Blue Marble University

Fast Track Combination Bachelor of Science (B.S.) and Doctor of Science (D.Sc.) in Biomedical engineering

5 Year program which you can enter right after High School
And Complete Entirely Online

B.S./D.Sc. 5 year Fast Track Combination Program, featuring a Bachelor Degree and a Doctoral Degree in Biomedical Engineering

This is a multidisciplinary program that can be entered after High School. The first two years feature various areas of preparation and the doctoral program is a multidisciplinary education in Biomedical Engineering. This program is best for those that want broad training in many areas that may be suitable for careers in clinical, biomedical, research, industrial, or academic settings.

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.

Please Note: This is a 5 year program only. We do not offer a Bachelor Degree to students who only complete the first two years.

Years 1 and 2 are Used for the Bachelor Degree Part of the Program
(See our note at the end relating to Seat Time)

Year 1	Year 2
Term 1	Term 2
Online Portfolio 1: Introduction to blogging and creation of digital portfolio of accomplishments and interests	**Fundamentals of Computer Science:** Examines the computer science discipline, covering basic computer concepts such as binary logic, computer hardware, design and writing of programs, and advanced applications such as artificial intelligence. General overview of the computer science major and the terminology and concepts students learn throughout the program.

Year 1	Year 2
English Writing: Practical writing and polishing of your writing skills	**Programming Concepts**: This course provides the student with an introduction to the fundamentals of computer problems solving and programming. Students are introduced to structured and object oriented programming concepts in a language independent manner. Basic programming concepts, specific control structures, and object oriented design are explored.
Research and Writing: Learn literature research skills and technical writing form	**Operating Systems**: This course focuses on the software operating systems that run today's personal computers. Emphasis will be placed on commands, functions, and terminology through practical instruction in the installation, configuration, and upgrade of operating systems.
Term 2	Term 2
Applied Human Biology: This course presents the human biology, anatomy, physiology, and medical terminology essential for biomedical equipment technicians and the devices involved in patient care. Focus is on the vocabulary necessary for effective medical communication skills in the hospital environment as part of the health care team.	**Electrical Engineering:** Introduction to electrostatics, basic dc circuits, circuit simplification techniques, introduction to magnetic fields, ac circuit components, the dynamic of circuits, analysis of ac circuits, resonance, sinusoids and phasor, three phase power systems, operational amplifiers, transistors as amplifiers, diodes and transistors as switches.

Year 1	Year 2
Laboratory Techniques in Biology: Introduction to basic laboratory techniques and methods using video demonstrations. The isolation and purification of Firefly Luciferase may be used as a model.	**Applied Electricity and Magnetism**: Fundamentals of electricity and magnetism, vector calculus, Maxwell's equations, Kirchhoff's laws, static electric and magnetic fields, resistance, capacitance, inductance, magnetic circuits, and transformers.
Bioengineering Subspecialties: Various subspecialties of Biomedical Engineering are reviewed in order that the student may begin thinking about possible dissertation topics.	**Electronics:** Signal and amplifier concepts; operational amplifiers; diodes and nonlinear circuits; Bipolar junction transistors; biasing, small and large signal analysis; Transistor amplifiers; two-port networks.
Term 3	Term 3
Math Review: A course designed to polish your math skills.	**Medical Instrumentation**: A broad course covering sample medical instruments for measuring, sensing, and imaging.
Differential Equations: Systems of ordinary differential equations; existence, uniqueness and stability of solutions; initial value problems; bifurcation theory; Jordan form; higher order equations; Laplace transforms.	**Modern Optics and Photomics:** Lightwave fundamentals: geometrical and wave optics, interference, diffraction, scattering, Fourier optics; photonic passive & active devices: waveguides, lasers detectors, modulators, photonic integrated circuits, displays; optical system design and engineering.
Statistics for Biomedical Scientists: Introduction to statistics and methods	**Electronics for the Clinical Laboratory Technician:** This course provides a study of devices, circuits, computers, test equipment, transducers, and sensors which are specific to the clinical laboratory. This course includes the analysis of applied electronics circuits incorporated in this environment.

