

**Program of:
Science and Technology
of Fermentation Industry
Diploma
(Program Scheme and
Courses Content)**

Program of Science and Technology of Fermentation Industry Diploma

First Year: First Semester

Code	Course Title	No. H.	Prac. H.	Exams		Grade
				Y.W.	Wr.	
IF5101	Cytology and microbial genetics.	4		60	140	200
IF5102	Mycology and Algae	2		30	70	100
IF5103	Company laws and work legislation.	2		30	70	100
IF5104	Bacteriology and virology.	2		30	70	100
IF5105	Language.	2		30	70	100
	Elective Courses (A)*	2		30	70	100
	Elective Courses (B)**	2		30	70	100
	Total	16		240	560	800
	* Elective Courses (A) Choose one from the following:	<p>Note:</p> <p>Course Code Description:</p> <p>Course Name: AB CDEF</p> <p>(AB): is an indicator for the diploma name.</p> <p>(C) : is a number for graduate course level (from 1 to 4).</p> <p>(D) : is a number indicating the semester number.</p> <p>(EF): is a number indicating the serial number of the course during the semester.</p>				
IF5106	Organic chemistry.					
IF5107	Food Chemistry					
IF5108	Principle of Food Technology					
	** Elective Courses (B) Choose one from the following:					
IF5109	Physical Chemistry.					
IF5110	Food Analysis.					
IF5111	Food Enzymes.					
*** Extended courses						

Program of Science and Technology of Fermentation Industry Diploma

First Year: Second Semester

Code	Course Title	No. H.	Prac. H.	Exams		Grade
				Y.W.	Wr.	
IF5201	Microbial Growth control and microbial food poisoning.	4		60	140	200
IF5202	Immunology and Enzymology.	2		30	70	100
IF5203	Genetic engineering.	2		30	70	100
IF5204	Yeast genetics.	2		30	70	100
IF5205	Technical writing.	2		30	70	100
	Elective Courses (A)*	2		30	70	100
	Elective Courses (B)**	2		30	70	100
	Total	16		240	560	800
	* Elective Courses (A) Choose one from the following:					
IF5206	Chemistry of carbohydrates.					
IF5207	Standard Specifications of Foods					
IF5208	Microbial Spoilage of Foods					
	** Elective Courses (B) Choose one from the following:					
IF5209	Food processing.					
IF5210	Fermented Foods					
IF5211	Physical Properties of Foods					
*** Extended courses						

Program of Science and Technology of Fermentation Industry Diploma

Second Year: First Semester

Code	Course Title	No. H.	Prac. H.	Exams		Grade					
				Y.W.	Wr.						
IF5301	Biochemistry.	2		30	70	100					
IF5302	Research project***.	2		---	---	---					
IF5303	Industrial microbiology	4		60	140	200					
IF5304	Agricultural laboratory (I) ***.		4	25	25	50					
IF5305	Computer programming.	2		30	70	100					
	Elective Courses (A)*	2		30	70	100					
	Elective Courses (B)**	2		30	70	100					
	Total	14	4	205	445	650					
	* Elective Courses (A) Choose one from the following:										
IF5306	Industrial Fermentation										
IF5307	Engineering and Technology of Food Processing.										
IF5308	Non-alcoholic Beverages.										
	** Elective Courses (B) Choose one from the following:										
IF5309	Economics of food factories.										
IF5310	Computer Systems and Performance Evaluation.										
IF5311	Technology of Starch and Glucose Industry.										
*** Extended courses											

Program of Science and Technology of Fermentation Industry Diploma

Second Year: Second Semester

Code	Course Title	No. H.	Prac. H.	Exams		Grade					
				Y.W.	Wr.						
IF5401	Quality control in fermentation industry.	2		30	70	100					
IF5402	Research project***.	2		50	50	100					
IF5403	Biochemical Engineering and Yeast Biotechnology	4		60	140	200					
IF5404	Agricultural laboratory (II)***.	---	4	25	25	50					
IF5405	Statistical analysis.	2		30	70	100					
	Elective Courses (A) *	2		30	70	100					
	Elective Courses (B) **	2		30	70	100					
	Total	14	4	255	495	750					
	* Elective Courses (A) Choose one from the following:										
IF5406	Instrumental analysis.										
IF5407	Marketing research.										
IF5408	Design of Industrial Waste Treatment Systems.										
	** Elective Courses (B) Choose one from the following:										
IF5409	Sanitation of food industries.										
IF5410	Plant equipment planning.										
IF5411	Food Packaging Technology.										
IF5412	Project Economics.						*** Extended courses				

