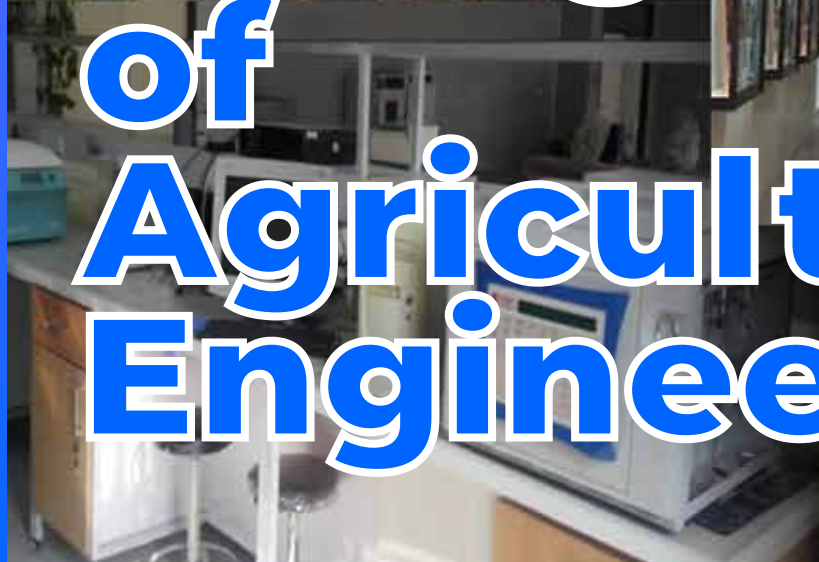




**Isfahan
University of
Technology**



College of Agricultural Engineering



In The Name of God

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Overview

College of Agricultural Engineering at Isfahan University of Technology founded in 1977 with the intention of improving and raising the level of agricultural products in the country through enhancement of scientific know-how, educational planning and research activities. IUT College of Agricultural Engineering is internationally well-known for its academic activities primarily for its research, teaching, and knowledge improvement.

The College includes 1334 undergraduate and graduate students, 9294 alumni, 73 faculty and 65 staff members. This community is strongly determined to improve life through training highly qualified students, broadening knowledge and coming up with innovations. The college is comprised of ten departments:

1. Department of Agricultural Biotechnology
2. Department of Plant Production and Genetics
3. Department of Animal Sciences
4. Department of Biosystems Engineering
5. Department of Food Science and Technology
6. Department of Horticultural Science
7. Department of Plant Protection
8. Department of Rural Development
9. Department of Soil Science and Engineering
10. Department of Water Sciences and Engineering

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Department of Agricultural Biotechnology

Biotechnology and its application to agricultural systems have been recognized as a frontier technology for achieving sustainability of the food production in the world. In Iran, biotechnology has been also identified as one of the key strategic technologies aiming at supporting sustainable crop production. Therefore, education in the field of agricultural biotechnology in Iran has been considered as an essential part of planning and performing modern agriculture.

The Department of Biotechnology was founded in 1999 based on a recognition that the future of Iran's agriculture will strongly depend on the incorporation of biotechnology in this field. The department offers graduate study program in agricultural biotechnology. The overall aims of this department are to acquaint students with the latest techniques and advances in agricultural biotechnology with a strong emphasis on understanding the theories, principles, and techniques in different key areas of biotechnology. The MSc. students are instructed to have a clear understanding of molecular genetics, plant cell and tissue culture, molecular markers and genetic engineering and proteomics. The overall aim for MSc program is to give the students experience in project management, written and oral presentation of scientific discoveries.

Academic Programs

Our Department provides academic programs for the degree of Master of Science (M.Sc.) in Agricultural Biotechnology. It also offers studies leading to the degrees of Ph.D. in Agricultural Biotechnology.

Graduate

The Department of Agricultural Biotechnology offers programs for the degrees in Master of Science. Students must pass 32 (including thesis or dissertation) course credits for M.Sc. degree. Graduate students must conduct an original research study for their thesis or dissertation, and defend their findings in an oral and public presentation.

Research Fields

The Department of Agricultural Biotechnology is nationally recognized for its excellence in both the basic and developmental research in agricultural biotechnology. The research activities at this department are focused on both basic and applied sciences including:

■ **Bioinformatics, Genomics and Transcriptomics**

- Bioinformatic methods for the integrated analysis of genomic, transcriptomic, proteomic, metabolomic, and phenotypic information.
- Identification of candidate genes involved in metabolic pathways using new techniques.
- The study of the candidate genes and genetic variation in the quantitative traits.
- Evaluation of gene expression and its relation with different physiological circumstances.

■ **Proteomics, Protein Engineering and Protein Chemistry**

The work in proteomics lab aims to identify and functionally characterize the proteins involved in different plant cellular mechanisms. Our research interests particularly focus on the enzymes which are involved in the regulation of cell redox homeostasis such as thioredoxin, superoxide dismutase and the proteins involved in chelation of metals such as metallothionein. Since many gene products of biological interest are naturally produced in minute quantities, it is difficult to study them. To circumvent this problem, one solution is to produce recombinant form of these proteins. Therefore, we use genetic engineering tools for isolation and cloning of genes encoding our proteins of interest. The recombinant proteins are heterologously expressed in prokaryotic or eukaryotic hosts. After protein purification, functional analysis of proteins is performed using protein chemistry and enzyme kinetics techniques along with protein engineering tools such as site-directed mutagenesis.

■ **Molecular Basis of Offense and Defense in Plant-fungal Interactions**

Offense and defense are the central and main events occurring during plant-microbe interactions. These processes are sophisticated mechanisms, employed by host plants and invader fungal pathogens during interactions and, thus, the interface between hosts and pathogens is regarded as the molecular battlefield.

Only host plants are attacked by their related fungal pathogens. How is this specificity achieved? The specific recognition of host plants by their particular pathogens is achieved through specific signaling pathways. Once plants are attacked by fungal pathogens, they have to actively defend to survive. Triggering defense mechanism depends on recognition of invader, which is the first line of defense. Plants are equipped with intelligent systems to monitor nearby pathogens. Recognition might be triggered through PAMP recognition by specific receptors designated as PRR leading to PAMP-triggered immunity. To combat with this layer of defense, pathogens defeat PTI by secreted effectors resulting in Effector-Triggered Susceptibility (ETS).

Plants, in turn, have evolved R protein to resist against pathogen and induce Effector-Triggered Immunity (ETI). The ETI response is suppressed again by other types of fungal effectors. Once recognition is suppressed by pathogens, the offensive process is triggered during which the invaded plants are bombarded with many different molecular weapons called "virulence factors" enabling them to colonize the host tissue.

Through collaborative research with national and international researchers, we aim to understand how fungal pathogens and host plants sense each other and what are the molecular mechanisms underlying offense and defense using various genetics, genomics, transcriptomics, bioinformatics approaches.

■ **Genetic Diversity and Plant Tissue Culture**

This research area has been focused on optimization of plant cell, tissue and organ culture especially in medicinal and horticultural plants.

■ **Genetic Engineering**

■ **Plant Tissue Culture and Production of Transgenic Plants**

Research Projects

- Transcriptome Landscape Variation in the Genus *Thymus* (Dr. Soorni)
- The first transcriptome profile of *Allium hirtifolium* (Dr. Soorni)
- Whole genome duplication in medicinal plants (Dr. Soorni)
- Genetic networks of bolting regulation in spinach (Dr. Soorni)
- Identification of resistance genes in plant using NGS technology (Dr. Soorni)
- Creating transcriptome database for terpene synthetic plants (Dr. Soorni)
- Propagation of *Taxus baccata* seedling using tissue culture techniques (Dr. Sayed Tabatabaei)
- *Azolla* domestication (Dr. Sayed Tabatabaei)
- Phenotypic and molecular interactions of wheat-fungal pathogens (Dr. Mehrabi)
- Identification of candidate effector candidates of barley pathogens (e.g. *Rhynchosporium commune*, *Pyrenophora* spp.) (Dr. Mehrabi)
- Identification of effector candidates of wheat fungal pathogens e.g. *Cochliobolus sativus*, *Zymoseptoria tritici*, *Pyrenophora tritici-repentis* (Dr. Mehrabi)
- Genome-wide association mapping of resistance against wheat pathogens (Dr. Mehrabi)
- Genome-wide association mapping of resistance against chickpea pathogens (Dr. Mehrabi)
- Identification of resistance genes to important diseases in wheat using molecular markers (Dr. Mehrabi)
- Production and purification of recombinant superoxide dismutase in order to their application in medicine (Dr. Shahpiri)

- Arsenic bioremediation using engineered bacteria (Dr. Shahpiri)
- Plant metallothionein and genetic engineering for bioaccumulation of toxic metals in bacteria (Dr. Shahpiri)
- Establishment of microbial platform using metabolic engineering techniques for production of secondary metabolites (Dr. Shahpiri)
- The use of barley aleurone layer as a model system for plant signaling (Dr. Shahpiri)
- Genetic diversity and population structure of pomegranates using DNA markers (Dr. Talebi)
- Phytoremediation of heavy metals in different *Azolla* species, molecular aspects (Dr. Talebi)
- Expression analysis of anthocyanin and carotenoid genes in pomegranates (Dr. Talebi)
- Micropropagation and in vitro accumulation of secondary metabolites in some medicinal plants such as *Chatarantus roseus* and *Dra-cecephalum kotschyi* (Dr. Talebi)
- Molecular legume- rhizobium symbiosis (Dr. Talebi)

Research Facilities

■ Plant Computational Genomics Lab

Coordinator: Aboozar Soorni

Email: soorni@iut.acc.ir and aboozar.soorni@gmail.com

Our research focuses on the computational analysis of genomic and transcriptomic sequences from non-model plant species. We do this by developing approaches to examine gene finding, gene expression, transcriptome assembly, and conserved element identification, through machine learning and computational statistics. We use these novel methods to address questions related to genome biology and population genomics.

