Curriculum

Semester	Course Number	Title	Credits
Fall I	BTEC 575	Introduction to Climate Change	3
Fall I	BTEC 501	Genetic Engineering / Advanced Molecular Biology	3
Fall I	BTEC 531	Research Ethics	2
Spring I	BTEC 580	Emerging Diseases	3
Spring I	BTEC 502	Protein Structure, Function, & Dynamics	3
Spring I	BTEC 650	Plant Biotechnology	3
Fall II	BTEC 675	Mitigation of Climate Change through Biotechnology	3

- Explain the human causes of climate change, including the sources of greenhouse gas emissions. Because energy consumption is central to greenhouse gas emissions, students will understand the global energy infrastructure in a historical context and evaluate technological options for reducing emissions.
- Apply quantitative analysis of concepts relevant for climate change, drawn from chemistry, physics, and economics, through homework problems.
- Evaluate the successes and failures of past national and international efforts to address climate change and evaluate prospects for future management of climate change.
- Evaluate the issue of climate change from the perspective of individual nations.

BTEC 501 Genetic Engineering / Advanced Molecular Biology 3 Credits

The World Health Organization warned in its 2007 report that infectious diseases are emerging at a rate that has not been seen before. Since the 1970s, nearly 40 infectious diseases have emerged as a major threat to humans, including SARS, MERS, Ebola, chikungunya, avian flu, swine flu, Zika and now a new coronavirus-COVID19. Even though COVID19 has taken a central stage among the emerging diseases, emergence or reemergence of new pandemic cannot be ignored.

This course will describe the major courses of emergence of potentially lethal diseases and teach how biotechnology can be used to combat the new threats. How climate change and global warming play an important role in emergence of major epidemics and pandemics. Other factors including living in more densely populated areas, migration from rural areas to cities, international air travel, poverty, wars, and destructive ecological changes due to economic development and land use, coming into closer contact with wild animals, and deforestation, increases potential for emerging infectious diseases to spread rapidly and cause global epidemics. In addition, there is the potential for diseases to emerge as a result of deliberate introduction into human, animal, or plant populations for terrorist purposes (i.e., anthrax, smallpox, tularemia and Ebola).

Many emerging diseases arise due to zoonoses. However, climate change is an important factor in the emergence of infectious diseases. As Earth's climate warms and habitats are altered, diseases can spread into new geographic areas. For example, warming temperatures allow mosquitoes - and the diseases they transmit - to expand their range. Emergence of antimicrobial resistance microbes. Bacteria, viruses, and other microorganisms are evolving and developing resistance to multiple drugs.

We will discuss numerous factors that create the environment for the emergence of new epidemics or pandemics. We will learn from the past pandemics and discuss the strategies that can teach us how to prevent the future emerging diseases. We will also cover the new frontiers in Biotechnology that can assist us in combating the new emerging diseases.

BTEC 502 Protein Structure, Function, & Dynamics 3 Credits

interpret observed phenomena; and (c) relate concepts of statistics, thermodynamics, and mathematics to biological systems

BTEC 650 Plant Biotechnology 3 credits

Climate change as a result of global warming has major impact on agricultural production due to changes in rates of plant growth, transpiration, respiration and photosynthesis. Increase in atmospheric CO2, rising temperature and altered precipitation patterns also affects crop production. Climate change alters ecosystem that results both biotic and abiotic stresses on plants. These stresses change the status of weed, pest resistance, disease resistance, drought tolerance, cold tolerance, increases salinity and water deficit, and reduces soil fertility. To overcome climate change effect on agriculture in general and crop production in particular, it is important to reduce the impact of climate change owing to global warming by adopting two-prong strategy by reducing fossil fuel consumption and development of biotic and abiotic stress tolerant crops. Fossil fuel consumption can be gradually reduced by using bio-fuel, and

BTEC 675 Mitigation of Climate Change 3 Credits

In this course, learners will identify the types of actions that we can pursue to address climate change. These actions fall into two broad categories: 1) mitigation, which refers to efforts to reduce greenhouse gas emissions or enhance carbon sinks, and 2) adaptation, which refers to our preparations for climate impacts. We will explore the use of biotechnologies, programs, and policies related to both mitigation and adaptation. These strategies include specific uses of agricultural biotechnology in the design of salt tolerant crops, drought resistant crops, heat stress enable crops as well as the genetic manipulation of microorganisms involved in fishery management, bio-fuel production, and carbon sequestration. Learners should leave the course with an improved ability to identify and evaluate climate actions undertaken by communities, governments, and businesses.

This course focuses on the climate impacts occurring and expected to occur across the United States and around the world. Our approach will be regional and sectoral, with consideration of impacts on water resources, transportation, energy, agriculture, forests, health, and coastal/marine resources. We will also look at how you can apply bio-technological approaches to address these problems.

Learning outcomes
Students should be able to:
i) differentiate between the different types and goals of mitigation strategies
ii) identify technological options to reduce emissions, their barriers and costs and co-benefits.
iii) explain climate policy tools, their theoretical merits and practical experiences as applied to biotechnology mitigation strategies
v) recognize co-benefits, tradeoffs, potentials, and limitations of a wide range of climate change mitigation options, from the energy to the land sector (including negative emission technologies and geoengineering).

Competences:
The student should be able to
i) Identify, find and interpret relevant knowledge in the scientific literature on climate mitigation.
ii) Explain the terminology and principles for assessing climate mitigation measures.
iii) Identify actors and assess potential challenges and barriers associated with the implementation of climate mitigation measures and policies as well as the consequences of these.
iv) Quantify climate change impacts and mitigation benefits through appropriate metrics.
v) Report and discuss climate-relevant aspects in a scientifically rigorous way.

BTEC 515 Environmental Policy and Management 3 Credits

This course focuses on planning, management of hazardous wastes (including industrial and medical wastes), and conservation of terrestrial, aquatic and forest resources for sustainable use. Topics covered include sources and types of wastes, waste classification, environmental laws and regulations and physicochemical and biological treatment methods. Environmental laws and regulations will focus on the following topics: water pollution, public health and sanitation, energy policy and climate change. The course will also cover alternative energy production

9. Report and discuss climate-relevant aspects in a scientifically rigorous way.

COURSE OUTLINE

1. The Scientific Method
    - Proposing mitigation strategies and experimentation
    - Review case studies of climate mitigation approaches (3)
    - Discuss the role of policy, stake holders, and limitations of specific mitigation efforts
2. Teamwork, collaboration, and group writing
    - Identifying potential stakeholders,
    - Identifying constraints, factoring in stakeholder needs (Workshop)
3. Writing a Proposal
    - Strategies for writing a literature review (Workshop)
    - Principles in writing a Materials & Methods Section (Case study Workshop)
    - Writing Specific Aims in a Biotechnology Proposal (Workshop)
    - Creating reasonable Timelines (Workshop)
4. One-on-one workshops to provide mentoring for proposal.