Note: Satisfactory Completion of the first two years of this program qualifies the student for continuing into the 3 year doctoral program in Biomedical Engineering, and that 3 year program is detailed again here:

Year 1
Term 1
Anatomy and Physiology for Engineers: This course provides an introduction to anatomy and human physiology for engineers and other non-life-scientists. Topics include nervous system, muscle and cardiac function, digestive system, and immune system
Human Cell and Molecular Biology for Engineers: Advanced examination of the organization and function of the cell with emphasis on the biophysical and quantitative aspects of cellular function. Emphasis will be on the biomedical engineering applications of regulation of cell division, protein transcription and translation within the cell, cellular energetics, and intracellular networks for cell signaling and cell function.
Human Adult Stem Cell Biology: The course examines blood and blood components, identification of adult stem cells, biological and medical properties of adult stem cells, and tissue sources. Lab created embryonic stem cells are also studied.
Term 2
Immunofluorescence Labeling Techniques: One of the most important imaging systems in modern medicine, we cover this course from the standpoint of cell labeling and imaging of cells and cell components.
Tissue Engineering: Creation of artificial organs and tissue from biological materials, including an investigation of bio-artificial organs which use synthetic and biological components. Use of case studies to explore pathologies of tissue, current clinical treatment, and the role of engineers in developing new technologies to diagnose and treat these pathologies.
Genetic Engineering: We cover recombinant DNA technology, genetic modification and manipulation and gene splicing. The production of human synthetic insulin from modified bacteria is studied.
Term 3
Batch Preparation of Human Cells: The current status of bioreactors, current status of batch processes as related to human cells, and in particular to human stem cells, is studied within the historical back-drop of the batch processing of bacterial cells. Equipment, growth media, control processes will be investigated.
Cell Labeling and Separation: Biochemical, immunological, nano-particle, and optical cellular labeling and separation techniques are presented.
Bio-nanotechnology: Preparation and use of nanometer size particles in biological systems, with emphasis on cellular labeling, and cell separation via nano-particle recognition

Year 2
Term 1
Biophotonics: Manipulation of light with emphasis on use of the laser for sensing and imaging of cells and tissue. Also covered is the thermal response of random media in interaction with laser irradiation; calculation of the rate of heat production caused by direct absorption of the laser light, thermal damage, and ablation.
Fiber Optic Applications: Using fiber optics for biomedical sensing of pressure, differential pressure, acoustics, substance and cellular detection.
Biosensors: Biosensors represent a newly arising frontier in biomedical engineering. The course offers a solid preparation on sensors (theory, physical principles, and applications) so valuable in industry and R&D.
Term 2
Signal Processing: Merging biomedical engineering with advanced signal processing skills can create professional competencies that most companies are looking for, and most engineers are not able to give. We look at sensing principles and algorithms taken from neural networks, radar, and space communication as made relevant to biological systems.
Medical Devices and Regulations: Many categories of devices are covered, with emphasis on devices for people with disabilities.
Medical and Biological Imaging: Physical principles and signal processing techniques used in thermographic, ultrasonic, and radiographic imaging, including image reconstruction from projections such as CT scanning, MRI, and millimeter wave determination of temperature profiles
Term 3
Implants and Biomaterials: Overview of biomaterials, including prosthetics, ceramics, metal implants, and polymers, with specific emphasis on properties and applications. The immunology of material-tissue interactions and the issues of biocompatibility are also covered.
Pharmaceutical Materials: Introduction to pharmaceutical materials and its application to designing and manufacturing drug products. Focus is on materials encountered in the pharmaceutical industry and how the materials affect processes they are used in.
Bioinformatics and Robotics: Developing and using computer tools for data collection and analysis, with emphasis on robotics.

Year 3
Term 1
Research Methodology and Writing: We include creation of the student's Online Portfolio and introduction to blogging. The Online Portfolio is the student's digital presentation of accomplishments, education, research, and other interests published to the internet
Select and Outline Thesis Topic
Dissertation Preparation I
Term 2
Dissertation Preparation II
Term 3
Final Dissertation Presentation and Completion of Online Portfolio

Credits: Each of the above courses (with the exception of Final Dissertation Presentation and Completion of Online Portfolio which is 6 credits) consists of 3 trimester credits each.The doctoral 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.

Note Concerning Undergraduate Degree and "Seat Time"

As we have stated before, we drop "seat time" from each and every one of our programs. All of our students must demonstrate "Proficiency" with regard to the subject matter of their studies. Consequently, our programs are shorter.

"Seat time", which is the foundation of "accreditation" in the USA, is the old fashioned, outdated requirement that a student spend a required amount of time and/or take required general studies courses in order to receive a Bachelors Degree. We follow the USA Department of Education in its "National Education Technology Plan 2010" wherein it recognized that "seat time" has got to go. At Page 12 of the report: *"One of the most basic assumptions in our education system [accreditation] is time-based or “seat-time” measures of educational attainment.... [colleges and universities should be organized] around competence rather than seat time and others that enable more flexible scheduling that fits students’ individual needs* ***rather than traditional academic periods and lockstep curriculum pacing."***