Lab Facilities

- Research Lab I (Transcriptomics Lab)
- Research Lab II (General Molecular Lab)
- Research Lab III (Electrophoresis Lab)
- Research Lab IV (Plant Tissue Culture and Gene Transfer Lab)
- Educational Lab

Greenhouse Facilities

- Controlled greenhouse for fungal disease assay
- Controlled greenhouse for general experiments

Contact Us

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Molecular Genetics, Plant Tissue Culture

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Department of Plant Production and Genetics

Plant Production and Genetics Department started its activity in 1980 to improve farming systems and agricultural products by educating and training students to prepare them for careers in farms, industry, government and academic circles. Its mission is to expand and transfer knowledge of agronomy and plant breeding to continuously improve factors such as the safety, quality, harvest index, and economic value of crops. The faculty members are mainly involved in teaching and investigating different fields of plant sciences with the emphasis on new advances in this realm. The department provides a range of research laboratories, as well as specialized devices for analyzing crops and agronomic products supporting educational programs at both undergraduate and graduate levels. About 20 faculty and staff members support a body of almost 100 students. At undergraduate level, the department offers a general program in plant production and genetics. The graduate program is specialized into agronomy and plant breeding with masters and PhD curriculum offered in both fields. The main goals of graduate programs are to train students for professional careers enabling them to manage research programs in the area of crop production, crop physiology and also classical and molecular breeding. Research is mainly focused on cereals, forage crops, oilseed crops as well as industrial and medicinal plants to improve yield and quality of production. Sustainability and environmental issues are highly considered in this process.



Degree Programs

Different Disciplines in the Department of Plant Production and Genetics	
B.Sc.	Plant Production and Genetics
M.Sc.	Agrotechnology – Crop Physiology
	Plant Breeding and Biotechnology
Ph.D.	Agrotechnology – Crop Physiology
	Plant Breeding and Biotechnology

Reason to Study at this Department

The IUT Department of Plant Production and Genetics is nationally a leading entity in research, teaching and delivery of different aspects of plant sciences, from lab to field, rangelands and beyond. We are committed to provide higher quality in education considering the needs of agro-industries and society. Having a team of highly qualified faculty members, the department addresses the national and regional agricultural, ecological and environmental needs through innovative science and high quality active undergraduate and graduate education. Studying at the Department of Plant Production and Genetics empowers individuals to function professionally in different realms of plant sciences including genetics, genomics, breeding, biodiversity, plant physiology, plant nutrition, weed science, ecosystem management and restoration and cropping systems.

Honors and Awards

The IUT Department of Plant Production and Genetics is nationally ranked among the top five plant science departments owing to its high academic standards. Many faculty members at the department are recognized for teaching and research awards granted at university, state and national levels.

Program Structure

For undergraduate program to be completed, students are required to take a total of 140 credit hours divided in a variety of specialized plant science courses. The program offers some degree of flexibility in about 20 credit hours elective courses.

At postgraduate program, the MSc is offered in two subdivisions of Agronomy and Plant Breeding. MSc must be completed no longer than six semesters and students are required to take 24 course units plus 6 units of thesis study that involves a combination of field and lab work. Both programs are thesis option with enough suppleness to allow students take courses that are more linked to their research.

The program at PhD level is also offered in two subdivisions of Agronomy and Plant Breeding, where students should take 18 credit units in course work and 15 units of dissertation. PhD dissertations are usually initiated very early in the program and the findings are expected to be published in high quality scientific journals. After students complete coursework, they are required to take and pass a comprehensive exam before they are allowed to continue in the program.

Program Objectives

Programs at IUT Plant Production and Genetics Department are designed to deliver high quality education and training to students preparing them for professions in farms, industry, administration and academic world. Improving farming systems and agricultural products by knowledge acquired through scientific methods is our main objective.

Projects and Income

The main source of research expenses comes from university resources and state, national and international grants. A reasonable set of budget is allocated for each graduate student by university which is usually augmented by student's main supervisor research grants.

Rerearch Areas

Considering Iran's geographical location, being in an arid and semi-arid region of the world, a considerable part of research in Plant Production and Genetics Department is oriented toward crop production under water limitations and other abiotic stresses. In general, crop physiology, biometrical genetics, agroecology, plant symbiotic interactions, and breeding methods coupled with new techniques of agrotechnology and biotechnology are applied to different crops including cereals, oil seeds, cool season grasses and medicinal plants. Many wild relatives of crops are being explored through hybridization and gene transfer in recent years. Aspects of plant microbe interactions are being studied in relation to crop production under abiotic stresses.

Interdisciplinary Approaches

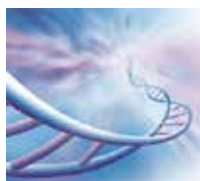
Innovative interdisciplinary research are highly encouraged and there are degrees of freedom for students to define their graduate thesis and dissertation to advance research at the interface between agronomy, plant genetics, soils, biosystems, food sciences, feeds and water sciences to help address the challenges of ecologically sustainable agriculture. Plant Production and Genetics Department is highly supported by eight other disciplines at the College of Agricultural Engineering in this respect.

A Profile of the Labs

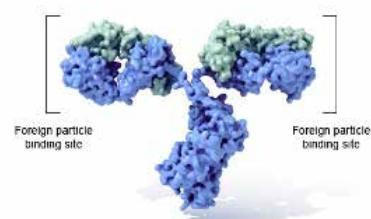
The following pictures are related to Lavark Experimental Farm where most of the field research is conducted . Almost 100 hectares of farming land with proper infrastructure is available for teaching and experimentations.

Department of Animal Sciences

Animal Science Department was established in the early 1980s at Isfahan University of Technology to train students so that they could properly manage livestock and poultry farms and improve practice in animal sciences. This department has aimed to increase the quality in all aspects of animal sciences. Our mission is to expand and transfer knowledge for continuous improvement of the animal husbandry and to support human population with sufficient safe products such as egg, milk, white and red meats, etc. Our academic members are teaching and researching in different fields of Animal Science including Animal Nutrition and Metabolism, Feed Evaluating System, Animal Physiology and Endocrinology, Animal Embryology, Farm Management Systems, Animal Immunology, Genetics and Animal Breeding, Animal Biotechnology, and Bioinformatics. Our department is supported with advanced research laboratories and specialized facilities to support research studies and graduate students' theses and dissertations, and also it offers services to the industry.



Immunoglobulin G (IgG)



(J. S. Hultsch Library of Medicine)

Academic Programs

Our Department provides academic programs for the degree of Bachelor of Science (B.Sc.) in Animal Sciences. It also offers graduate studies leading to the degrees of Master of Science (M.Sc.) in Ruminant and Poultry Nutrition, Animal Physiology, Animal Breeding and Animal Biotechnology. Besides, we have Ph.D. programs in Ruminant and Monogastric Nutrition, Animal Breeding and Genetics, and Animal Physiology.

Undergraduate

The Department of Animal Sciences offers a program at the undergraduate level. This program is designed for students preparing themselves for professional careers in animal or poultry farms and animal feed factories, and also for those seeking further graduate training in Animal Sciences. Undergraduate students must pass 55 credit hours of basic courses, 64 credit hours of obligatory courses, and 21 credit hours of elective courses (140 credits in total) to be qualified for the Degree of B.Sc. in Animal Sciences.

Graduate

The Department of Animal Sciences offers programs for the degrees in Master of Science and Doctor of Philosophy. The graduate programs attract students in different fields such as Animal Nutrition (Ruminant and Poultry Nutrition), Animal Breeding and Biotechnology, and Animal Physiology. Students must pass 32 and 40 (including thesis or dissertation) course credits for M.Sc. and Ph.D., respectively. Graduate students must conduct an original research study for their thesis or dissertation, and defend their findings in an oral presentation.

Admission of International Students

We accept international students in the coming semesters for both M.Sc. and Ph.D. programs. Admission to our graduate program will be highly competitive. Students are to contact initially with their master of interest for vacancy position. The minimum criteria for admission can be found in Admission Requirements for IUT. Applicants should hold at least a B.Sc.

degree or its equivalent in Animal or Biological Sciences from a credible institution. Beyond these minimum requirements, the admission committee looks for intellectual potentials by reviewing the previous performances in university coursework. If the applicant has published papers, attachment of one or two of them and a description of their impact are encouraged. The candidate's statement should include a description of the research interests as well as their motivation for pursuing graduate education.

Transfer students

Department of Animal Sciences at Isfahan University of Technology accepts transferring students to joint projects or sabbatical programs.

Research

■ Research Fields

The research initiatives carried out in IUT Department of Animal Sciences cover a range of topics including:

- Ruminant Nutrition
- Poultry Nutrition
- Animal Physiology and Biotechnology
- Animal Breeding and Genetics

■ Ruminant Nutrition

Nutritional Evaluation of Feedstuffs

- Application of new techniques for the determination of chemical composition of forage and concentrate.
- Application of in vivo, in situ and in vitro methods for ruminal and post-ruminal digestibility of common and new feedstuff.
- Ruminal degradability of forage and concentrate.
- Effects of TMR rations and different ratios of forage to concentrate on rumination, chewing activity and ruminal parameters of dairy cattle.
- Determination of the passage rate and digestion kinetics of feeds in ruminants.

■ Dairy Cattle Metabolism and Milk Production

- Application of feed additives for improving ruminal fermentation rate and increasing the quality and quantity of milk production.
- Feed processing to change the ruminal parameters, hepatic metabolism, and save energy.
- The relationship between ruminal parameters, blood metabolites, milk production and milk quality.
- Alterations of ruminal bacterial, protozoa and fungi populations in response to different rations.
- Application of the protected amino acids and trace minerals for improving milk production and the immune system.

■ Sheep Metabolism

- The effect of different forages and concentrates on ruminal parameters, blood metabolites, growth rate, and meat quality.
- Compensatory growth rate of lambs.
- Hormonal evaluation in response to nutrition.