First Year: First Semester

IF5101- Cytology and Microbial Genetics: (4h/w)

A) Cytology:

- General introduction: Historical background
- Macromolecules of the cell: Nucleic acids, proteins, carbohydrates, lipids.
- Cell structure and function.
- Light microscopy.
- Electron microscopy.
- Tissue and cell culture.
- Cytochemistry.
- Cell fraction

B) Microbial Genetic:

- Introduction.
- Importance of microbes in genetic studies.
- Organization of genetic material in microorganisms.
- Gene expression.
- Regulation of gene expression.
- DNA damage and Repair.
- Mutagenesis.
- Plasmids.
- Gene transfer in bacteria.
- Genetic engineering in microorganisms.
- Introduction.
- Importance of microbes in genetic studies.
- Organization of genetic material in microorganisms.
- Gene expression.
- Regulation of gene expression.
- DNA damage and Repair.
- Mutagenesis.
- Plasmids.
- Gene transfer in bacteria.
- Genetic engineering in microorganisms.

IF5102- Mycology and Algae: (2h/w)

Fungi:

- Classification of fungi.
- Morphology characteristics of fungi.

- Nutrition and fungal symbiosis.
- Vegetative and sexual reproduction.
- Structure of yeast cell.

Algae:

- Classification of algae.
- Morphology characteristics and mobility of algae.
- Nutrition and algal symbiosis.
- Reproduction of algae.
- Structure of algal cell.

IF5103- Companies Laws and Work Legislations: (2h/w)

- Law of work
- Individual and group work contracts
- Decrees of syndicates and companies
- Delimitations of employing delinquents and women, foreigners working for Egyptians and Egyptians working for foreigners
- Arabic and international work agreements
- Law of social insurance
- Kinds of social insurance
- Study of Decrees related to special kind of social insurance
- Distinguishing between Decrees of social insurance and other kinds of Insurance

IF5104- Bacteriology and virology: (2h/w)

Bacteriology:

- Distribution and importance of bacteria.
- Different classifications of bacteria.
- Morphology and cultural characteristics.
- Structure of bacteria cell.
- Sporulation of bacteria.
- Mobility of bacteria.
- Reproduction of bacteria.
- Nutrition of bacteria.
- Action of physical and chemical factors on bacteria.
- Aerobic and anaerobic respiration of bacteria.
- Actinomycetes, rickettsia and mycoplasma.

Virology:

- Nature of viruses.
- Multiplication and genetics of bacteriophages.
- Lysogeny, episome and transduction bacteriophage.

- Multiplication of genetics of animal viruses.
- Interference with viral multiplication and infectivity.

IF5105- Language: (2h/w)

- 1- Introduction.
- 2- Characteristics of the technical English.
- 3- Review of the English grammar.
- 4- Active sentences and its characteristics.
- 5- Some of the common errors in writing technical English sentences.
- 6- Phrasing: (Main idea – Methods of explaining the main idea – Types of phrases – Reading and analyzing some of the technical writing to develop the communication skills).

Note: This Course of Language is to be taught to all specialties.

Elective Courses
(First Year - First Semester)List (A)

IF5106- Organic Chemistry: (2h/w)

1- *Physical organic chemistry:*

Types of organic reactions, Mechanisms of organic reactions.

2- *Reactions of carbonyl compounds:*

Acid and base catalyses (specific and general),
Nucleophilic addition reaction of carbonyl compounds
on nitrogen and carbon nucleophiles.

3- *Cyclic addition reactions:*

Classifications, Thermocyclic addition reactions,
Dipolar cyclic addition reactions.

