Department of Chemical and Biomedical Engineering

E-mail: Statler-CHE@mail.wvu.edu

Degrees Offered

- Bachelor of Science in Biomedical Engineering (B.S.Bm.E.)
- Bachelor of Science in Chemical Engineering (B.S.Ch.E.)

Nature of the Programs

The Department of Chemical and Biomedical Engineering offers undergraduate degrees in chemical engineering (ChE) and biomedical engineering (BMEG). Chemical engineers focus on processes that convert raw materials such as crude oil, biomass, coal and natural gas into value-added finished products such as plastics, paints, detergents and pharmaceuticals. Biomedical engineers are trained to work at the interface of engineering and biomedical sciences, and they focus on developing engineering skills and applying them to materials, processes and procedures used in medicine and biology. Both degree programs require a strong background in chemistry, mathematics, and physics.

The chemical engineering curriculum is relatively structured with courses that must be taken in a specific sequence. A unique aspect of the ChE curriculum is its heavy emphasis on design, beginning in the sophomore year. Graduates with a BSChE degree are prepared for positions in production, product and process development, sales and marketing, management and also research. There is a large concentration of chemical industry in the area, and the ChE program benefits from interactions with industrial practitioners.

The biomedical engineering program offers significant flexibility of study through a variety of electives. With the participation of faculty from several engineering departments, students learn about cells and tissues but also topics such as imaging and mechanics. Students are encouraged to do research and work side-by-side with faculty in both engineering and the WVU Health Sciences Center in areas such as tissue engineering and cancer diagnosis. Graduates with a BSBmE degree are prepared for solving the health-related problems and improving the quality of life of the aging population within the state and the nation.

Students in both programs are also prepared for graduate school in engineering and for professional schools in business, law and medicine.

FACULTY

CHAIR

- Richard Turton - Ph.D. (Oregon State University)
  WVU Bolton Professor, P.E.; Process systems engineering, Particle and powder technology, Chemical process design

PROFESSORS

- Debangsu Bhattacharyya - Ph.D. (Clarkson University)
  GE Plastics Material Engineering Professor; Integrated gasification combined cycle (IGCC), Chemical looping, Fuel cells (SOFC & PEM), Optimization, Dynamic modeling of process systems, Process control
- Eugene V. Cilento - Ph.D. (University of Cincinnati)
  Physiological transport phenomena, Biomedical engineering, Image analysis, Mathematical modeling
- Pradeep Fulay - Ph.D. (University of Arizona)
  Associate Dean for Research. Advanced electronics, Magnetic materials and devices, Flexible electronics, Synthesis and processing of nanomaterials
- Rakesh Gupta - Ph.D. (University of Delaware)
  Berry Professor. Polymer processing, Rheology, Non-Newtonian fluid mechanics, Composite materials
- John (Jianli) Hu - Ph.D. (Tsinghua University)
  Shale gas utilization, Catalysis in refining processes, Coal and biomass conversion
- John W. Zondlo - Ph.D. (Carnegie Mellon University)
  Coal enhancement and utilization, Carbon science, Environmental remediation

ASSOCIATE PROFESSORS

- Zoica Cerasela Dinu - Ph.D. (Max Planck Inst of Molecular Cell Biology & Genetics & Dresden University of Technology)
  Associate Chair, BMEG. Nanomaterials, Bionanotechnology, Biomimetics, Catalysis
- David J. Klinke - Ph.D. (Northwestern University)
  Systems biology, Kinetics, Cellular signal transduction pathways, Immunology, Mathematical modeling, Bioengineering
ASSISTANT PROFESSORS

- Jessica L. Allen - Ph.D. (University of Texas at Austin)
  Neuromuscular biomechanics; Aging, injury, and disease-related mobility impairments; Rehabilitation engineering; Musculoskeletal modeling and simulation
- Margaret F. Bennewitz - Ph.D. (Yale University)
  Biomedical imaging, Fluorescence intravital lung microscopy, MRI contrast agents, Micro/nano drug delivery systems, Microfluidics, Tumor microenvironment, Cancer metastasis, Stem cells
- Ahmed E. Ismail - Ph.D. (Massachusetts Institute of Technology)
  Biomass and biopolymers, Interfacial phenomena, Multi-scale modeling, Algorithm development
- Fernando V. Lima - Ph.D. (Tufts University)
  Process design and operability, Model-based control and optimization, State estimation and process identification, Modular energy systems and sustainability
- Hanjing Tian - Ph.D. (Lehigh University)
  Chemical looping combustion, CO₂ capture, Shale gas utilization, Biomass gasification and refinery
- Shuo Wang - Ph.D. (California Institute of Technology)
  Human intracranial electrophysiology, Cognitive and social neuroscience