■ Weaning Age of Calves

- Feed additives and essential oils for reducing the weaning age.
- The use of management methods to enhance growth, health, ruminal microbial flora and fermentation.

■ Feed Processing

- Applying different methods along with additives for forage silages.
- Grinding, eradiation, heating, steam rolling, and flaking of cereal and oil seeds.



■ Poultry Nutrition

Nutrition and Metabolism

- Interactive effects of macro- and micro-nutrients on the performance and blood metabolites in broiler chicks and laying hens.
- Nutritional requirements of different poultry species using in vivo methods and modeling.
- Proximate analysis of feed ingredients and measurement of their nutritional value by in vitro and in vivo methods.
- Application of by-products in poultry nutrition.
- Digestibility experiments: evaluation of ideal and total tract digestibilities of feedstuffs.
- Strategies for feed restriction in broiler and breeder farms.
- Optimization of poultry resistance to metabolic and digestive disorders.
- Ideal protein and amino acid profile.

Poultry Immunology

- Nutritional immunity.
- Nutritional requirements of different nutrients (particularly micronutrients) for optimum immunological responses.
- Mycotoxins and immunity.

Poultry Physiology and Biotechnology

- Reproductive performance of poultry breeders in response to nutritional and environmental modifications.
- Mycotoxins and morphological and histological alterations in liver, kidney and ovary.
- Nutritional modifications for the regulation of key metabolic genes.

Poultry Physiology and Biotechnology

- Bioenvironmental concerns related to poultry farm manure.
- Strategies for controlling mineral excretions in poultry manure.
- Poultry behavior in response to environmental alterations.
- Factors affecting the quality and stability of poultry products.

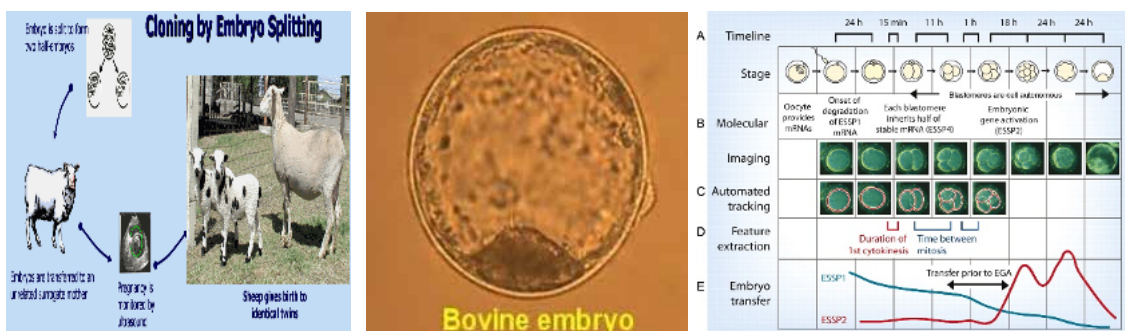
Animal Physiology and Biotechnology

Reproductive Physiology

- Understanding the effects of heat and cold stress on the reproductive performance of sheep, goat and cattle.
- Evaluating the immune system and the reproductive response of ruminants and nonruminants to dietary modifications.
- Probing the effect of feed additives and vitamin & mineral supplements on follicular dynamic and hormonal changes.
- Addressing the effect of unsaturated fatty acids on the reproductive performance of sheep and cattle.
- Investigating the effect of anti-nutritional factors on the health, hepatic enzymes, and the reproductive performance of sheep and cattle.

Gene Expression and Immune Responses

- Evaluation of gene expression and its relation with different physiological circumstances.
- Investigation of mRNA expression in response to different nutrients such as fatty acids, amino acids and minerals.
- On or off status of different genes, particularly in the immune and metabolic system.
- Activation of the gene in vitro or in vivo, with the programming of the cell and its controlling for physiological or pharmacological purposes.



Animal Breeding and Genetics

This section aims to provide new methods and strategies to improve livestock production, dairy and beef cattle, sheep, poultry (meat-type, egg-type and local birds) and honey bee. Some important topics can be pursued by students interested in genetics and biotechnology.

Quantitative genetics

- Improving economical traits (production, reproductive performance and survival traits).
- Developing the methods to evaluate and subsequently, streamline the research in livestock breeding to study the problems limiting genetic improvement.
- Studying the effect of genetic factors on the functioning of farm animals and optimum breeding schemes for selection.
- Conducting genetic analyses of commercial populations to get insight into the impact of both genetic and environmental sources on the economic traits.
- Addressing genetic variation and genetic correlations between the traits.

Genomics and Molecular Genetics

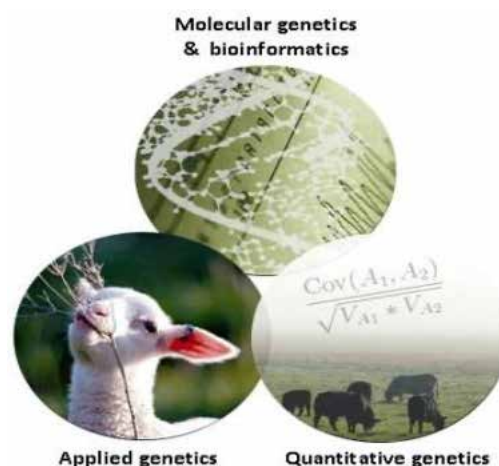
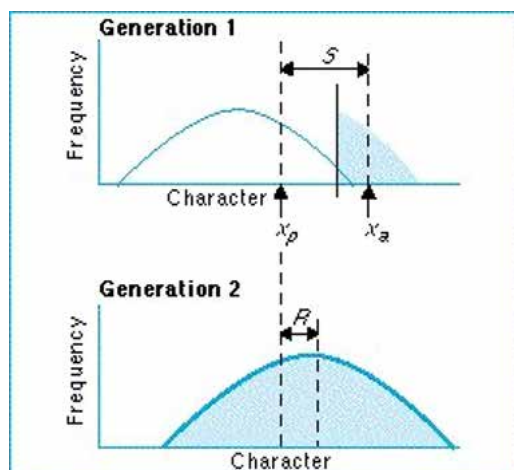
- Identification of candidate genes involved in livestock using new techniques.
- Bovine gene mapping and DNA sequencing.
- The study of the candidate genes and genetic variation in the quantitative traits.
- Methods and experimental designs for the detection of important QTL in farm animals for practical breeding programs.
- The use of different biometric approaches for the genetic ranking of breeding animals, including new tools, e.g. DNA information.
- The use of statistical genetic methods to evaluate candidate animals based on genetic models.
- Identification and development of PCR-based molecular markers linked to the improvement of genetic resistance to import-

ant diseases, e.g. mastitis.

- Bioinformatic methods for the integrated analysis of genomic, transcriptomic, proteomic, metabolomic, and phenotypic information.
- Diversity and conservation genetics studies of local breeds using morphological characters and DNA markers.

Quantitative genetics

- Improving economical traits (production, reproductive performance and survival traits).
- Developing the methods to evaluate and subsequently, streamline the research in livestock breeding to study the problems limiting genetic improvement.
- Studying the effect of genetic factors on the functioning of farm animals and optimum breeding schemes for selection.
- Conducting genetic analyses of commercial populations to get insight into the impact of both genetic and environmental sources on the economic traits.
- Addressing genetic variation and genetic correlations between the traits.



■ Research Projects

- Animal Nutrition (Dairy Cattle, Sheep and Goat)
- Poultry Nutrition and Modeling
- Animal and Poultry Physiology
- Animal Breeding and Genetics

■ Industrial Partners

Department of Animal Sciences has had very effective collaborations with industries. These collaborations focus on technology developments, applied research projects, and consultations. Our partner companies and organizations include:

- FKA Industrial Dairy Co.
- Milk & Meat Ghiam Co.
- Zomorod Industrial Laying Hens Co.
- Shahin Toyor Co.
- The Ministry of Agriculture of Jihad (Research Center).

Awards & Recognition

- Outstanding Researchers and Teachers at Isfahan University of Technology, Iran.
- The distinguished innovator of Isfahan Province, Iran (2012)



Labs and Research Facilities

Our department provides excellent research laboratories, as well as specialized facilities, including:

- Nutrition and Metabolism Research Labs
- Zoology Lab
- Anatomy, Physiology and Embryology Labs
- Biotechnology Labs
- Research Farms

■ Nutrition and Metabolism Research Labs

Coordinator: **Hamid Khoshoe** and **Mojtaba Arjmandfar**

B.Sc. in Animal Sciences

Tel: + 98 31 33913313-15

Emails: khoshoe@sepahan.iut.ac.ir and mojtaba8215953@yahoo.com

List of Features

- Gas Chromatograph (GC)
- Atomic Absorption Spectrophotometer
- Kjeldahl System
- Fiber Analyzer (Ankom system)
- Sox Let Fat System
- Daisy II Systems
- Milk Oscan
- Egg Quality Measurements Instruments
- Dual Flow Continuous Culture System
- NIR Spectrophotometer
- Freezer (-80°C)
- Adiabatic Bomb Calorimeter
- Viscometers
- Gamma Counter
- Autoclave
- Freeze Drier
- Fiber Tec



Zoology Lab

Coordinator: **Mojtaba Arjmandfar**

B.Sc. in Animal Sciences

Tel: + 98 31 3391 3518

Email: mojtaba8215953@yahoo.com

- Optical Microscopy
- Embryology Instruments



Anatomy, Physiology and Embryology Labs

Coordinator: **Mojtaba Arjmandfar**

B.Sc. in Animal Sciences

Tel: + 98 31 3391 3518

Email: mojtaba8215953@yahoo.com

- ELISA
- Electrophoresis Set
- Gel Reader
- Ultracentrifuges
- CO2 Incubator
- Freezers (-20 & -80°C)
- Autoclave
- Gamma Counter