4- *Photochemistry:*

The excited electronic states and Jablonski diagram,
Properties of photoreactions, Reactions of: unsaturated
organic carbon compounds carbonyl compounds and
aromatic compounds.

IF5107- Food Chemistry: (2h/w)

Water - Enzyme utilization in food industry – Amino acids –
Peptides – Proteins – Lipids – Carbohydrates – Aroma substances –
Vitamins – Minerals – Food additives – Food contamination.



IF5108- Principle of Food Technology: (2h/w)

Introduction – Nutrition state in Egypt and the world – Main components of food – Caloric value and Caloric requirements – Food spoilage – Main methods for the preservation of food – Principle of food preservation – Preservation by low temperature – Preservation by high temperature – Preservation by Dehydration – Preservatives – Preservation by fermentation.

Elective Courses

(First Year - First Semester)List (B)

IF5109- Physical Chemistry: (2h/w)

- Thermodynamics of interface, surface tension.
- Electrical properties of interfaces.
- Electokinetic phenomena, electrophoresis, electro osmosis.
- Interaction between colloidal particles and surfaces.
- Stabilization and flocculation of colloids using macromolecules.
- Surfactants, liquid crystals, adsorption of macromolecules on surfaces.

IF5110- Food Analysis: (2h/w)

- Preparation of sample for analysis.
- Moisture determination.
- Ash and mineral matter.
- Protein determination.
- Oil and Fat determination.
- Reducing sugars.
- Non-reducing sugar.
- Starch.
- Crude fiber.
- Vitamins.
- Colouring agents.

IF5111- Food Enzymes: (2h/w)

Enzymes in food processing – Engineering enzyme properties and functions – Enzyme structures and functions – Methods for modification of enzymes – Amylolytic enzymes – Cellulolytic enzyme – Proteolytic

enzymes – Lipolytic enzymes – Pectic enzymes – Lipoxygenase – Polyphenol oxidase – Glucose oxidase – Catalase – Xylose isomerase.

First Year: Second Semester

IF5201- Microbial Growth Control and Microbial Food Poisoning
(4h/w)

A: Microbial Growth Control:

- Heat sterilization.
- Radiation sterilization.
- Filter sterilization.
- Chemical growth control.
- Disinfectants and antiseptics.
- Microbial growth control in foods.
- Growth factor analogs.
- Antibiotics.
- β -lactam antibiotics.
- Antibiotics from prokaryotes.
- Viral control.
- Fungal control.
- Antibiotic resistance.

B: Microbial Food Poisoning:

- Epidemiology of food-borne diseases.
- Bacterial food-borne infections.
- Food intoxication.
- Mycotoxins in foods.
- Parasites infection in foods.
- Viral infection in foods.
- Prevention method of microbial food poisoning.
- Detection and determination methods of microbial toxins in foods.

IF5202- Immunology and Enzymology: (2h/w)

A: Immunology:

- Introduction and history of immunology.
- Mechanisms of microbial pathogenicity.
- The immune system.
- Microbial products which damage the host.
- Mechanisms of host resistance.
- Hypersensitivity reactions.
- Autoallergic diseases.

- Viral immunology.
- Immune reactions.
- Immuno-deficiency

B: Enzymology:

- Classification of enzymes-Nomenclature of enzyme.
- General chemistry of enzymes.
- Thermodynamic and kinetics of biological reactions.
- Thermodynamic of enzymes.
- Enzyme kinetics.
- Allosteric control of enzyme function.
- Enzyme Mechanisms.
- Multiple enzyme forms.
- Regulation of enzyme activity
- Coenzymes.
- Detection of some enzymes
- Restricted enzymes.
- Food enzymes and future development.
- Tailoring enzyme structures and function.
- Amylolytic, cellulolytic, proteolytic, lipolytic and peptic enzymes.
- Lipoxgenase, polyphenol oxidase, Glucose oxidase, peroxidases and Catalase.

IF5203- Genetic Engineering: (2h/w)

- Meaning of genetic engineering and its importance for human.
- Organization and gene expression in prokaryotes.
- Organization and gene expression in eukaryotes.
- Handling techniques with DNA.
- Plasmids and bacteriophages as cloning vectors.
- Required enzymes for gene cloning.
- Cloning strategies.
- Applications of genetic engineering in Agriculture and food industries.

