

Professional Biopharmaceutical Engineering

The Certificate of Professional Biopharmaceutical Engineering prepares students for professional careers in biologics manufacturing, advanced therapeutic production, and regulated pharmaceutical operations. The program integrates engineering fundamentals with bioprocessing, quality systems, regulatory science, and industry-based experiential learning to address workforce needs in the rapidly evolving biopharmaceutical sector.

Designed for both recent STEM graduates and working professionals, the curriculum emphasizes upstream and downstream bioprocessing, biotechnology manufacturing systems, process scale-up, and Good Manufacturing Practice (GMP) compliance. Students develop practical competencies through case-based instruction and a capstone experience incorporating applied biomanufacturing training.

The program is delivered primarily online, offering flexibility while maintaining rigorous academic standards and strong industry alignment. Graduates are prepared for roles in bioprocess engineering, pharmaceutical manufacturing, quality assurance and validation, and technology transfer within biotechnology companies, pharmaceutical manufacturers, and CDMOs.

12 Credits Total | 2 Core Courses + 2 Elective Courses

The Certificate program requires completion of 12 credits, consisting of:

- Core Courses (6 credits) — Two required courses providing the essential engineering foundation for biomanufacturing.
- Electives (6 credits) — Two elective courses allowing students to develop focused expertise aligned with career goals.
- Optional Capstone/Project/Internship — 3 credits, undertaken during the summer session of the one-year program (in addition to the 12 required credits, where applicable).

Required Core Courses (6 credits total)

- **PhEN 607 — Biotechnology Processes (3 credits):** Microbial/mammalian bioprocessing principles; bioprocess workflow; industrial biotechnology manufacturing.
- **PhEN 608 — Unit Operations in Bioprocess Engineering (3 credits):** Upstream/downstream unit operations; scale-up considerations; filtration, centrifugation, chromatography, separations.

Elective Courses (6 credits — choose 2)

Students select two elective courses (6 credits) from the following list. Electives span four competency areas, allowing tailored specialization:

Pharmaceutical Quality and Regulatory Engineering

- PhEN 602 — Pharmaceutical Facility Design (3 credits)
- PhEN 604 — Validation and Regulatory Issues in the Pharmaceutical Industry (3 credits)
- CHEM 714 — Pharmaceutical Analysis (3 credits)
- IE 673 — Total Quality Management (3 credits)

Biopharmaceutical Operations and Technology Management

- EM 636 — Project Management (3 credits)
- EM 637 — Project Control (3 credits)
- EM 691 — Cost Estimating for Capital Projects (3 credits)
- IE 659 — Supply Chain Engineering (3 credits)
- IE 618 — Engineering Cost and Production Economics (3 credits)
- IE 686 — Intro to Healthcare Systems (3 credits)
- PhEN 618 — Principles of Pharmacokinetics and Drug Delivery (3 credits)

Digital and Data-Driven Biomanufacturing

- MTEN 631 — Data Science for Chemical and Materials Engineering Applications (3 credits)
- MTEN 633 — Machine Learning in Chemical and Materials Engineering (3 credits)
- CHE 632 — Visual Communication with Chemical & Materials Engineering Data (3 credits)
- MATH 661 — Applied Statistics (3 credits)
- CHEM 737 — Applications of Computational Chemistry and Molecular Modeling (3 credits)

Biologically-Driven Engineering Systems

- BIOL 606 — Applied Bioprocessing & Immunological-Based Therapy (3 credits)
- BME 652 — Cellular and Molecular Tissue Engineering (3 credits)
- BME 682 — System Management for Medical Device (3 credits)
- CHEM 777 — Principles of Pharmaceutical Chemistry (3 credits)