Biotechnology Labs

Coordinator: **Mojtaba Arjmandfar**

B.Sc. in Animal Sciences

Tel: + 98 31 3391 3518

Email: mojtaba8215953@yahoo.com

List of Features

- ELISA
- High Performance Liquid Chromatograph
- Electrophoresis Set
- Quantitative Real-time PCR
- Gel Reader
- Ultracentrifuges
- CO2 Incubator
- Freezers (-20 & -80°C)

■ Research Farms

Coordinator: **Ghaderi & Molaei**

MSc of Ruminant Nutrition

Tel: + 98 31 3391

List of Features

- Three hundred milking dairy cows Farm
- Sheep Husbandry
- Broiler Farms
- Fishery System
- Honey Bee Husbandry



Useful Links

Department of Animal Science

- <http://agri.iut.ac.ir/>
- <http://www.iut.ac.ir/>
- <http://ps.fass.org/> (Poultry Science)
- <http://www.journalofdairyscience.org/> (Journal of Dairy Science)
- <http://www.journalofanimalscience.org/> (Journal of Animal Science)
- <http://www.sciencedirect.com/> (scienceDirect)
- <https://www.asas.org/> (American Society of Animal Science)
- <http://www.wpsa.com/> (World Poultry Science Association)
- <http://www.bsas.org.uk/> (British Society of Animal Science)
- <http://www.eaap.org/> (European federation of Animal Science)

Contact Us

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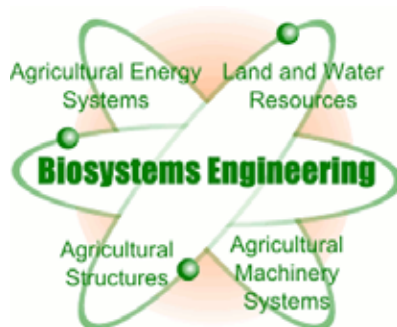
Department of Biosystems Engineering

Biosystems Engineering is a field of engineering which integrates engineering science and design with applied biological, environmental, and agricultural sciences. It represents an evolution of the Agricultural Engineering discipline applied to all living organisms, not including biomedical applications.

The IUT Department of Biosystems Engineering was established in 1983 and offers accredited undergraduate and graduate programs. Due to the diverse nature of agriculture and the position of the agricultural industry in Iran, the scope of the research at the department is widespread. Solving common problems related to water, soil, plant, agricultural products, and animal environments has provided a unique situation of multi-disciplinary research and scientific cooperation between this department and other departments at the College of Agricultural Engineering , as well as other IUT Departments .

Typical program areas include:

- Farm machinery design, development, and performance evaluation
- Precision farming
- Tillage systems for crop production, soil compaction, and deep tillage
- Post-harvest technology, nondestructive quality evaluation techniques, food processing and food safety, stored grain ecosystems, and development of biosensors
- Controlled-environment agriculture, greenhouse technology, biological treatment of wastes, bio-processing, and animal and plant production environment
- Alternative building systems, biological processing of biomass, food, feed, and wastes



Degree Programs

Different Disciplines of the Department of Biosystems Engineering	
B.Sc.	Biosystems Engineering
M.Sc.	Biosystems Engineering- Design of Farm Machinery
	Biosystems Engineering- Postharvest Technology
Ph.D.	Biosystems Engineering- Design of Farm Machinery

Reason to Study at this Department

In the field of power and machinery, the IUT Department of Biosystems Engineering has in its possession all kinds of farm machinery currently used in modern agriculture. These are used in field study performance under local conditions. The Tractor Test Center (TTC) evaluates the tractors used on farms in the region. The center enables researchers to monitor the current performance of power units on farms. A draft force sensing and measuring unit is also available to determine the draft force requirements of various agricultural tools. Engine Test Station (ETS) is mainly an educational unit but it is also involved in studying the application of different fuel sources in different engine types. The station is fully computerized to provide information with regard to engine performance under various loads and working conditions. Manufacturing workshop, inline and rotary soil bin facilities, soil mechanic apparatus, and a collection of farm machineries are considered other facilities and equipment in the Department of Biosystems Engineering.

In the field of postharvest technology, the department is equipped with various product testing and processing devices. To achieve the effective training outcome, the Postharvest Technology lab has been equipped with a vacuum frying system, a continuous high voltage thawing system, and various drying systems including conventional fixed and vibrated fluidized bed hot air, heat pump-assisted hot air, microwave-assisted hot air, infrared-assisted hot air, solar, spray, pulse electric field, and elec-

tro-hydrodynamic (EHD) dryers. The Nondestructive Tests (NDT) lab has versatile devices for quality evaluation of agricultural products noninvasively such as UV-VIS-SWNIR spectrometers and NIR spectrometer with fiber optic probe, hyperspectral camera, spectrum analyzer, impact measurement devices, and different types of laser.



Program Structure

Undergraduate courses are offered in 140 credits, including 120 compulsory and 20 optional credits. The elementary courses include a variety of mathematics, physics, agricultural science, and engineering principles courses. Graduates in Biosystems Engineering integrate engineering, agricultural, and environmental sciences in a variety of applications.

The MSc graduate program is offered in two branches including Design of Farm Machinery and Postharvest Technology. During this program, the students are first registered for 26 credits that should be spent for two semesters. Additionally, there is a practical thesis that should be defended for 6 credits.

Design of farm machinery is offered as a specialized subject in the graduate program at the Ph.D. level. During this program, the students are first registered for 18 credits of courses. Undertaken after a student completes coursework and passes a comprehensive examination, the dissertation is the final hurdle in completing a Ph.D. degree.

Program Objectives

■ Educational Objectives

The educational objectives of Biosystems Engineering degree programs are to graduate students who are uniquely qualified to use their knowledge of mathematics, physics, agricultural science, and engineering principles in a variety of applications, including:

- Design innovative agricultural machineries
- Mechanization and agricultural machinery management
- Remote sensing of natural resources
- Application of non-destructive tests in developing new sorting and grading equipment
- Development of new technology for food processing industry
- Designing equipment for postharvest processing of agricultural products
- Development of environmental controls for animals and plants production
- Applying the electrical and electronic apparatuses to overcome agricultural problems



■ Research Objectives

- Qualitative and quantitative promotion of articles published in high impact international journals
- Defining interdisciplinary research projects with other engineering and agricultural departments
- Building a partnership with industry to exploit new technologies applicable in educational programs and industrial partners

Research Areas

- Automation technology: Intelligent machines, Automatic control, Image processing, and biosensors
- Information technology: Wireless sensor networks, Internet of things, Data mining, and decision support systems
- Precision agriculture: Yield, weed and soil mapping, Geographical positioning systems, and Pest management
- Power and machinery: Tillage systems, Harvesting machines, Tractors and agricultural vehicles, Dynamics, vibration and noise, hydraulics and pneumatics
- Postharvest technology: Crop drying, processing and storage,
- Optoelectronic size grading, ripeness, quality, damage, and disease detection
- Animal production technology: health monitoring, feeding, and robotic milking
- Soil and water: tillage, traction and compaction, automatic irrigation



A Profile of the Labs

■ NDT (Nondestructive Tests)

- UV-VIS-SWNIR spectrometers
- NIR spectrometer
- Hyperspectral camera
- Spectrum analyzer
- Impact measurement device

■ Soil Mechanics

- Direct shear testing equipment
- CBR penetration test apparatus
- Uniaxial soil apparatus
- Soil bin facilities

■ Test of Motor and Tractor

- PTO dynamometer
- Engine dynamometer
- Draft sensing and measuring unit

■ Postharvest Technology

- Heat pump-assisted hot air dryer
- Microwave-assisted hot air dryer
- Infrared-assisted hot air dryer
- Electro-hydrodynamic dryer
- Spray dryer
- Solar dryer
- Deep fat vacuum fryer
- Continuous high voltage thawing system
- Conventional fixed and vibrated fluidized bed hot air
- Pulse electric field

■ **Physical and Mechanical Properties of Agricultural Materials**

- Universal testing machine
- Test stand for the measurement of the terminal velocity
- Air resistance measuring system
- Device for measuring static and dynamic coefficient of friction
- Direct shear test equipment
- Impact force measurement device

■ **Measurement and Instrumentation**

- Oscilloscope
- Real-time soil moisture sensor
- Real-time soil resistance sensor
- Data logger
- Torque meter
- Compression load cell
- TR-200 strain gauge
- Transducer
- DC power supply



Contributions to Sustainable Development and its Impacts on Society

Energy is a major concern of the modern world economy. Consumption of energy in agricultural production for the various operations of planting and soil preparation constitutes a large portion of agricultural production costs. Therefore, optimum utilization of farm equipment and machinery and the design of new ones are the research concerns and integral parts of agricultural engineering and mechanization. The department of Biosystems Engineering is committed to help the promotion of the engineering aspect of agriculture in the region. Almost all of the conducted research in our department focuses on issues related to Sustainable Development Goals (SDG), including:

- Studying the effects of conventional and non-conventional (non-inversion, minimum tillage, no-tillage, surface tillage) systems on soil physical characteristics and crop yields under both arid and semi-arid conditions
- Evaluating the impacts of sub-soiling practices on soil physical characteristics
- Examining the effects of different planting methods on crop yield under dryland and irrigated conditions
- Conducting various research projects on precision agriculture and smart farming as a key to develop sustainable agriculture
- Improving the application rate efficiency of herbicides, pesticides, and nutrients with the use of variable rate technology, enhancing crop production with minimal impact on the environment
- In brief, during the last decade and for the future, Biosystems Engineering Department at Isfahan University of Technology has tried to link agricultural science and technology to achieve the Sustainable Development Goals (SDG).

Department of Food Science and Technology

Department of Food Science and Technology was established in 1980 at Isfahan University of Technology (IUT) to impact the food system and improve quality of life by educating and training students for careers in industry, government, and academia. Our mission is to expand and transfer knowledge for continuous improvement of the safety, quality, value, and security of the food supply through basic research and outreach programs. Our full-time faculty members are teaching and investigating in the different fields of Food Science including Food Engineering, Food Chemistry, Food Microbiology and Food Processing. This department provides excellent research laboratories, as well as specialized facilities and pilot scale-manufacturing plant. Currently the department of Food Science and Technology offers diverse and highly rated educational programs in three degrees (BSc, MSc, and PhD).

