major Professor, in collaboration with the student's Graduate Committee, and returned to the Chemical and Biological Engineering Graduate Program Coordinator. This form is to be used for program assessment only.

	Highly Competent (3 Points)	Competent (2 Points)	Marginally Competent (1 Point)	Not Competent (0 pts)	Score
Critical Thinking	Exhibited highly effective use of critical thinking skills; incorporated content knowledge to identify new solutions/ideas relevant to professional practice; used content appropriate to situation and audience; cited information sources accurately	Demonstrated critical thinking skills; incorporated content knowledge to identify new solutions/ideas relevant to professional practice; made connection between support and main points	Displayed poor or ineffective use of basic critical thinking skills; marginally incorporated content knowledge in the development of solutions to professional problems; provided little support for main ideas	Displayed lack of use of basic critical thinking skills; failed to incorporate content knowledge in the development of solutions to professional problems; provided no support for main ideas	
Knowledge and Application to Chosen Field	Demonstrated original thinking; applied specific scientific theory and/or knowledge from courses and literature to analyze, synthesize, and evaluate data and conduct research	Evidenced some application of specific scientific theory and/or knowledge from courses and literature to analyze, synthesize, and evaluate data and conduct research	Displayed little to no use of appropriate application of specific scientific theory and/or knowledge from courses and literature to analyze, synthesize, and evaluate data and conduct research	Displayed lack of use of appropriate application of specific scientific theory and/or knowledge from courses and literature to analyze, synthesize, and evaluate data and conduct research	
Original Independent Research	Problem has high level of significance; research plan and implementation of the plan is thorough and complete; work has significant impact and is of great value to many others in the field	Problem is significant; research plan and implementation of the plan is adequate; work makes contributions, has impact and is of value to others in the field	Problem is marginally significant; research plan and implementation of the plan is marginal; work has little significance, minor impact and is of marginal value to others in the field	Problem has no significance; research plan and implementation of the plan is inadequate; work has little to no significance, no impact and is of no value to others in the field	
Technical Communications Oral	Used professional terminology; evidenced precise and vivid language; defined unfamiliar terms; varied sentence structure consistently; displayed confidence and poise; clearly organized; graphics used appropriately and effectively	Produced some varied sentence structure and word choice; used professional terminology without prompting; displayed appropriate standards of usage for situation and audience; inspires reasonable confidence; adequately organized; graphics used appropriately and effectively with some errors.	Displayed marginal standards of usage; marginal variance in sentence structure, professional word choice, and professional terminology limited;; marginally organized; some confidence; some errors in use of graphics	Displayed lack of standards of usage; repeated sentence structure, professional word choice, and professional terminology not used (even when prompted); divulged slang words or other inappropriate language for situation and audience; disorganized; little confidence; inappropriate use of graphics	

Technical Communications Written	Used professional terminology; evidenced precise and vivid language; defined unfamiliar terms; varied sentence structure consistently; clearly organized; graphics used appropriately and effectively	Produced some varied sentence structure and word choice; used professional terminology without prompting; displayed appropriate standards of usage for situation and audience; adequately organized; graphics used appropriately and effectively with some errors.	Displayed marginal standards of usage; marginal variance in sentence structure, professional word choice, and professional terminology limited;; marginally organized; some confidence; some errors in use of graphics	Displayed lack of standards of usage; repeated sentence structure, professional word choice, and professional terminology not used (even when prompted); divulged slang words or other inappropriate language for situation and audience; disorganized; little confidence; inappropriate use of graphics	
Dissemination	Research work has already been disseminated through journal publications, patents and presentations	Clear dissemination plan in place, with submissions made and some presentations completed	Minimal plan for dissemination and no submissions or presentations made.	No plan for dissemination	
Ethics and Professionalism	Member of multiple professional organizations; leadership in student organizations; communicates regularly with advisor and Committee; knows policies and requirements; completes tasks promptly; treats colleagues with respect; has highest integrity with scientific research and reporting of results	Member of one professional organization; participates in student organizations; communicates as needed with advisor and Committee; needs some guidance and policies and requirements; needs few reminders to complete tasks; usually treats colleagues with respect; has highest level of integrity with scientific research and reporting of results	Member of one professional organization or a student organizations; communicates sporadically with advisor and Committee; needs extensive guidance and policies and requirements; needs many reminders to complete tasks; usually treats colleagues with respect; has average level of integrity with scientific research and reporting of results	Not a member of any professional organizations; does not participate in student organizations; communicates infrequently with advisor and Committee; ignores policies; makes little progress without significant pushing; sometimes treats colleagues with respect; has minimal level of integrity with scientific research and reporting of results.	
TOTAL SCORE					

