**Blue Marble University**

**Doctor of Science (D.Sc.) in Chemical Engineering**

**(3 Year Program You Can Complete Entirely Online)**

Chemical engineers apply the principles of chemistry, biology, and physics to solve problems. These problems involve the production or use of chemicals, fuel, drugs, food, and many other products. They design processes and equipment for large-scale safe and sustainable manufacturing, plan and test methods of manufacturing products and treating byproducts, and supervise production. A chemical engineer is involved in the design, development, construction and operation of industrial processes and factories for the production of a diverse range of products, as well as in commodity and specialty chemicals. Relevant industries include oil and gas, pharmaceuticals, energy, water treatment, food and drink, plastics and toiletries. Modern chemical engineering is also concerned with pioneering valuable new materials and techniques, such as nanotechnology, fuel cells and biomedical processes and engineering. As a chemical engineer, you may work in research, teaching, development, manufacturing, technical support, marketing, sales, project engineering, or enter into engineering management.

This program will build on your baccalaureate engineering degree by providing you with advanced knowledge and skills. You will take core courses covering mathematical modeling, thermodynamics, fluid mechanics, and chemical reaction engineering, then you will move on to more specialized subjects such as materials science, process control, environmental science, and petroleum engineering, among many others.

We have an exciting program, and it is not as difficult as you think!! Dissertation topics are always open to the student to select what he/she would like to research (with faculty guidance and approval). We are currently encouraging dissertations that relate to the batch processing of human stem cells, growth media, and nanotechnology for labeling and sorting of cells, but this topic in biomedical processes is not a requirement.

We operate on a trimester schedule, which means that our academic year is divided into 3 segments of 4 months each. In each 4 month period, students take three courses. For some terms, or as determined by the University, students may be assigned courses in sequence, lasting about 1 month each. In that event, for any approximate one month period, a student will be studying one course.

**TOTAL: 72 TRIMESTER CREDITS**
**(Equivalent to the USA Minimum Requirement for a Doctoral Degree)**

**In the following table, all the courses for a particular year are shown sequentially in the column for that year.**

| Year 1 | Year 2 | Year 3 |
|---|---|---|
| Term 1 | Term 1 | Term 1 |
| **Advanced Thermodynamics:** This course explores properties of pure substances, first and second laws of thermodynamics, entropy and energy analysis with applications to energy conversion devices and thermodynamic cycles, single- and multi-phase systems, irreversibility in thermodynamics | **Advanced Plant Design:** In this course principles of technical and economic evaluation are applied to a chemical engineering problem. | **Research Methodology and Writing:** Includes introduction to blogging and preparation of Online Portfolio to highlight the student's education, accomplishments, and interests. |
| **Advanced Mathematics for Chemical Engineers**: This course explores the use of the basic laws of conservation of momentum, mass and energy to formulate partial differential equations describing chemical engineering processes. Analytical and numerical solution of partial differential equation, matrices, and vector analysis. | **Energy Systems Processes**: This course explains the concepts and process of energy conversion. It presents power systems structure, components and operation. It deals with the applications of power transmission lines and transformers, energy system representation, load flow, power system protection, symmetrical components, faults and stability. This course examines energy supply, conventional fuel reserves (coal, oil, natural gas), alternative sources (nuclear, solar, geothermal, etc.) | **Topics for Thesis:** A thesis topic will be determined and outlined. |