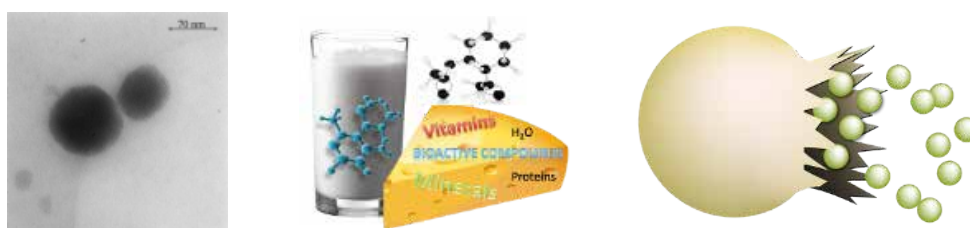
Research Activities

■ Research Fields

The Department of Food Science and Technology has a strong research culture based on the application of fundamental scientific principles and focuses on expansion of understanding of foods as biomaterials. The research initiatives cover a range of topics including Food Chemistry, Food Engineering, Food Microbiology, and Food Technology.

● Food Chemistry

Food chemistry is the study of chemical processes and interactions of all biological and non-biological components of foods. We apply chemical techniques, concepts and laws to determine the kinds and amounts of molecules in foods, their physical properties, and their chemical transformations during manufacture and storage. Research in food analysis develops novel methods for the detection of both harmful (pesticide residues) and helpful (bioactive components, or nutraceuticals, that promote health) components in food. Research on the chemical transformations of lipids, carbohydrates, and proteins, seeks to understand how these components are affected by various food processes. All of this research is concerned with understanding the fundamental mechanisms operating to influence quality of food.



● Food Microbiology

The major importance of Food Microbiology is the study of microorganisms causing food spoilage. However "good" bacteria such as probiotics are becoming increasingly important in food science. Food safety and shelf-life enhancement of new processed foods based on their microbial aspects are analyzed in our department. Biological preservation, production of microbial product from agricultural waste, extension of food shelf-life using natural antimicrobial agents and different aspects of biotechnology is considered.



● Food Technology

Our faculty members in this field work on development of novel food products and enhance the processing techniques. They have focused on policy issues relating to the promotion of food processing industries in the country which would result in reduction of loss, efficient storage and transportation, processing, increase in shelf-life of food products and availability of fresh and processed products. In addition, study on the nutraceutical and drug food and improvement of food safety is among our priorities.



■ Research Projects (former and current projects)

- Production of functional milk by its fortification using vitamins D3 and E nanocapsules, (2013-continueing).
- Improvement of nutritional-therapeutic characteristic of camel meat during artificial tenderizing by ficin, (2013-continueing).
- Biodiesel production from vegetable oil recovered from spent bleaching earth, (2011-continueing)
- Production of caffeic acid nanocarriers and investigation of its effect on antioxidant activity of caffeic acid after release in gastric-intestinal condition, (2011-2013).
- Production and evaluation of physicochemical properties of hesperetin nanocarriers, (2011-2013).
- Production of structured lipid containing conjugated linoleic and linolenic acids and evaluation of its effect on mice healthiness, (2011-2012).
- Optimization of nitrosomyoglobin production in vitro for production of nitrite-free meat products (2010-2011).
- Flour Quality Management (2010-2011).

■ International Collaborations

- A joint project on production of novel functional food (Isfahan University of Technology, Iran and Guelph University, Canada)
- A joint project on regularity of using antibiotics in food products (Isfahan University of Technology, Iran and Purdue University, USA)
- A joint project on controlling of texture in meat production (Isfahan University of Technology, Iran and University of Nottingham, United Kingdom).
- A joint project on development of a functional milk product (Isfahan University of Technology, Iran and University of Bari, Italy).
- A joint project on optimization of exopolysaccharide production by *Lactobacillus* species (Isfahan University of Technology, Iran and University of Alberta, Canada).
- A joint project on detection of Ochratoxin A by application of gold nanoparticles-based immunochromatography (Isfahan University of Technology, Iran and oil crops research institute of the Chinese Academy of Agricultural Sciences, China).
- A joint project on the production of probiotic yoghurt using native *Lactobacillus plantarum* A7 (Isfahan University of Technology, Iran and Lille 1 University, France).

Academic Programs

■ Undergraduate

The Department of Food Science and Technology's undergraduate program offers valuable real-world experience and leadership skills by providing an innovative curriculum; varied extracurricular activities; research lab opportunities; professional and industrial contacts and experience; numerous internships and scholarships. Students are supposed to pass 140 course credits to complete their program. They find career opportunities in product development, quality assurance/control, processing and engineering, technical sales, management, research, sensory analysis, and food law and regulations.

■ Graduate

The Department of Food Science and Technology's Master of Science and Doctor of Philosophy graduate programs attract students from different fields such as engineering, chemistry, microbiology and processing of food. Students pass 32 and 24 course credits for MSc and PhD, respectively. Students are supposed to conduct an original research for the thesis or dissertation, and defend in an oral examination.

■ Graduate

We will accept international students in the coming semesters for the graduate programs. Admission to our graduate programs will be highly competitive. Students are supposed to contact initially to a faculty member to be informed about any vacancy position. The minimum criteria for admission can be found in Admission Requirements for IUT. Applicants should hold at least a bachelor's degree or its equivalent in a physical, biological or engineering food-related science from an institution of acceptable standing. Beyond these minimum requirements, the admission committee looks for evidence of intellectual potential by reviewing performance in university coursework, and carefully considering the can-

candidate's statement of interest and letters of recommendation. The candidate's statement and recommendation letters should highlight the applicant's potential for performing independent, thoughtful research. If the applicant has published papers, attachment of one or two of them as well as a description of their impact is encouraged. The candidate's statement should include a description of the student's future research interests, as well as their motivation for pursuing graduate education.

■ **Transfer Students**

Department of Food Science and Technology accepts transferring students for joint projects or for sabbatical programs.

Industrial Partners

Department of Food Science and Technology has established very effective collaborations with industries. These collaborations focus on technology developments, applied research projects, and consultations. Our partner companies and organizations include:

- Iranian Pistachio Research Institute
- Bahareh Company
- Chika Industrial Group
- Paris Potato Processing
- Seamorgh Company
- The Ministry of Agriculture of Jahad

Awards & Recognition

- Distinguished researcher in Agriculture and Natural Resources in 2012, Isfahan Province, Iran (3 times).
- Winner of the Best Book Award in Agriculture and Natural Resources from the Book of the Year of the Islamic Republic of IRAN (2003, 2013).
- Outstanding Student of Iran Holder Award (2013).
- Recipient of the Second Practical Teaching Award from Agriculture and Natural Resources Engineering Organization of Iran (2004).
- Recipient of Certificate of Distinguished Professor Award (2009).

Research Facilities

Our department provides excellent research laboratories, as well as specialized facilities and pilot scale-manufacturing plant.

■ Food Processing Lab

- Gas Chromatograph (GC)
- HPLC with Fluorescence, UV/Vis and Refractive Index Detectors
- UV/Vis Spectrophotometers
- Refrigerated Centrifuge
- Instron Universal Testing Machine
- Farinograph
- Electrophoresis
- Particle Size Analyzer
- Viscometers



Food Microbiology Lab

- CO2 Incubator
- Refrigerated Centrifuge
- UV/Vis Spectrophotometer
- Freezer (-80°C)
- Optical Microscopy
- Fermenter
- Electrophoresis
- Laminar Hood
- Freeze Dryer
- Stomacher
- PCR
- Refrigerated Incubator



Food Engineering Lab

- Differential Scanning Calorimeter
- Texture Analyzer
- Electrospinning Unit
- Ultrasonic Homogenizer
- Water Activity Meter
- Freezing Tunnel
- Packing Machine
- Vacuum Oven



Pilot

- Milk Pasteurization Unit
- Caning Manufacture Unit
- Packaging Unit
- Baking Processing Unit



Contact Us

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Department of Horticultural Science

Department of Horticulture (formerly Iranian Institute for Horticulture) was established at Isfahan University of Technology (IUT) in 1983 to help Iran's horticultural industries to achieve their full potential through research and marketing by educating and training students for careers in farm, industry, government, and academia. Our mission is to train and educate innovative graduates, create knowledge, enhance entrepreneurship and provide community service/outreach through quality teaching, training and technologically-oriented research in Horticultural Sciences and Technology. Our full-time faculty members are teaching and investigating in the different fields of horticulture including pomology, olericulture, floriculture, landscape design, medicinal plants, postharvest technology and recently greenhouse crops. This department provides excellent research laboratories, as well as specialized facilities and research and education greenhouses. Five hectares of grape and other temperate and subtropical fruit collection and olive adaptation orchard are other facilities of our department. Currently, the department of Horticulture offers diverse and highly rated educational programs in three degrees (B.Sc., M.Sc., & Ph.D.).



Degree Programs

■ Bachelor's Program:

- Horticulture (140 Credits)

■ Master's Programs:

- Pomology (26 Credits + Thesis with 6 credits)
- Floriculture and Ornamental Plants (26 Credits + Thesis with 6 credits)
- Greenhouse Crops Production (26 Credits + Thesis with 6 credits)

■ Doctoral Program:

- Physiology and Postharvest Physiology of Horticultural Crops (18 Credits + Thesis with 18 credits)

Reason to Study at this Department

- Small class sizes, qualitative supervision, directed research, experimental training, high-level experts as remarkable features of our department
- Equipped labs for physiological and molecular research work
- Collaboration with national/ international research centers
- A thriving partnership with other departments at IUT including plant breeding and soil science
- Freedom in course selection and planning
- Strong links with international organizations
- International exchange partners such as the University of Cordoba, Spain
- Innovative teaching methodology (such as lectures, project-based workshops, seminars, study trips, etc.)
- Stimulating environment for basic and applied research including greenhouse, labs and field
- Close ties with technological and economic sectors in Iran

Academic Programs

■ Undergraduate

The Department of Horticulture's undergraduate program offers valuable real-world experience and leadership skills by providing an innovative curriculum; varied extracurricular activities; research lab opportunities; professional and industrial contacts and experience; numerous internships and scholarships. To obtain B.Sc. degree in Horticultural Science, undergraduate students must take a total of 140 credits of which 20 credits are general courses, 31 credits are basic courses, 83 credits are major courses and 6 credits are selective courses. The graduates find career opportunities in greenhouses, municipalities, research stations, private companies, etc.

