

A. Food Biotechnology

Introduction

The Option of Food Biotechnology aims at producing graduates who are well equipped with skill and basic knowledge in biotechnology and food processing, capable of integrating the gained knowledge and applying it fruitfully for the benefit of the society and the country. It also aims at conducting applied research and extending accumulated knowledge to the local food industry and the society.

Carrier opportunities

Students graduating in this Option will have possibilities in food production, quality control, quality assurance, processing, fermentation processing, development of new products and research. The main carrier openings include:

- **Food industry:**
 - meat industry
 - beverage (alcoholic and non-alcoholic)
 - cereals (baking, milling, pasta making)
 - dairy industry
 - fruits and vegetables (canning, pastes, concentrates)
 - roots and tubers (industry of starch and other processed products)
 - fats and oils
- **Biotechnology:**
 - bioethanol
 - Organic acids (citric acids, acetic acids, etc.)
 - proteins
 - food additives and supplements production
- **Essential oils and fragrant**
 - food regulation
 - food quality assurance
 - food sanitation
 - good manufacturing practices
 - food analysis

Exit profile

The principal objective of the Option is to train students to be food technologists and engineers equipped with chemical and biological skills and engineering methodology for a comprehensive understanding of physicochemical properties of foods, processing and preservation of food materials, and biotechnological applications. The Option emphasizes both basic principles and key technologies necessary for food and bio-industry. The curriculum is, therefore, designed to provide core courses such as food chemistry, food microbiology, food engineering, food processing and preservation, food analysis, food biotechnology, and biochemical engineering. Organic chemistry,

analytical chemistry, physical chemistry, applied mathematics, biochemistry, and molecular biology are also required to pursue major courses. Students will also have knowledge in food regulations and standards, food quality, safety and hygiene.

Entry profile

The student applying for this Option should have Interest in laboratory research and food science and technology, secondary school studies in biology, organic and inorganic chemistry, mathematics and physics. Here combinations of Physics-Chemistry-Biology (PCB), Physics-Chemistry-Math (PCM), Math-Chemistry-Biology (MCB), Math-Physics-Geography (MPG), and Biology-Chemistry-Geography (BCG) can apply for this option. The student should have also Computer skills at user level and good English both reading and writing.

Facilities

The department of Biotechnology at INES possesses three fully equipped laboratories (physic-chemistry, microbiology and tissue culture) and one molecular biology laboratory partly equipped. Plans for building food processing and analysis laboratories are there. The library is also equipped with books helpful for students to do their research. There are also class rooms, computer laboratories with internet connection to help students.

Modules description

Level I

Module	Module code	Units	Credits
Languages I	LAN 111	CSE I TEOE I	15
Research skills	RSK 112	Introduction to ICT Introduction to Scientific Research	15
Philosophical studies	PHS 113	Introduction to Philosophy Introduction to Ethics	10
Mathematics	MAT 114	Algebra Mathematical Analysis Differential Equation	20
Fundamental physics	PHY 125	Classical and Fluid Mechanics Electricity and Magnetism Optics and Waves	20
General chemistry	CHE 126	Inorganic and Analytic Chemistry Physical Chemistry Organic Chemistry	20
General Biology	BIO 127	Cell Biology Plant Biology Animal Biology	20
Total			120

Level II

Module	Module code	Units	Credits
Languages II	LAN 211	CSE II TEOE II	10
Production Techniques	PTE 212	Plant Production Animal Production	15
Food Technology	FTE 213	Introduction to Food Science and Technology Food Processing, packaging and Preservation	20
Food Engineering	FEN 214	Food Engineering and Unit Operations I Food Engineering and Unit Operations II	20
Advanced Chemistry	CHE 225	Physical Chemistry Organic Chemistry Structural and Metabolic Biochemistry	20
Food Chemistry	FCH 226	Food Chemistry I Food Chemistry II	15
Microbiology	MIC 227	General Microbiology Food Microbiology	20
Total			120

Level III

Module	Module code	Units	Credits
Advanced Molecular Biology	AMB 311	Molecular Biology Molecular Genetics	20
Plant Products Processing	PPR 312	Processing of Cereals Roots, Tubers and Sugars Processing of Legumes, Fruits and Vegetables Fats and Oils Processing	120
Animal Products Processing	APR 313	Dairy Products Science and Technology Meat products Science and Technology	20
Total			60

Level IV

Food Biotechnology	FBT 424	Microbial Genetics Microbial Biomass Production Microbial Metabolites Production	15
Postharvest Technology	PHT 425	Perishable Products Handling Non-Perishable Products Handling	10
Research Methods	RME 426	Descriptive Statistics and Probability Biometry Research Methodology	20
Professional experience	PEX 427	Seminar Entrepreneurship	15

	Industrial Attachment I	
Total		60

Level IV

Module	Module code	Units	Credits
Biochemical Engineering	BCE 511	Industrial Enzymology Bioprocess and Biochemical Engineering	15
Beverages Science and Technology	BST 512	Non-alcoholic Beverages Alcoholic Beverages	15
Products analysis	PAN 513	Physical and Chemical Food Analysis Special Methods of Analysis	20
Food quality and Waste Management	FWM 524	Food Quality Management, Hygiene and Sanitation Industrial Waste Management Food Product development	20
Economics and Social Sciences	ECO 525	Agribusiness Management Food Standards, Policies and Legislation	10
Human Nutrition and Dietetics	HND 526	Human Nutrition Dietetics Community Nutrition and Food Security	150
Professional Experience	PEX 527	Industrial Attachment II Dissertation	20
Total			120

B. PLANT BIOTECHNOLOGY

Introduction

Plant biotechnology option is one of three options found in Department of Biotechnologies in Faculty of Applied Fundamental Sciences.

