CHEMICAL ENGINEERING & BIOENGINEERING (CHBE)

Degrees Offered: Ph.D., M.Eng., M.S.

This program is offered in Durham.

The Department of Chemical Engineering and Bioengineering offers the M.Eng. degree, M.S. degree, and Ph.D. degree in Chemical Engineering. All levels include research opportunities in biomaterials, biomedical engineering, biophysics, catalysis, chemical and biosensors, energy storage, electrochemical engineering, modeling and simulation, synthetic biology, and tissue engineering.

https://ceps.unh.edu/chemical-bioengineering

Programs

- Chemical Engineering (Ph.D.)
- Chemical Engineering (M.Eng.)
- Chemical Engineering (M.S.)

Courses

Chemical Engineering and Bioengineering (CHBE)

CHBE 805 - Fossil Fuels and Renewable Energy Sources
Credits: 4
Processing and refining of coal, crude oil, natural gas, tar sands and shale oil. Biomass co-combustion, biofuel extraction, impediments to widespread utilization. Exploration of environmental issues with energy generation and consumption. Lab.
Equivalent(s): CHE 805
Grade Mode: Letter Grading

CHBE 806 - Electrochemical Methods: Fundamentals and Applications
Credits: 4
Fundamentals and applications of thermodynamics of electrochemical processes; kinetics of electrochemical reactions; examples in electrochemistry current technology.
Prerequisite(s): CHEM 683 with a minimum grade of D- or CHEM 684 with a minimum grade of D-.
Equivalent(s): CHE 806
Grade Mode: Letter Grading

CHBE 812 - Introduction to Nuclear Engineering
Credits: 4
Development of nuclear reactors; binding-energy; radioactivity; elements of nuclear reactor theory; engineering problems of heat transfer, fluid flow, materials selection, and shielding; environmental impacts.
Equivalent(s): CHE 812
Grade Mode: Letter Grading

CHBE 814 - Chemical Sensors
Credits: 4
Interdisciplinary approach using thermodynamic, physical and surface chemistry, kinetic, electrochemical, and optical principles to analyze and design chemical sensors. Topics will include selectivity and sensitivity pf sensors, biosensors, electrochemical sensors, mass sensors, optical sensors, and multivariate sensors. Lab.
Equivalent(s): CHE 814
Grade Mode: Letter Grading

CHBE 822 - Introduction to Microfluidics
Credits: 4
Fundamentals and applications of microfluidics; scaling laws; microfabrication technology; hydrodynamics and electrodynamics; interfacial phenomena; capillary effects and diffusion; microvalves; micropumps; lab-on-a-chip systems; biochips. Fluids mechanics course required prior to taking this course.
Equivalent(s): CHE 822
Grade Mode: Letter Grading

CHBE 825 - Cell Phenotyping and Tissue Engineering Laboratory
Credits: 4
Introduction to culture and phenotyping of mammalian cells (cell line models), with applications to bioengineering and biomedical sciences. Skills, techniques, and knowledge covered include sterile technique, cell culture, cell line models, cell proliferation, cell survival, cell migration, cell adhesion, and drug response. Inquiry-based team projects investigate cell proliferation, cell death, transfection, flow cytometry, 3D scaffolds, or cell imaging.
Equivalent(s): BENG 825
Grade Mode: Letter Grading

CHBE 844 - Corrosion
Credits: 4
Fundamentals of corrosion processes in industrial and environmental settings; thermodynamics, kinetics, and mass transport in local corrosion cells; protection by electrochemical, chemical, surface modification or barrier methods; instrumental methods in corrosion science. Lab.
Equivalent(s): CHE 844
Grade Mode: Letter Grading

CHBE 852 - Process Dynamics and Control
Credits: 4
Dynamic behavior of chemical engineering processes described by differential equations; feedback control concepts and techniques; stability analysis. Lab.
Equivalent(s): CHE 852
Grade Mode: Letter Grading

CHBE 855 - Computational Molecular Bioengineering
Credits: 4
Introduction to fundamental concepts in bioengineering with primary emphasis on understanding details of biomolecular structures integrated with molecular modeling, simulation, and visualization techniques.
The course will introduce structural details of various biomolecules (proteins, nucleic-acids, sugars, and lipids), followed by concepts in thermodynamics and physical chemistry (such as intermolecular forces, energy, entropy, chemical potential, and Boltzmann's distribution), the applications of which will be discussed in the context of drug-receptor interactions, molecular recognition, biomolecular folding, enzyme catalysis, allosteric communication, diffusion, and transport. The laboratory will include training and learning about advanced simulation and visualization software engines.
Equivalent(s): BENG 855
Grade Mode: Letter Grading