■ Graduate

The Department of Horticulture's Master of Science and Doctor of Philosophy graduate programs attract students from different fields such as Ornamental Plants, Greenhouse Crops Production Technology and Pomology. Students pass 32 and 28 course credits for M.Sc. and Ph.D, respectively. Students are supposed to conduct an original research for their thesis or dissertation, and defend it in an oral examination.

■ Admission of International Students

We will accept international students in the coming semesters for the graduate programs. Admission to our graduate programs will be highly competitive. Students are supposed to contact initially to a faculty member to be informed about any vacancy position. The minimum criteria for admission can be found in Admission Requirements for IUT. Applicants should hold at least a bachelor's degree or its equivalent in a crop-related science from an institution of acceptable standing. The candidate's statement and recommendation letters should highlight the applicant's potential for performing

independent, thoughtful research. The candidate's statement should include a description of the student's future research interests, as well as their motivation for pursuing graduate education.

Research Areas

The department is actively engaged in the five major areas of greenhouse crops production technology, medicinal plant production and breeding, urban landscape design and management, pomology and vegetable production technology.

Industrial Projects

- Effect of auxin on fruit set in tomato growing under adverse temperatures in field. 2000
- In vitro propagation of sugarcane (*Saccharum officinarum*). 2001
- Effect of mother plant size on off shoots regeneration in date palm cv. 'Sayer' under field conditions. 2001
- Collection, evaluation, breeding and study on the factors affecting seed production of native onions. 2001
- Effect of plant growth regulators on seedling growth in four species of almond. 2006
- Collection and evaluation of visual quality and drought resistance of different ecotypes of *Cynodon dactylon* in Isfahan and Chaharmahal va Bakhtiari regions. 2006
- 1-MCP and temperature may affect on storage and qualities of olive prior to processing. 2007
- Investigation of temperature effects on germination of Iranian shallot. 2008
- Study for introduction of olives and eucalyptus in Isfahan landscape. 2012

- Evaluation of growth and phytoremediation ability of two native turf-grass species for landscape using in hydrocarbon contaminated areas. 2013-2014
- Effect of hormone, tree age and transplanting method on establishment of dominant trees in Isfahan urban landscape. 2013-2015
- Improving the survival of urban landscape trees using a novel endotherapy tool in Fredericton urban landscape. 2018-2019
- Improving root system development and other seedling quality attributes in choke and pine cherries. Canadian Forest Service. 2018-2019
- Response of pine cherries to arbuscular mycorrhizal fungi and biostimulants. 2018-2019
- Designing the urban landscape of Khomeini-Shahr town. Khomeini-Shahr Municipality, Iran. 2016 to present.
- Compilation standards and executive direction on management of plants cultivation and preservation in Isfahan urban landscape parks and pathways. Isfahan Municipality, Isfahan, Iran. 2012-2016.
- Effect of mycorrhizal fungi on growth characteristics and essential oil changes of rose-scented geranium (*Pelargonium graveolens*) in complete and deficit irrigation conditions. Barij Essence Co. Kashan, Iran. 2013-2015.
- Isfahan University of Technology landscape designing and construction supervising according to water-wise landscaping principles (1st phase: 6 blocks). Isfahan, Iran. 2011-2013.
- Investigation of the effect of irrigation system and water quality on growth indices of olive trees in landscape. Isfahan, Iran. 2010-2012.
- Studying the possibility of *Aeolesthes sarta* control on elm trees via direct trunk injection system in Isfahan urban landscape. Isfahan Municipality, Isfahan, Iran. 2009-2011.
- Controlling lime witches broom through direct trunk injection. Hormozgan, Iran. 2007-2008.
- Assessment of morphological and drought resistance of Iranian *Achillea* species in order to introduce to urban landscape of Isfahan. Isfahan Municipality, Isfahan, Iran. 2011-2013.

- Effect of salt stress and harvesting time on essential oil content and composition of myrtle (*Myrtus communis* L.). Barij Essence Co. Kashan, Iran. 2013-2015.
- Assessment of antioxidant compounds, essential oil composition and molecular variation of *Achillea* species in Iran. Iran National Science Foundation. 2010-2012.
- Evaluation of cats application on bell pepper in greenhouse Tessenderlo Company, Holland. 2019.
- Evaluation of morphological, phonological and physiological characteristics of spinach populations and flowering genes. Iran national science foundation. 2019.
- Effect of Petroleum Hydrocarbon Levels on Morphological and Physiological Traits of Two Bermudagrass Cultivars. Refinery Isfahan. 2013-2015.
- Application of medicinal plant wastes as greenhouse cucumber cultivators and evaluation of growth indices and its performance in achieving organic crops. Barij Essence Co. Kashan. 2012-2013.
- Effect of vermicompost fertilizer on growth and drought tolerance of olive. 2016-2017.

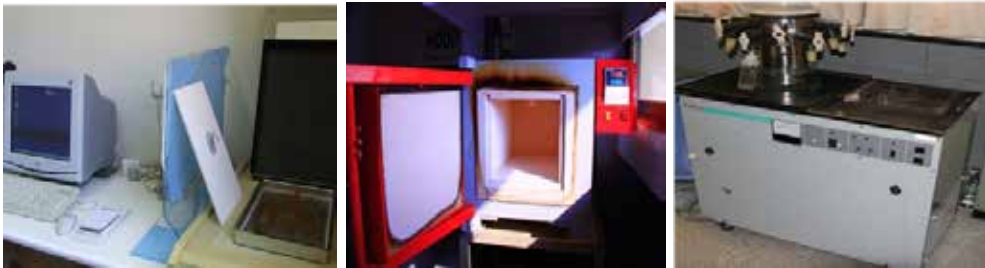
A Profile of the Labs

In addition to a set of greenhouses and research orchards on the campus, the department's laboratories are equipped for the research type outlined above. Some of the major equipment in the department laboratories are listed below.



■ General Horticulture Lab

- Centrifuges
- Spectrophotometers
- Flame Photometer
- Freeze Dryer
- Muffle Furnace



■ Postharvest Physiology Lab

- Refractometers
- pH Meters
- Electrical Conductivity Meters
- Chlorophyll Content Meter
- Plant Efficiency Analyser
- Penetrometer
- Rotary Evaporator



■ Plant Physiology Lab

- Seed Counter
- Hot Water Bath (bain marie)
- Winnower
- Germinators



■ Micopropagation and Tissue Culture Lab

- Vertical Laminar Air Flow
- Horizontal Laminar Air Flow
- Autoclaves
- Vertical and Horizontal Electrophoresis
- Stereo-microscope
- Electrical Conductivity Meters
- Growth Chambers
- Incubators



International Profile

- Adjunct Professors: Professor Mohammad Pessarakli (The University of Arizona)
- Stay abroad for students (PhD): 6-9 Months of Sabbatical Leave

Department of Rural Development

The Department of Rural Development was established in 1998 to improve the rural status and agricultural products by educating and training students to prepare them for careers in rural areas, government and academia. Our mission is to expand and transfer knowledge of rural development and also plan to continually improve dimensions such as the socioeconomic, environmental, agricultural, cultural and physical infrastructure in rural areas. Our full-time faculty members are teaching and exploring different fields of rural development and emphasis on new advances in this field. For us, rural areas are the real laboratories for research. The Department of Rural Development provides a lab with a range of electronic equipment and an academic environment for discussion and presentation. Currently, the department offers programs in M.Sc. level. The department consists of four full-time faculty and staff supporting a body of 40 students. The main goals of graduate curriculum are to train students for professional careers, enabling them to manage research programs in the area of sustainable development, socioeconomic development, institutional environmental and organizational governance analysis, agricultural extension and training, women studies, participatory rural appraisal, cooperatives and community-based natural resources management.

The Master of Science graduate program attracts students from different fields such as agriculture, economics, social science, engineering, and etc.



Research Activities

- Agricultural and Rural Development
- Qualitative and Participatory Research
- Environmental Economics and Policy
- Integrated Project Appraisal

Different Disciplines of the Department of Rural Development	
M.Sc.	Rural Development

Department of Soil Science and Engineering

Department of Soil Sciences and Engineering was established in 1983 to address the challenges of developing sustainable soil management for agriculture and environmental tasks. The Department's main goal is to expand and transfer knowledge for continuous improvement of research in the field of soil sciences and engineering and outreach all of the programs related to this field. This brings improvement for educating and training students to be prepared for careers in various places such as industry, government, and academia. The full-time faculty members are teaching and researching in different fields of soil science emphasizing on environmental issues and regional shortcomings. The department is relatively well-equipped with the research laboratories, as well as technical facilities. The principles of the department, as a strong scientific institute, are focused on expansion of understanding soil and environment. The research areas include a range of topics covering soil biology, soil chemistry and fertility, plant nutrition, soil genesis and classification, soil physics and soil-water and plant relationships. The Soil sciences and Engineering Department offers a general BSc degree in this field. For the MSc and PhD programs, the courses are offered in soil physics, soil chemistry and fertility, soil genesis and classification, soil biology and soil environmental sciences. About 15 full-time faculties and staff support a body of about 100 students at different graduate levels.



