BIOSYSTEMS ENGINEERING (BIOE)

BIOE 7040 Fluid Mechanics of Unsaturated Porous Solids 3 cr
Statics and dynamics of two immiscible fluid phases occupying the voids of porous solids. Concepts include capillary pressure, bubbling pressure, saturation, intrinsic and relative permeability, pore-size distribution indices.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: consent of instructor.

BIOE 7110 Grain Storage 3 cr
A synthesis of major aspects of the storage of grain including: abiotic and biotic characteristics of stored grain bulks, regional variables, grain pressure theories, methods of controlling deterioration, and health hazards.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: consent of instructor.

BIOE 7140 Advanced Irrigation and Drainage 3 cr
Selected advanced problems and new developments in irrigation and drainage. Interrelationships between irrigation and drainage and the environment.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: consent of instructor.

BIOE 7180 Bioprocessing 3 cr
This course allows students with a background in either biological sciences or engineering to gain an understanding of biochemical engineering processes. Topics include production of biofuels, bioplastics, biophamaceuticals, and processing technologies. This course is also offered in the Department of Microbiology as MBIO 7070. BIOE 7180 is not to be held with MBIO 7070.
Equiv To: MBIO 7180

BIOE 7200 Bulk Solids Storage and Handling 3 cr
Fundamental characteristics of bulk solids, bulk solids flow during storage and handling, loads in bulk solids storage and handling systems, mechanical, pneumatic and hydraulic conveying of bulk solids, safety in storage and handling of bulk solids.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: consent of instructor.

BIOE 7210 Numerical Modelling of Biosystems 3 cr
Applications of numerical methods to the solution of problems dealing with biological systems: structure analysis, mechanical behaviour of biological materials, moisture sorption and desorption, cooling and heating of biological materials, and flow through saturated and unsaturated porous media. Solution of transient and non-linear problems. Use of commercial finite element packages for problem solving.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: consent of instructor.

BIOE 7220 Advanced Machine Design Analysis for Biosystems 3 cr
Analysis of machines for use in biosystems with respect to design and functional performance, in-field traction, operator safety and comfort, and energy source, transmission and application. Engineering analyses will be used to study biosystems machinery problems of current and future interest.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: consent of instructor.

BIOE 7230 Advanced Topics on Light-Frame Buildings 3 cr
Structural and environmental design and analysis of light-frame buildings. Topics include: loads in light-frame buildings; frame design; construction management; environmental control in light-frame buildings; and structure-environment interactions.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: consent of instructor.

BIOE 7240 Special Problems in Biosystems Engineering 3 cr
Advanced work in a specialized field involving engineering applications to biological systems.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: consent of instructor.

BIOE 7250 Mechanical Behavior of Biological Materials 3 cr
Elastic and inelastic behavior of biological materials under applied load. Emphasis on unprocessed and semi-processed food products. Use of mechanical behavior properties in the design of handling, storage, processing and sensing systems for food products.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: consent of instructor.

BIOE 7260 Research Methods in Biosystems Engineering 3 cr
Introduction to quantitative research methods emphasizing reproducible research and analysis. Topics include statement of research objectives and hypotheses; moving through experimentation, measurements, and data acquisition; and ending with exploratory analysis, statistical analyses and estimation.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: consent of instructor.

BIOE 7270 Advanced Seminar in Biosystems Engineering 3 cr
A series of seminars to be given by Ph.D. candidates on research topics of current interest in Biosystems Engineering.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: consent of instructor.

BIOE 7280 Advanced Topics in Biosystems Engineering 3 cr
An opportunity to extend, update or acquire specialized knowledge in particular area of interest.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: consent of instructor.

BIOE 7290 Biosystems Engineering Seminar 1 3 cr
Oral and written presentation of engineering research is discussed. Students are expected to actively participate in weekly seminars and to present two seminars both orally and written.

BIOE 7300 Food Process Engineering 3 cr
Food engineering concepts are presented using quantitative relationships that define the process. Various advanced methods of heating and processing foods are discussed and their mathematical and physical relationships described. Descriptive information of typical equipment assists students in utilizing engineering principles in design.
PR/CR: A minimum grade of C is required unless otherwise indicated.
Prerequisite: consent of instructor.

BIOE 7310 Materials Incorporation into Soil 3 cr
Types and characteristics of agricultural materials; solid and liquid waste (including manure) incorporation; crop residue incorporations, seed placement; chemical incorporation; methods and equipment; performance evaluation; measurement technique.

BIOE 7320 Membrane Processes for Water and Waste Treatment 3 cr
Principles of membrane filtration, classification, design and manufacture. Principle mechanisms of mass transport to the membrane surface and particle/solute rejection. Investigation of membrane bio-fouling and bio-film control strategies. Fundamentals of reverse osmosis, nano-, ultra-, and micro-filtration process design and operation. Practical applications of membranes in the area of water and wastewater treatment. Innovative and novel bio-reactor designs utilizing membrane filtration for environmental reclamation.

BIOE 7350 Bioresource Engineering and Sustainability 3 cr
Students will gain an understanding of overall sustainability of industrial activities, energy usage, and resource depletion. Course topics will include: environmental emissions (as it relates to air and water pollution, solid and hazardous wastes, noise and traffic impacts); life-cycle assessment and related techniques for evaluating sustainability; design improvements to enhance environmental performance of engineered systems; and methodologies for assessing social and economic impacts of new developments.

BIOE 7360 Biological Systems: Behaviour, Modelling and Simulation 3 cr
Applications of engineering principles and mathematical methods to model and simulate biological ecosystems. Course materials will analyze critical elements of a biological system and interactions among these elements, principles and techniques of modelling biological systems, the modeling process, estimation of model parameters, and model analysis and validation. Examples of existing models will be discussed and used to simulate various biological systems.

BIOE 7370 Engineering Properties of Fibres for Industrial Uses 3 cr
Students will gain an understanding of various engineering properties of fibre and textiles for industrial uses. Case studies are used to illustrate the failure of textiles in engineering applications. The course will emphasize how to engineer and evaluate a fibre for biomedical, geotechnical, or athletic applications.

BIOE 7380 Biomaterial Science and Engineering 3 cr
The course provides students with an overview of materials that are synthesized for, or have agricultural, environmental or biomedical applications, including their sources, physical/chemical/biological properties and applications. The course includes the synthesis/isolation/fabrication and characterization of biomaterials, and the structure-property relationship of those materials. Students will be exposed to concepts on several material characterization techniques at the morphological, chemical and biological level.

BIOE 7400 Agro-Based Biocomposites for Industrial Applications 3 cr
This course introduces biocomposite materials made from biodegradable, eco-friendly constituents. Students will be introduced to fibres produced from flax, hemp, canola, and cattail stalks, and will learn various methods to produce biocomposite materials using these biodegradable reinforcement materials mixed with biobased resins. Finally, students will learn how to i) evaluate biocomposite materials for adhesion and mechanical properties and ii) modify surface properties to enhance biocomposite properties.

BIOE 7410 Sustainability in the Textile Industry 3 cr
This course will provide students with an understanding of the environmental problems associated with the textile industry by learning how to assess the environmental footprint associated with the manufacturing of clothing and other textile-based products. In the latter half of the course, students will be introduced to recent research on the utilization of fibres derived from waste biomass as a potential sustainable alternative to traditional textile fibres. Students will gain hands-on experience in the processing of plant stalks for fibre.