CHBE 860 - Principles of Bioengineering
Credits: 3
This course aims to provide students with the fundamental framework of how bioengineering works. Topics covered include basics of molecular and cellular principles, important physiological principles of human body, specific applications of bioengineering such as drug delivery, tissue engineering, nanotechnology, immune-bioengineering, artificial organs, and cancer therapy. Knowledge of differential equations and general chemistry/physics is required for this course.
Grade Mode: Letter Grading

CHBE 861 - Biochemical Engineering
Credits: 4
Immobilized enzyme technology, microbial biomass production, transport phenomena in microbial systems, biological reactor design, process instrumentation and control, applications in separation and purification processes. Lab.
Equivalent(s): CHE 861
Grade Mode: Letter Grading

CHBE 862 - Biomedical Engineering
Credits: 4
Overview of the biomedical engineering through topical studies such as drug delivery and sensors. Discussion of modern engineering methods through primary research sources. Prereq: differential equations and statistics.
Equivalent(s): BENG 862, CHE 862
Grade Mode: Letter Grading

CHBE 866 - Biomaterials
Credits: 4
Fundamental principles of biology and material science, along with latest topics in biomaterials research. Topics include cell biology, wound healing, host response to foreign materials, polymers, hydrogels, diffusion and methods of material characterization. Specific medical applications of biomaterials such as orthopedic and dental implants, heart valves, artificial blood vessels, cochlear and ophthalmic implants and tissue engineering. Laboratory. Students are expected to have some background in chemistry, mathematics, and high school biology.
Equivalent(s): BENG 866, CHE 866
Grade Mode: Letter Grading

CHBE 898 - Chemical Engineering Project
Credits: 3
Concluding experience for Master of Engineering Degree.
Repeat Rule: May be repeated for a maximum of 6 credits.
Equivalent(s): CHE 898
Grade Mode: Graduate Credit/Fail grading

CHBE 899 - Master's Thesis
Credits: 1-9
Master's Thesis.
Repeat Rule: May be repeated for a maximum of 9 credits.
Equivalent(s): CHE 899
Grade Mode: Graduate Credit/Fail grading

CHBE 900 - Seminar
Credits: 0 or 1
Topics of interest to graduate students; reports of research ideas, progress, and results; lectures by outside speakers. Must be taken twice for 1.00 credit. Students register for 0.00 credits for all other semesters in ChE graduate program.
Repeat Rule: May be repeated for a maximum of 2 credits.
Equivalent(s): CHE 900
Grade Mode: Graduate Credit/Fail grading

CHBE 923 - Advanced Chemical Engineering Thermodynamics
Credits: 3
The multi-component open system; the volumetric and phase behavior of pure substances and of multi-component systems at physical and chemical equilibrium, fugacity and activity; thermal properties of equilibrium, chemically reacting systems; introduction to statistical thermodynamics.
Equivalent(s): CHE 923
Grade Mode: Letter Grading

CHBE 932 - Advanced Chemical Engineering Kinetics
Credits: 3
Specialized applied kinetics problems; catalysis; fast reaction and shock tubes; combustion and detonation processes; non-isothermal kinetics; heat and mass transfer in non-equilibrium, chemically reacting systems.
Equivalent(s): CHE 932
Grade Mode: Letter Grading

CHBE 940 - Advanced Transport Phenomena
Credits: 3
This course is a graduate level engineering course designed to review the governing relations of momentum, heat, and transfer at an advanced level for students who have already been exposed to transport at the undergraduate level. Principal concepts will be illustrated through their application to classical and practical paradigms in transport phenomena. Students will learn useful analytical methods for studying and solving steady state and unsteady state (transient) transport problems with and without fluid convection. Prior to taking this course, completion of the following courses are required; fluid mechanics, heat transfer, and mass transfer.
Equivalent(s): CHE 940
Grade Mode: Letter Grading

CHBE 996 - Graduate Independent Study
Credits: 1-4
Directed reading or investigation at the advanced level on topics in chemical engineering, including internships for graduate students.
Equivalent(s): CHE 996
Grade Mode: Letter Grading

CHBE 999 - Doctoral Research
Credits: 0
Doctoral Research.
Equivalent(s): CHE 999
Grade Mode: Graduate Credit/Fail grading

Faculty

Chemical Engineering and Bioengineering Faculty