Degree Programs

■ Bachelor's Program:

- Soil Sciences and Engineering

■ Master's Programs:

- Soil Biology and Biotechnology
- Soil Genesis, Classification and Land Evaluation
- Soil Chemistry and Fertility
- Soil Physics and Conservation

■ Doctoral Program:

- Soil Biology and Biotechnology
- Soil Genesis, Classification and Land Evaluation
- Soil Chemistry and Fertility
- Soil Physics and Conservation

Reason to Study at this Department

In parallel and comparable with other international Soil Science Departments we perform almost all teaching, research and innovative activities in high quality levels. Our goal is to produce and share high-impact knowledge that contributes to solving challenges affecting people's life at national and global scales. For example, the majority of our research is focused on soil quality, soil organic carbon and soil pollution as well as food security through the studies in soil fertility including maximizing the efficiency of the agronomic use of nutrients and improving crop productivity. In regard to improving water efficiency and battling drought and climate change crisis, hydroponic culture concept is one of the outstanding subjects that is taught and trained in our department. Students and researchers work together and the internationally high qualified profes-

sors and technicians are easily approachable for discussions and consultations. This interaction between researchers and students and other users is an essential part of the academic life at our department.

This department also supports a center of excellence in Soil and Water Pollution and Human Health that has been awarded as the top center of excellence in Iran. Moreover, our department supports a Soilless Culture Research Center.

The soil science department has established international collaboration with several universities, institutes and scientific centers around the world such as ETH of Zurich (exchanging faculty and students) and EAWAG Research Center, Switzerland. Also, our department has successfully experienced collaborations with Wageningen University (The Netherlands), University of Ghent (Belgium), University of São Paulo (Brazil), University of UPCT (Spain), Institute of Soil Science and Plant Cultivation or IUNG (Poland), Ohio State University (USA), Swedish University of Agricultural Sciences (Sweden), Agroscope Research Station ART (Switzerland), Memorial University of Newfoundland (Canada), New Mexico State University (USA), Tottori University (Japan), University of Bayreuth (Germany), University of Valencia (Spain), University of Guelph (Canada), University of California (Riverside) and University of California (Berkeley) in recent years for spending sabbatical stays of PhD students and faculty members, as well as scientific publications. Our department also has strong links with Iranian Institute of Soil and Water, and Iranian Soil Science Association.

Mutually interested and thriving partnerships have been established with other related departments at IUT. There is a possibility to pass the principal courses and some required complementary courses in different programs with other departments such as Chemistry, Physics and Mathematics. In the graduate levels, teaching of all specific courses of soil science are presented based on the fieldwork and laboratory training, with lectured and occasionally project-based programs.

Honors and Awards

The Center of Excellence corresponded to our department (Soil and Water Pollution and Human Health) is awarded a ranking as the top excellent center among the Iranian Centers by the Ministry of Science, Research, and Technology.

Program Structure

Undergraduate courses are offered in 140 units, including 120 compulsory and 20 optional. The elementary courses include a variety of specialized agricultural and soil science courses.

The postgraduate program at MSc is offered in four branches. During this course that lasts 2 years, students are required to take 30 units including 24 credit units and 6 units in practical thesis that should be defended.

The postgraduate program at PhD is offered in four branches, during which students should take 18 credit units and 15 units in practical dissertation. Undertaken after a student completes coursework and passes a comprehensive examination, the dissertation is the final hurdle in completing a PhD degree.

Program Objectives

■ Educational Objectives

- Developing interdisciplinary courses and field with other agricultural and environmental majors.
- Increasing the effectiveness of introductory courses to attract new majors
- Providing additional projects and internships to enhance students' interest in soils

■ Research Objectives

- Qualitative and quantitative promotion of articles published in highly impacted international journals
- Achievement of scientific authority for the department at the international level
- Providing solution for shortcomings and problems in soil management of Iranian Soils
- Awarding national and international funds
- Expanding and deepening international cooperation with overseas scientific and research centers.

Research Areas

- Soil evolution, micromorphological, geomorphological, and mineralogical studies of Iranian soils
- Soil survey and digital soil mapping, soil and land evaluation
- Soil erosion and soil redistribution by wind and water erosion
- Monitoring, assessment and remediation of soil pollution by heavy metals and hydrocarbons.
- Monitoring and assessment of dust deposits in central Iran
- Soil physical quality and soil degradation including compaction, sealing and salinization
- Phytoremediation of hydrocarbon contamination soils
- Tillage impacts on soil physico-chemical and biological properties
- Soil hydraulic properties and modeling
- Soil water availability to plants
- Solute and pathogen transport in soil and modeling
- Agricultural soil mechanics and tillage systems
- Root growth biophysics and mechanics
- Physical and chemical processes in the rhizosphere
- Root effects on soil properties and biophysical and biochemical processes
- Modeling of soil-water-plant relations and root water uptake
- Retention, mobility and biological effects of nano-particles in soils
- Metal and nutrient chemistry and fate in soil and water
- Organic/inorganic contaminant removal from water/wastewater

- Rhizosphere effects on soil biochemical and biological processes
- Slow and controlled release fertilizers
- Nutrient solutions and soilless culture systems
- Peat substitution with processed organic residues in different applications
- Nutrient cycling in terrestrial ecosystems
- Soil microbial ecology
- Optimization of quality and quantity of extracted amino acids from Azolla

Industrial Projects

- Soil survey and determination of soil suitability and limitation for green landscapes in Isfahan city
- Soil suitability assessment for soils in green landscapes of Mobarakeh Steel Company and Zobahan Complex, Isfahan Province.
- Assessing the physical, chemical and biological quality of soils irrigated with treated wastewater in green space of Mobarakeh Steel Complex
- Soil constrictions and their management in green landscapes of Isfahan
- Application of slag and sludge of iron and steel industries as soil amendments.

Interdisciplinary Approaches

- Plant functional traits and soil properties in relation to climate change mitigation
- Screening and identification of crop species and genotypes with good quality of rhizosphere

A Profile of the Labs

■ Soil Genesis and Soil Survey

- X-ray Diffractometer
- Bartington-Magnetic Susceptometer
- Polarized Microscopes
- GIS Lab

■ Soil Erosion

Wind Tunnel for Soil Erosion Studies

■ Soil Chemistry

Pressure Plate Apparatus, Sand Box, Sand-kaolin box, Tensiometers, Min tensiometers, Air Permeability Apparatus, One-chamber Gas Diffusivity Apparatus, Wet-sieving Apparatus, Cone Penetrometer, Micropenetrometer, Shear Box, Consolidometer, Uniaxial Machine, Tempe Cell

■ Soil-water and Plant Relations

- Pressure Bomb, Root Growth Pressure Apparatus

■ Soil Biology and Biotechnology

- Molecular Research Instruments



Contributions to Sustainable Development and its Impacts on Society

The United Nations offers a unique opportunity for soil science to demonstrate the role it can play when focusing on the Sustainable Development Goals (SDG's). Several strategic reports have presented key issues for sustainable development: food security, freshwater and energy availability, climate change and biodiversity loss but not soil degradation. Focusing on soil contributions towards interdisciplinary studies of these key issues, rather than emphasizing on soils by themselves, is therefore bound to be more effective for the soil science profession. Land-related SDG's, require a broader ecosystem approach that can be achieved by a direct link between soil functions and corresponding ecosystem services. Thus, the key issues are not considered separately but linked as part of a dynamic ecosystem characterization following a narrative as is demonstrated for food security, that can be well addressed by precision agriculture. As all key issues and at least five of them are directly land-related, soil science can potentially play an important role in the suggested interdisciplinary studies. But in addition, the current information on society with knowledgeable stakeholders requires innovative and interactive transdisciplinary scientific approaches by not only focusing on knowledge generation, but also on co-learning with stakeholders and, more importantly, on implementation. During the last decade and for the future, Soil Science Department at Isfahan University of Technology has tried to bring these transdisciplinary approaches to achieve the SDG's and link science and society. This is a need for specific results on the ground of illustrating with hard data (more than four decades of data gathering) and the key role soils can play in realizing the nation at first and secondly for the SDG's.



Department of Water Sciences and Engineering

Water Engineering Department was established in the early 1977s at Isfahan University of Technology to train the students so that they could properly manage and design of irrigation systems. This department has aimed to increase the quality in all aspects of irrigation sciences. Our mission is to expand and transfer knowledge for increasing of irrigation efficiency water management on farm. Our academic members are teaching and researching in different fields of Water Engineering including Irrigation and Drainage, Water Resources and Water structures. Our department is supported with advanced research laboratories and specialized facilities to support research studies and graduate students' theses and dissertations, and also offers services to the industry.



Academic Programs

Our Department provides academic programs for the degree of Bachelor of Science (B.Sc.) in Water Science and Engineering. It also offers graduate studies leading to the degrees of Master of Science (M.Sc.) in Water Resource Engineering, Irrigation and Drainage and Water Structure. Besides, we have Ph.D. programs in Irrigation and Drainage.

Undergraduate

The Department of Water Engineering offers a program at the undergraduate level too. This program is designed for students preparing themselves for professional work on farms, and also for those seeking further graduate training in irrigation and water engineering. Under-

graduate students must pass 20 credit hours of general, 24 credit hours of basic courses, 86 credit hours of obligatory courses, and 10 credit hours of elective courses (140 credits in total) to qualify for the Degree of B.Sc. in Water Science and Engineering.

■ Graduate

The Department of Water Engineering offers programs for the degrees in Master of Science and Doctor of Philosophy. The graduate programs attract students in different fields such as Water Resource Engineering, Irrigation and Drainage and Water Structure . Students must pass 32 and 36 (including thesis or dissertation) course credits for M.Sc. and Ph.D., respectively. Graduate students must conduct an original research study for their thesis or dissertation, and defend their findings in an oral presentation after acceptance of a research paper.