| Year 1 | Year 2 | Year 3 |
|---|---|---|
| **Experimental Design, Statistical Process and Quality Control**: This course explores how to design an experimental study, carry out an appropriate statistical analysis of the data, and properly interpret and communicate the analyses. At the end of the course a review of quality control in industrial settings is given. | **Introduction to Materials Science**: This course reviews the structure, processing, properties, and applications of metals, ceramics, polymers, and composite materials. | **Dissertation Preparation I**: The student will spend the rest of the time engaged in generating an independent work. |
| Term 2 | Term 2 | Term 2 |
| **Advanced Reaction Engineering**: This course explores the advanced treatment of chemical reaction engineering including effects of non-ideal flow and fluid mixing on reactor design. Multi-phase reaction systems of non-heterogeneous catalysis and catalytic kinetics. | **Wastewater Treatments:** This course provides an introduction to wastewater treatment operation and maintenance and to the facilities used to treat wastewater. It also provides in-depth coverage of preliminary wastewater treatment facility operation and maintenance. | **Dissertation Preparation II** |
| Advanced Fluid Mechanics: This course surveys the principal concepts and methods of fluid dynamics. Topics include mass conservation, momentum, and energy equations for continua, the Navier-Stokes equation for viscous flows, similarity and dimensional analysis, lubrication theory, boundary layers and separation, circulation and vorticity theorems, potential flow, an introduction to turbulence, lift and drag, surface tension and surface tension driven flows. | Introduction to Petroleum Engineering: This course studies the reserves of coal, oil, and natural gas. It deals with petroleum processing and refining; coal, oil shale, and tar sand; gasification and liquefaction of coal. It explores methods used to evaluate the natural and synthetic properties of oil and gas. | |

| Year 1 | Year 2 | Year 3 |
| --- | --- | --- |
| Advanced Process Control: Advanced topics in control, including feed forward control, cascade control, and frequency response analysis. Control of processes using microprocessors and digital computers is introduced. Specification of control systems and on-line process instrumentation is stressed. A survey is made of the most recent methods for analysis of the dynamic behavior and control of process systems. | Polymer Engineering: This course examines polymer chemistry, polymerization kinetics, polymer rheology, and material characteristics. It considers design and analysis of polymer reactors, extruders, molding machines, and other forming operations, and discusses modern industrial and commercial processes for production and fabrication of polymer materials. | |
| Term 3 | Term 3 | Term 3 |
| Modeling of Chemical Processes: This course is a review of mathematical modeling of chemical processes, application of numerical techniques to the solution of equations, use of a programming language to write programs for calling numerical subroutines, numerical solutions of problems resulting in partial differential equations. | Introduction to Biochemical Engineering: This course analyzes immobilized enzyme technology, microbial biomass production, and transport phenomena in microbial systems, biological reactor design, process instrumentation and control, applications in separation and purification processes. | Dissertation Presentation and Completion of Online Portfolio |
| Advanced Heat and Mass Transfer: This course covers problems of heat and mass transfer in greater depth and complexity than is done in previous courses and incorporates many subjects that are not included or are treated lightly in those courses; analysis is given greater emphasis than the use of correlations. | Biomedical Engineering: The course covers basic concepts of biomedical engineering and their connection with the spectrum of human activity. It serves as an introduction to the fundamental science and engineering on which biomedical engineering is based | |

| Year 1 | Year 2 | Year 3 |
|---|---|---|
| Advanced Reactor Design: The overall objective of the course is to introduce students to the concepts of reactor design and reaction engineering covering more advanced topics. Chemical reaction engineering involves the exploitation of chemical reactions on a commercial scale. This is what specifically sets chemical engineering apart as a distinct branch of the engineering profession | Environmental engineering: This course reviews the control technologies used for management of air, water, and wastewater pollutants. It examines the characteristics of air and water quality, their physical, chemical, and bacteriological parameters, and control, including filtration, sedimentation, coagulation, absorption, chemical treatment, and aeration. | |

**Credits**: Each of the above courses (with the exception of Dissertation Presentation and Completion of Online Portfolio which is 6 credits) consists of 3 trimester credits each.The program comprises 72 trimester credits, and consequently is equivalent to the minimum 60 semester credits for a USA regionally accredited college or university. Upon completion, and for a nominal fee, graduates will be able to obtain a Certificate of Equivalency from a foreign education credentials evaluation service approved by the USA Department of Education for employment purposes in the USA.