TEACHING ASSOCIATE PROFESSOR

- Paul T. Daniell - Ph.D. (West Virginia University)
  Engineering Education, Cyber Security, and Rheology

TEACHING ASSISTANT PROFESSOR

- Robin S Hisam - Ph.D. (University of Delaware)
  Biomaterials, Polypeptides, Drug delivery, Bioengineering and materials science

TEACHING INSTRUCTOR

- Jeremy S. Hardinger - Ph.D. (West Virginia University)

RESEARCH ASSISTANT PROFESSOR

- Nagasaree Garapati - Ph.D. (West Virginia University)
  Carbon dioxide capture and storage (CCS) in various geologic media, utilizing carbon dioxide in gas hydrate reservoirs, petroleum reservoirs and geothermal reservoirs for enhanced gas, oil and heat recovery

RESEARCH ASSOCIATE

- Sushant Agarwal - Ph.D. (West Virginia University)
  Polymer processing and characterization, Rheology, Nanocomposites, Emulsions, Nanofluids, Suspensions

ADJUNCT PROFESSORS

- Deepak DoraSwamy - Ph.D. (University of Delaware)
- Scott M. Galster - Ph.D. (The Catholic University of America)
  Applied Experimental Psychology
- Laura F. Gibson - Ph.D. (West Virginia University)
  Professor and Senior Associate VP for Research and Graduate Education; Genetics and Developmental Biology
- Joseph D. Henry - Ph.D. (University of Michigan)
- Charles M. Jaffee - Ph.D. (University of Colorado)
  Theoretical Chemistry, Molecular and Atomic Physics, Nonlinear Dynamics, Astrodynamics
- George E. Keller, II - Ph.D. (Pennsylvania State University)
- Mahesh Padmanabhan - Ph.D. (University of Minnesota)
- Yon Rojanasakul - Ph.D. (University of Wisconsin, Madison)
  Pharmaceutical Sciences
- George A. Spirou - Ph.D. (University of Florida, Gainesville)
  Neuroscience
- Robert Wildi - B.S. (Fenn College/Cleveland State University)
- Stephen Zitney - Ph.D. (University of Illinois at Urbana-Champaign)
Dynamics, Control and optimization of energy systems; Computational fluid dynamics (CFD) and process co-simulation; Pulverized coal combustion; Oxy-coal Combustion; Integrated gasification combined cycle (IGCC); Chemical looping; Supercritical CO2 power cycles; CO2 capture

ADJUNCT ASSOCIATE PROFESSOR
- Thirimachos Bourlai - Ph.D. (University of Surrey, U.K.)
  Electrical and Electronic Engineering
- Valeriya Gritseniko - Ph.D. (University of Alberta)
  Neuroscience
- Yuxin Liu - Ph.D. (Louisiana Tech University)
  Microelectronics
- Sam M. Mukdadi - Ph.D. (University of Colorado, Boulder)
  Mechanical Engineering
- Sergiy Yakovenko - Ph.D. (University of Alberta)
  Neuroscience

ADJUNCT ASSISTANT PROFESSOR
- Joshua A. Hagen - Ph.D. (University of Cincinnati)
  Materials Science and Engineering
- Victor S. Finomore, Jr. - Ph.D. (University of Cincinnati)
  Applied Experimental Psychology (Human Factors)
- Jeffrey S. Reynolds - Ph.D. (West Virginia University)
  Electrical Engineering
- John Twist - Ph.D. (Rutgers University)
  Pharmaceutical Sciences

PROFESSORS EMERITUS
- Eung H. Cho - Ph.D. (University of Utah)
  Mineral processing, Leaching, Solvent extraction, Environmental science
- Dady B. Dadyburjor - Ph.D. (Delaware)
  Catalysis, Reaction Engineering
- Edwin L. Kugler - Ph.D. (Johns Hopkins)
  Catalysis, Adsorption, Coal liquefaction
- Joseph A. Shaeiwitz - Ph.D. (Carnegie-Mellon)
  Design, Design Education, Outcomes Assessment
- Alfred H. Stiller - Ph.D. (University of Cincinnati)
  Physical/inorganic/soluton chemistry, Coal liquefacion, Carbon science
- Ray Y. K. Yang - Ph.D. (Princeton)
  Biochemical and Chemical Engineering, Nonlinear Dynamics