IF5204- Yeast Genetic: (2h/w)

Yeast genetics

- Introduction
- Yeast identification
- Genetics of mating. type locus

- Isolation of mutants
- Haploidization
- Studying methods of genetic improvement for the productive yeast strains.
 - 1- (Mutagenesis)
 - 2- (Protoplast Fusion)
 - 3- (Transformation)

IF5205- Technical Writing: (2h/w)

- 1- Elements of technical reports.
- 2- Methods of engineering writing.
- 3- Methods of analyzing the engineering data.
- 4- Correct expressions and analytical reading.
- 5- Report of projects.
- 6- Report of experiments.
- 7- Assignment reports.

Note: This Course of Technical Writing is to be taught to all specialties.

**Elective Courses
(First Year - Second Semester)List (A)**

IF5206- Chemistry of Carbohydrates: (2h/w)

- Definition of carbohydrates
- Classification of carbohydrates:
 - 1- According to the functional groups, (aldoses and ketoses)
 - 2- According to the complexity (mono, oligo and polysaccharides)
- Stereoisomers in carbohydrates
- Determination of molecular weights of carbohydrates
- Detailed studies on some monosaccharides involving:
 - 1- Structural formula
 - 2- Cyclic structure
 - 3- Chemical properties
 - 4- Transformation of one sugar to another
 - 5- Photosynthesis of carbohydrates.

IF5207- Standard Specifications of Food: (2h/w)

Preparation bases of standard specification of food – Preparation stages of a standard specification – Characteristic of product – Evolution

methods for quality of food products – Egyptian and International standard specification of foods and food products.

IF5208- Microbial Spoilage of Foods: (2h/w)

Microbial spoilage of meat, fish, eggs, fruit and vegetable – Spoilage of honey – Spoilage of sugar and sweets.

Elective Courses

(First Year - Second Semester)List (B)

IF5209- Food Processing: (2h/w)

Refrigeration – Freezing – Irradiation - Sun-drying and dehydration – Fermentation – Washing – Grading – Sorting – Peeling – Blanching – Pasteurization – Sterilization – Milling – Sieving – Mixing – Baking - Curring (Aging) – Smoking – Salting – Waxing - Freez-drying – Extraction – Clarification – Refining – Crystallization - Evaporation and Concentration – Distillation.

IF5210- Fermented Foods:(2h/w)

- Production of starter cultures.
- Alcoholic beverages.
- Fermented fruit and vegetal products.
- Fermented cereal products.
- Fermented legume products.
- Microbial food additives products.
- Microbial flavors and aromatic products.
- Fermented meat products.
- Fermented dairy products.

IF5211- Physical Properties of Foods: (2h/w)

Density – Refractive index – Polarization – Viscosity and Plasticity – Surface tension – Colloid properties of foods – Practical applications on the physical properties of foods.

Second Year: First Semester

IF5301- Biochemistry: (2h/w)

- Overview of metabolism.
- Microbial nutrition and Nutrients as energy sources.
- Basic mechanisms of ATP synthesis.

- Biosynthesis of microorganism cells from glucose:
Assimilation of ammonia – Biosynthesis of amino acids
- Formation of Pentose phosphate and NADPH₂ -
- Ribonucleotides and Deoxyribonucleotides – Biosynthesis of lipids – Synthesis of polymers.
- Aerobic growth of microorganism on substrate other than glucose.
- Metabolic diversity of aerobic heterotrophs:
The different mechanism for the up take of substrate –
pentose phosphate cycle-Methylglyoxal bypass –
Diversity in energy metabolism – Dissimilatory
reduction of nitrate.
- Catabolic activities of aerobic heterotrophs.
- Regulation of bacterial metabolism.
- Microbial fermentation:
Alcoholic fermentation – Lactate fermentation
- Butyrate and butanol – Acetone fermentation
Mixed acid and butanediol fermentation – Propionate
and succinate fermentation – Methane and acetate
fermentation – Sulfide fermentation – Fermentation of
nitrogenous compounds.
- Phototrophic metabolism.
- Fixation of molecular nitrogen.