The Program of Plant Biotechnology aims at producing graduates who are well equipped with skill and basic knowledge in plant biotechnology and capable of integrating the gained knowledge and applying it fruitfully for the benefit of the society and the country. It also aims at conducting applied research in plant biotechnology as breeders, agricultural technician in tissue culture laboratories, cleaning and multiplication of seed. Those will help the student to be important in community and society.

Carrier opportunities

Students graduating in this program will have possibilities to work in Agricultural institutions, Research institutions, NGO's working in agricultural area, Private institutional as a worker, Private sector as breeders, cleaning seeds as multiplier. The main carrier openings include

Research institutions:

- laboratory of plant pathology
- laboratory of tissue culture
- laboratory of nematology
- laboratory of molecular biology
- entomology researchers
- botanic garden and plant medicinal
- botanist

Private sector as

- multiplier of seeds
- cleaning and multiplication of seeds

NGO's working in agricultural area:

- seeds and manager coordinator
- multiplier and seeds

conservation Agricultural institutions:

- plant quarantine
- pest and diseases surveillance
- seeds storage and conservation

Exit profile

The principal objective of the Program is to train students and make them as plant biotechnologist and engineers equipped with a high knowledge in plant breeding, plant molecular, biological engineering, plant pathology and production, seeds biotechnology and conservation, seeds cleaning and multiplication, taxonomy and phytosociology. With this knowledge, the student will be able to help our country to go fast in research development that has a positive impact in the economy growth.

Entry profile

The student applying for this option should have interest in laboratory research, plant production, agriculture and biotechnology basic. In this regard, secondary school students who have finished their studies in biology, Physics-Chemistry-biology (PCB), Maths-chemistry-biology (MCB), Biology-chemistry –Geograph (BCG), Maths-Physics-Geography (MPG), Physics-Chemistry and Maths (PCM) are the ones who have to apply for this option with great competence in Biology and Chemistry. The student should have also Computer skills at user level and good English both reading and writing.

Facilities

The department of Biotechnologies at INES possesses three fully equipped laboratories (physic-chemistry, microbiology and tissue culture) and one laboratory partly equipped (molecular biology). There is also a botanic garden and medicinal plant, 2 greenhouses for transfer of plantlets from tissue culture laboratory. There are plans to build new laboratories, especially a plant pathology, nematology and entomology. The library is also equipped with books helpful for students to do their research and there is a constant renewal of books in the library.

There are also class rooms, computer laboratories with internet connection to help students in research work.

Note that the students in this option have the common courses in first year with other options in department of Biotechnologies.

Curriculum of Plant Biotechnology program

Level I

Module	Module code	Units	Credits
Languages I	LAN 111	CSE I TEOE I	15
Research skills	RSK 112	Introduction to ICT Introduction to Scientific Research	15
Philosophical Studies	PHS 113	Introduction to Philosophy Introduction to Ethics	10
Mathematics	MAT 114	Algebra Mathematical Analysis Differential Equation	20
Fundamental Physics	PHY 125	Classical and Fluid Mechanics Electricity and Magnetism Optics and Waves	20
General chemistry	CHE 126	Inorganic and Analytic Chemistry Physical Chemistry Organic Chemistry	20
General Biology	BIO 127	Cell Biology Plant Biology Animal Biology	20
Total			120

Level II

Module	Module code	Units	Credits
Languages II	LAN 211	CSE II TEOE II	10
Biodiversity	BIO 212	Ecology General entomology and pest control	15
Plant diversity	PDI 213	Plant taxonomy and systematic Phytosociology	20
Physiology	PHY 214	Animal physiology Plant physiology	15
Advanced chemistry	CHE 221	Physical chemistry Organic chemistry Biochemistry	20

Microbiology		General Microbiology Microbiology physiology and metabolism	20
Genetic & evolution		Classical genetics Population genetics	20
Total			120

Level III

Module	Module code	Units	Credits
Basic Biotechnology	BBT 311	Basic concept of biotechnology Environmental biotechnology	20
Plant Pathology and Production	PPP 312	Introduction to plant production Plant pathology Insect and plant interactions	20
Plant Biotechnology	PBT 313	Plant tissue culture DNA recombinant & Anti-sense RNA technology	20
Total			60

Level IV

Seeds Biotechnology and Conservation	SBC 421	Seeds production and conservation Seeds technology	20
Biological Engineering	BEN 422	Physical Methods of Analysis Enzymology	10
Research Methods	REM 423	Descriptive Statistics and Probability Biometry Research Methodology	20
Professional Experience	PEX 424	Seminar Entrepreneurship Industrial attachment I	10
Total			60

Level V

Module	Module code	Units	Credits
Plant Breeding and Improvement	PBI 511	Conventional plant breeding Molecular plant breeding	20
Plant Genetic Engineering	PGE 512	Basis of plant genetic engineering Genetic engineering and Ethics	20
Bioinformatics	BIO 513	Plant genomic and bimolecular analysis Bioinformatics and functional genomic	20
Economics		Agribusiness management Plant and plant products trade and regulations Field trip	20
Professional experiences	PEX 522	Seminar Industrial attachment II	20
Dissertation	DIS 523	dissertation	20
Total			120