BIOMEDICAL ENGINEERING MINOR
MINOR CODE - U142

The minor is open to all students with the prerequisite coursework, which includes:
Biology: BIOL 115/BIOL 116 OR (BIOL 101, BIOL 102, BIOL 103, AND BIOL 104)
Mathematics: MATH 155 and MATH 156. Students must also complete MATH 251 and MATH 261 for completion of minor.
Chemistry: CHEM 115/CHEM 115L and CHEM 116/CHEM 116L

The minor consists of 5-6 courses, totaling 16 hours.

Required Courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMEG 201</td>
<td>Introduction to Biomedical Engineering</td>
</tr>
<tr>
<td>or EE 425</td>
<td>Bioengineering</td>
</tr>
</tbody>
</table>

Choose one of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 235</td>
<td>Human Physiology</td>
</tr>
<tr>
<td>&amp; BIOL 236</td>
<td>and Human Physiology: Quantitative Laboratory</td>
</tr>
<tr>
<td>BIOL 117</td>
<td>Introductory Physiology</td>
</tr>
<tr>
<td>&amp; BIOL 118</td>
<td>and Introductory Physiology Laboratory</td>
</tr>
</tbody>
</table>

Electives: 9
Choose three of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMEG 310</td>
<td>Biomedical Imaging</td>
</tr>
<tr>
<td>BMEG 311</td>
<td>Biomaterials</td>
</tr>
<tr>
<td>BMEG 340</td>
<td>Biomechanics</td>
</tr>
<tr>
<td>or MAE 473</td>
<td>Bioengineering</td>
</tr>
<tr>
<td>BMEG 480</td>
<td>Cellular Machinery</td>
</tr>
<tr>
<td>BMEG 481</td>
<td>Applied Bio-Molecular Modeling</td>
</tr>
<tr>
<td>BMEG 482</td>
<td>Introduction to Tissue Engineering</td>
</tr>
</tbody>
</table>

Total Hours: 16

**CHEMICAL ENGINEERING MINOR**

**MINOR CODE - U101**

Any student may take a minor in chemical engineering by passing the following courses and maintaining a 2.0 GPA or better in these courses.

Courses must be taken in the following order:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHE 201</td>
<td>Material and Energy Balances 1</td>
<td>3</td>
</tr>
<tr>
<td>CHE 202</td>
<td>Material and Energy Balances 2</td>
<td>3</td>
</tr>
<tr>
<td>CHE 320</td>
<td>Chemical Engineering Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>CHE 312</td>
<td>Separation Processes</td>
<td>3</td>
</tr>
<tr>
<td>CHE 325</td>
<td>Chemical Reaction Engineering</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Hours: 15

**Biomedical Engineering Certificate**

**CERTIFICATE CODE - CU02**

The Department of Chemical Engineering administers a certificate program in biomedical engineering that is open to all students with appropriate prerequisites, which are: basic biology (BIOL 115), mathematics through MATH 261 (differential equations), CHEM 115, and CHEM 116 and a working knowledge of organic chemistry, specifically the naming conventions for, and knowledge of charge distribution in, organic molecules. Currently, the certificate program consists of six required courses listed below. As other courses are added in the biomedical engineering area, more choices of elective courses will be made available.

**Required Courses**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 235</td>
<td>Human Physiology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 236</td>
<td>Human Physiology: Quantitative Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>BMEG 201</td>
<td>Introduction to Biomedical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>BMEG 311</td>
<td>Biomaterials</td>
<td>3</td>
</tr>
</tbody>
</table>

**Electives**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMEG 481</td>
<td>Applied Bio-Molecular Modeling</td>
<td>3</td>
</tr>
<tr>
<td>BMEG 482</td>
<td>Introduction to Tissue Engineering</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Hours: 16

For chemical engineering undergraduates, the certificate program can be completed with the addition of one additional credit hour (134 hours total). Students wishing to attend medical school will have to take CHEM 234/CHEM 236 (four hours) for a total of 138 credit hours.