■ Admission

We accept international students in the coming semesters for both M.Sc. and Ph.D. programs. The Ph.D. is as research-based in Irrigation and Drainage and M.Sc. in Sustainable Management of Water and Climate Change (SMWCC). The (SMWCC) program will be known as an interdisciplinary graduate program between Water Engineering Department in College of Agricultural Engineering, Department of Mathematical Science, Department of Natural Resources, and Department of Chemical Engineering at Isfahan University of Technology (IUT). The SMWCC program will provide a balanced program of study in the science of climate change, water science and management in the context of climate change. The program will help students develop a thorough understanding of hydrologic processes as well as their variability, change and interrelationships. Students will gain an in-depth understanding of numerical modeling (both physically-based and stochastic), statistical methods, and Geographical Information Systems (GIS). The program also will help students gain a broad understanding of the field of climate change science, water resources engineering and related disciplines.

Admission to our graduate program will be highly competitive. Students are to contact initially with their master of interest for vacancy position.

The minimum criteria for admission can be found in Admission Requirement for IUT. Applicants should hold at least a B.Sc. degree or its equivalent in Water Science and Engineering from a credible institution. Beyond these minimum requirements, the admission committee looks for intellectual potential by reviewing the previous performance in university coursework. If the applicant has published papers, attachment of one or two of these and a description of their impact are encouraged. The candidate's statement should include a description of the research interests as well as their motivation for pursuing graduate education.

■ **Transfer Students**

Department of Water Engineering at Isfahan University of Technology accepts transferring students for joint projects or sabbatical programs.

Research

■ **Research Fields**

The research initiatives carried out in IUT Department of Water Engineering cover a range of topics including:

- Irrigation and Drainage
- Water Structure
- Water Resource Engineering

Graduate research and projects in the Irrigation and Drainage program typically consider topics such as:

- Applying of DSSAT program for determination of water use efficiency and nitrate leaching under subsurface and surface drip irrigation in the field.
- Simulation of water and solute transport in soil using HYDRUS software and its application in irrigation water management.
- Simulation of flow through coarse porous media.
- Quality modeling of the constructed wetland with different bed materials.

Graduate research and projects in the Water Structure program typically consider topics such as:

- Hydraulic jump with different condition as positive slop.
- Scouring of bridge pier in experimental flume.

Graduate research and projects in the Water Resource program typically consider topics such as:

- Drought characterization and prediction
- Evaporation from water bodies and soils
- Hydrologic effects of climate change
- Hydrologic impacts of large-scale atmospheric and oceanic interactions (i.e. ENSO & PDO)
- Hydro-climatology and hydrometeorology
- Water reuse, desalination and Water Purification
- Human impacts on hydrologic processes
- Numerical modeling of hydrologic systems
- Rainfall-runoff modeling of watersheds and river basins
- Risk and uncertainty analysis of water resources systems
- Stochastic analysis, modeling, and simulation of hydrological processes
- Water quality and hydrologic processes

Research Projects

- Evaluation and qualitative modeling of hybrid constructed wetlands for domestic wastewater treatment
- Reduction of evaporation from open reservoirs
- Interaction of natural and artificial superabsorbent materials on soil hydraulic properties
- Evaluation of the performance of a combined artificial wetland with Pumice and Vetiver in supplementary treatment of livestock effluent
- Design and Engineering of Smart Water Management for Irrigation Systems Based on Integrated Processing of the Water, Soil, Plant and Atmosphere Data (IPSIM)

International Collaborations

Isfahan University of Technology (IUT) and Lethbridge College have signed a mutual MOU. This MOU aims at establishing a cooperative relationship between both institutes in the field of agricultural engineering and conducting applied research and student exchange as well as creating positive outcomes for education and research.



Labs and Research Facilities

Our department provides excellent research laboratories, as well as specialized facilities, including:

- Hydraulics Labs



- Surveying Lab
- Drainage Lab
- Soil Physics Labs



● Irrigation Lab



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Department of Plant Protection

Plant protection is a branch of agricultural sciences that studies biology and the ecology of crops' harmful organisms. It develops methods to control and prevent crop damage and yield loss.

Plant protection involves disciplines that require knowledge of the biology of pests, principles of crop production, biotechnology, pesticide toxicology, and environmental sciences. Besides, plant protection is an integrated approach based on biological control strategies, population dynamics, and molecular and genetic understanding of plant-pathogen, plant-pest interactions in order to minimize damaging species' impacts upon natural environments.

The Department of Plant Protection was established in 1982 by admitting students at B.Sc. level. The Department has been offering Master of Science programs in Agricultural Entomology since 1995 and Plant Pathology since 2002. The Ph.D. program in Plant Pathology has been offered since 2013.

One of our department's assets is the ability to provide students with top-ranked educational and research opportunities in a collegial and friendly atmosphere.



Mission of the Department

The mission of the department is to improve plant health in agriculture, so as to ensure long-term food security and sustainable use of natural resources. Besides, the department is engaged in quality research, education, and outreach in plant protection, with emphasis on the understanding of relationships among pests, their hosts, and the environment, and on the management of pests and diseases and other threats impacting agricultural and natural ecosystems, food safety, and human and environmental health. Our research activities are mainly in the areas of Toxicology of Pesticides, Insect Physiology, Biological Control of Pests, Integrated Pest Management (IPM), Acarology, Fungal Molecular Systematics and Phytopathology, Plant-microbe Interactions, Plant Viruses and Virus-vector Relationships.

Academic Programs

The Department of Plant Protection offers undergraduate and graduate studies leading to:

- Bachelor of Science (Plant Protection)
- Master of Science (Agricultural Entomology and Plant Pathology)
- Doctor of Philosophy (Plant Pathology)

Undergraduate Programs

Undergraduate students must take 20 credits in general courses, 35 credits in basic courses, 35 credits in basic agriculture courses, 32 credits in major-specific courses and 18 credits in elective courses (total 140 credits) to obtain B.Sc. in Plant Protection.

Graduate Programs

This Department offers two majors in M.Sc. level and one Ph.D. program:

- **Agricultural Entomology:** To obtain an M.Sc. degree in Agricultural Entomology, graduate students must take at least 31 credits, 24 credits from the major-specific courses, one credit is seminar, and six credits are thesis.
- **Plant Pathology:** The M.Sc. program consists of at least 31 credits, 25 credits of which are coursework and six credits are thesis. The Ph.D. program consists of at least 36 credits, 18 credits of which are course work and 18 credits are dissertation.

Research Fields

Our research activities are driven by the key challenges that we face in our region or country. We do this by undertaking inter- and multi-disciplinary research, collaborating widely with colleagues across the country and the world.

- Molecular ecology and genetic diversity of plant - pathogenic bacteria, fungi and viruses
- Detection and molecular characterization of fungi, bacteria and viruses associated with field and horticultural crops
- The Rhizobium – legume Symbiosis
- The Grass Endophytic Fungi
- The development and use of microsatellite markers for genetic analysis of orphan plants
- Plant Virology
- Virus- Vector Interaction
- Mycology and Fungal Plant Pathology
- Insect Toxicology and Physiology
- Insecticide Resistance
- Integrated Pest Management (IPM)
- Biological Control of Pests
- Insect Ecology
- Taxonomy of Insects
- Plant – Arthropod Interactions

Research Facilities and Labs

We continually invest in resources, and improve our research facilities to ensure that our academic members and students are able to pursue their ideas and undertake research to ensure significant national impact. We have a number of special facilities that allow us to conduct a wide breadth of research on insect and plant pathogens. These facilities include entomological research and educational laboratories, plant pathology laboratories and molecular genetics laboratory.

- A dedicated, controlled environment facility for insect and plant pathogens that comprises plant growth chambers and controlled greenhouses and field farm
- Advanced light microscopy facility
- Molecular and genomic studies facility
- Diagnostic clinic which is dedicated to providing the highest quality service by providing plant disease diagnosis and pest identification, and management strategies
- Campus Biological Electron Microscopy facility
- Campus Bioinformatics Core facility
- Campus DNA Technologies and Expression Analysis Core facility



Research Projects

- The detection and identification of plant pathogenic bacteria and phytoplasmas based on classical and molecular methods (Dr. Bahar)
- Development of reliable and efficient methods for early detection of bacterial pathogens from seed lots (Dr. Bahar)
- Reducing the impact of prokaryotic pathogens on potato crop (Dr. Bahar)
- Identification and characterization of fungal disease of cereal crops (Dr. Sharifnabi)
- Identification of *Trichoderma* species using morphological characters in Western provinces of Iran (Dr. Sharifnabi)
- Evaluation of resistance and identification of molecular markers (AFLP) linked to safflower root rot resistance genes (Dr. Sharifnabi)
- Study on sainfoin seed mycoflora in Iran (Dr. Sharifnabi)
- Resistance to viruses and their vectors in cereals (Dr. Massah)
- Genome organization and genetic variation of plant viruses (Dr. Massah)
- Interactions between cereal viruses and their vectors (Dr. Massah)
- Investigating pesticide resistance status and mechanisms in major key agricultural and urban pests (Dr. khajehali)
- Evaluation of insecticidal and acaricidal activities of plant based products (Dr. khajehali)
- Studying sublethal effects of pesticides on the beneficial and harmful arthropods (Dr. khajehali)
- Molecular identification of Iranian *Trichogramma* wasps and the evaluation of their efficiency in controlling pests (Dr. Poorjavad)
- Studying the combined effect of entomopathogenic agents and chemical insecticides in controlling pests (Dr. Poorjavad)
- The biology and ecology of important pests and their demographic responses to environmental changes (Dr. Poorjavad)
- Screening of plant potential sources of resistance to arthropods basis on the population growth and nutritional parameters (Dr. Talaea)
- Studying the bottom-up effects of fertilizers on plant arthropod pests and their natural enemies (Dr. Talaea)

Honors and Awards

- Outstanding and distinguished teacher (Dr. Bahar) at “National Award for Outstanding Academic Teacher” in 2021.
Two distinguished books:
- “Diseases of Field Crops in Iran” by Dr. Sharifnabi awarded at Book of the Year Award of Iran in 2011.
- “Entomology” by Dr. Ebadi & Rakhshani awarded at Book of the Year Award of Iran in 2020.

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