Overall Impression and Additional Comments:

Graduate Student Survey

Student Name:

Date:

Years in ChE/CBE Graduate Program:

Degree Program: MS Non-Thesis MS Thesis PhD

PART I: PROGRAM EVALUATION					
	Strongly Agree (3)	Agree (2)	Disagree (1)	Strongly Disagree (0)	N/A
The faculty teaching courses in my program were effective teachers.					
Courses in my major were academically challenging.					
The intellectual caliber of students in my graduate program was high.					
Courses in my major were offered frequently enough for timely completion of degree requirements					
I was satisfied with the variety of courses available to me as a graduate student.					
My adviser and I meet at regular intervals to discuss my progress towards my degree.					
The information provided to me by my adviser regarding my course of study is accurate and helpful.					
My adviser displays a personal interest in my progress towards my educational goals.					
My adviser gives helpful feedback on my research project or creative activity.					
My adviser gives prompt feedback on my research project or creative activity.					
My adviser provides adequate opportunities for research or creative activity outside of my research project.					
My adviser has reasonable expectations that challenge me and can be achieved with the resources available					
The Graduate School office handled my application for admission to graduate study efficiently.					
Requests for information from the Graduate School Office were handled in a timely manner.					
Graduate School staff members were willing to help me resolve problems.					

	Strongly Agree (3)	Agree (2)	Disagree (1)	Strongly Disagree (0)	N/A
Staff members in the Graduate School office were friendly when I approached them with problems.					
Standards for admission to graduate study were clear and understandable.					
The Graduate Office website featured useful information.					
The Graduate Office website was easy to use.					
The Graduate School staff was effective in explaining procedures for me to follow to complete requirements for my degree.					
Library resources are adequate to support my class needs.					
Library resources are adequate to support my research needs.					
Library staff members were helpful with my requests for assistance.					
The hours of operation of the library are adequate for my needs.					
Computer equipment that was available was adequate for my class and research needs.					
Wireless internet access on campus was adequate for my class and research needs.					

Part II: Open-Ended General Questions

1. What technical areas of chemical and biological engineering do you feel most confident with (e.g., thermodynamics; transport – momentum, heat, mass; reactor design/reactions; biology; etc.)?
2. What technical areas of chemical and biological engineering do you feel you need to improve? Have you taken classes in these areas yet?
3. Have you had an opportunity to publish your research work? How many publications and in what format (journal, proceedings, formal reports, etc.)?
4. What is your level of confidence in preparing written communications about your work (3-Very confident; 2-somewhat confident; 1-needs extensive proofreading; 0-no confidence)
5. Have you had an opportunity to present your research work? What type of audience (national meeting, department seminar, group meeting, etc.) have you presented to?
6. What is your level of confidence in preparing oral communications about your work (3-Very confident; 2-somewhat confident; 1-needs extensive practice and assistance; 0-no confidence)

7. What are some areas the Department is doing well?
8. What are some areas the Department could improve?
9. Have you completed a GTA position? How many? Was it voluntary (you asked to do it), or were you required to do it?
10. Are there other courses or emphasis areas you would like to have access to?
11. Is research space adequate? Are there specific space needs that should be addressed?
12. Are research resources (equipment, software, expertise, facilities, funding, etc.) adequate? Are there specific resources that should be addressed?
13. Was office space adequate?
14. Are there other suggestions/ideas you would like to bring up?

CBE supported activities

The Chemical and Biological Department provides support to CBE M.S. and Ph.D. students to participate in a number of professional meetings. The following list is a sample of meetings the CBE M.S. and Ph.D. attend and in which they participate.

- ACS: American Chemical Society
- AIChE: American Institute of Chemical Engineering
- ASEE: American Society of Engineering Education
- BMES: Biomedical Engineering Society
- FOMMS: Foundations of Molecular Modeling and Simulation
- FIE: Frontiers in Education
- Gordon Research Conferences
- ISAM: International Society for Aerosols in Medicine
- ISSF: International Symposium on Supercritical Fluids
- SDSM&T Student Research Symposium
- SDSWMA: South Dakota Solid Waste Management Association
- SEFI: European Society of Engineering Education
- SFB: Society for Biomaterials
- SIMB: Society for Industrial Microbiology and Biotechnology
- WEEF: World Engineering Global Forum (sometimes held in conjunction with the Global Engineering Deans Council).