

Chemical and Biological Engineering Ph.D.



Contact Information

Dr. Jan A. Puszynski

Department of Chemical and Biological
Engineering
Chemistry/Chemical Engineering Bldg C224
(605) 394-1230 Fax: (605) 394-1232
Dept: (605) 394-2421
E-mail: Jan.Puszynski@sdsmt.edu
<http://cbe.sdsmt.edu>

Faculty

Professors Bang, Dixon, Puszynski, Salem,
Winter; Associate Professors Christopher,
Gilcrease; Assistant Professors Benjamin, Hower,
Menkhaus, Sani, Shende.

Program Advisory Council

Professors Bang, Dixon, Puszynski (Program
Coordinator), Winter; Associate Professor
Gilcrease; Assistant Professor Benjamin.

Chemical and Biological Engineering

The Department of Chemical and Biological Engineering (CBE) offers, in addition to B.S. and M.S. degrees in chemical engineering, a Ph.D. degree in chemical and biological engineering. The Ph.D. program provides the chemical and biological engineering Ph.D. graduate a core educational experience in transport phenomena, chemical kinetics, biochemical engineering,

chemical thermodynamics, and biotechnology. This knowledge base, along with key electives, provides graduate students the training to participate in biochemical and petrochemical processing, bio-based energy technologies, including biomass and biofuels; catalysis; bio-based and bio-compatible materials; bioremediation; emerging energy technologies; synthesis and functionalization of nanomaterials, and processing of polymers and composite materials. These areas are aligned with the expertise of our faculty members. The current research interest of the faculty can be found on the departmental website <http://cbe.sdsmt.edu>.

The State of South Dakota is recognized as a leader and major producer of ethanol from starch in the United States. Hence the State of South Dakota is well positioned to play an important role in development of new bio-based technologies and value-added agricultural products. This Ph.D. program directly supports the recently established **National Science Foundation Industry/University Cooperative Research Center (NSF I/UCRC) for BioEnergy Research and Development (CBERD)**. This unique national center focused on bio-based energy and chemical feedstocks, is comprised of five universities, including the SDSM&T, North Carolina State University, Kansas State University, State University of New York - Stony Brook, University of Hawaii, and more than 30 industries and state and federal laboratories. Students participating in CBERD I/UCRC Center research will be working on projects of current and immediate interest to the industrial sponsors. Students also have the opportunity to participate in more fundamental research being pursued through the **2010 Center for Bioprocessing Research and Development (CBRD)** at the South Dakota School of Mines and Technology and the South Dakota State University. The CBRD center focus is to develop the fundamental understanding and technologies to convert lignocellulose to fuels and key building block chemicals. The research foci of the of these two research centers — pretreatment, conversion, extremophiles, separations, and process simulation and economic analysis — relies on the fundamental underpinnings taught in the

Chemical and Biological Engineering Ph.D. program.

The Ph.D. program is also a strong supporter of State-focused areas in advanced materials, polymers, composites, and nanotechnology. The **Composites and Polymer Engineering Laboratory (CAPE)** is a key resource utilized by our students <http://cape.sdsmt.edu/>. Opportunities exist for CBE Ph.D. students to participate in cutting-edge research funded by the National Science Foundation, the Department of Energy, the Department of Defense, and industrial collaborators.

The Ph.D. Program in chemical and biological engineering is administered by a graduate Program Coordinator and Program Advisory Council consisting of appointed faculty members actively involved in the program. The Program Advisory Council is responsible for the curriculum and program policies.

Curriculum

The current curriculum is designed to provide the CBE Ph.D. graduate with the depth and breadth of engineering knowledge to become a leader in their chosen focus area. To facilitate this, each student is asked to complete a program of study plan that will provide the framework for the student's course work and research. This should be filed with the Program Coordinator before the midterm of the second semester in residence. The CBE Ph.D. Advisory Council must approve all programs of study. Detailed information on examination policy, admission to candidacy, and defense of dissertation are included in the Chemical and Biological Engineering Ph.D. Program Handbook.

Students entering the program with B.S. or M.S. degrees from disciplines other than Chemical or Biochemical Engineering will be required to take several selected courses in Chemical Engineering at the undergraduate level, to provide a firm understanding of engineering principles.

The Graduate Record Examination (GRE), three letters of recommendation, and a GPA of 3.00 or better are required of all applicants for the

Ph.D. program. The TOEFL exam is required for students whose native language is not English.

All CBE Ph.D. candidates are required to successfully complete the required minimum credits and earn a grade of "C" or better, except for a final grade of "S" in CBE 898. However a 3.00 GPA must be maintained to receive graduate research assistantships (GRA).

Below is the summary of the basic required courses:

| Category | Credits |
|---|-----------|
| Required courses ¹ (minimum 6 credits from Chemical Engineering and 6 credits from Biological Engineering focus areas) | 24 |
| Required seminar | 2 |
| Minimum required research credits | 30 |
| Minimum electives ^{1,2} | 12 |
| TOTAL | 80 |

¹ Students entering with a M.S. degree in Chemical Engineering or a closely related discipline may apply a maximum of twenty-four (24) course credit hours toward the required and elective course requirements subject to approval of the Chemical and Biological Engineering Ph.D. Program Advisory Council.

² Elective courses can be selected from other SDSM&T courses as a part of a student's program of study, subject to approval of his/her major professor and graduate committee.

Required courses (focus area — Chemical Engineering)

| | | |
|-----------|---|---|
| CBE 544 | Reactor Design | 3 |
| OR | | |
| CBE 728 | Heterogeneous Kinetics | 3 |
| CBE 550 | System Analysis Applied to Chemical Engineering | 3 |
| CBE 612 | Transport Phenomena: Momentum | 3 |
| CBE 613 | Transport Phenomena: Heat | 3 |
| CBE 621 | Advanced Chemical Engineering Thermodynamics I | 3 |
| CBE 616 | Computations in Transport Phenomena | 3 |
| CBE 714 | Transport Phenomena: Mass | 3 |

Required courses (focus area — Biological Engineering)

| | | |
|----------|-----------------------------|---|
| CBE 584 | Fund. of Biochemical Eng. | 3 |
| CBE 584L | Biochemical Engineering Lab | 1 |
| CBE 734 | Intro to Biocatalysis | 3 |
| CBE 735 | Bioseparations | 3 |
| CBE 792 | Molecular Biology for Eng. | 3 |

Required courses (Seminar and Research)

| | | |
|---------|--------------------|-----|
| CBE 890 | Graduate Seminar | 1 |
| CBE 898 | Ph.D. Dissertation | 1-9 |

Example elective courses

| | | |
|--------------|-------------------------------|-----|
| CBE 791 | Independent Study | 1-3 |
| CBE 792 | Topics | 1-3 |
| CBE 890 | Graduate Seminar | 1 |
| CBE 894 | Adv. Tech Internship | 1-6 |
| CBE 574L | Experimental Polymer Tech. | 1 |
| CBE 574 | Polymer Technology | 3 |
| CHEM 560 | Biochemistry | 3 |
| CHEM 582 | Environmental Chemistry | 3 |
| MES 708/708L | Adv. Instrumental Analysis | 3/1 |
| MES 712 | Interfacial Phenomena | 3 |
| NANO 701 | Nano Materials | 3 |
| ENGM 631 | Optimization Techniques | 3 |
| ENGM 720 | Statistical Process Control | 3 |