IF5302- Research Project *: (2h/w) (to be continued)**

The project must be in one of the problems related to the fermentation industry.

IF5303- Industrial Microbiology: (4h/w)

- Enzymes production.
- Ethyl alcohol production.
- Yeast production.
- Acetone, butanol and glycerol production.
- Organic acids production.
- Single cell protein and amino acids production.
- Hormones production.
- Antibiotics production.
- Polysaccharides production.
- Lipid production.

- Steroids production.
- Mushroom production.
- Vitamins production.
- Biogas production.
- Bioinsecticides production.

IF5304- Agricultural Laboratories (I)*: (4h/w)**

- Isolation and identification of microorganisms used in industrial fermentations.
- Maintenance of microbial stock cultures.
- Raw materials utilized in industrial fermentation and their pretreatments.
- Estimation methods of microbial growth.
- Detection and determination of fermentative products.

IF5305- Computer Programming: (2h/w)

- 1- Computer components. (computer generation - components - input and output units - control unit - microprocessor - memory decimal operational system and special letters and characters).
- 2- Basic Programming
- 3- Fortran Programming
- 4- Cobol Programming

Elective Courses
(Second Year - First Semester)List (A)

IF5306- Industrial Fermentation: (2h/w)

Microorganisms used in industrial fermentation – Equipments of fermentation – Substances, Media and solutions used as well as the methods of their preparation – Production of lactic acid – Production of ethyl alcohol – Production of citric acid – Production of Gluconic acid – Microbial production of lipids, protein, vitamins and growth hormones – Methods for diagnosis of fermentation products.

IF5307- Engineering and Technology of Food Processing: (2h/w)

- Size Reduction:
Size reduction procedures - Fineness Modulus - Size reduction devices
- Materials handling of Food products

- Cleaning and Sorting
Grade Factors - Washing – Sorting - Separators
(Pneumatic – Gravity – Spiral Disc and Cylinder –
Centrifugal – Cyclone)
- Humid Air
- Concentration by evaporation
- Mixing
- Drying or Dehydration
Moisture Determinations - Drying Processes - Drying
Procedures - Types of Dryers
- Canning of Food Products
- Packing of Food Products
- Waste Production and Management
- Conditioned Storage and Transportation of Food Products.

IF5308- Non-alcoholic Beverages:(2h/w)

Raw material used for production of non-alcoholic – Production of Beverages – Practical applications for the production of non-alcoholic beverages.

Elective Courses
(Second Year - First Semester)List (B)

IF5309- Economics of Food Factories: (2h/w)

Technical and economic feasibility study of enterprises – Demand and supply theory – Enterprises location (Allocation theory) – Pricing (Pricing management of products) – Size of storage – Horizontal and vertical expansion of enterprise – Nature and function of markets of products – Costs – Marketing margins – Marketing functions.

IF5310-Computer Systems and Performance Evaluation: (2h/w)

Provides a comprehensive overview of the quantitative aspects of computer systems with a particular focus on performance evaluation. Topics include performance measurement, the analysis and interpretation of measurement data, workload characterization and modeling, the design and evaluation of performance experiments, and the design and application of analytical techniques. A variety of application domains will

be considered.

IF5311- Technology of Starch and Glucose Industry: (2h/w)

Historical of starch industry – Composition of starch – Industry of starch from maize, wheat, rice and potatoes – Converted products and starch derivatives – nutritional uses of starch – Industrial uses of starch – Industry of glucose syrup – Dextrose – Products industry from glucose.

Second Year: Second Semester

IF5401- Quality Control in Fermentation Industries: (2h/w)

- Quality of raw materials.
- Evaluation of filtration and separation processes.
- Sampling and testing of products during fermentation progresses.
- Assay of enzyme activities produced by fermentation.
- Evaluation of fermentors efficiency.
- Evaluation of by-products and wastes.
- Detection of miserable components and pathogens in fermentation industries.
- Attributes of fermented products quality
- Colour
- Viscosity
- Texture
- Size and shape
- Defects
- Odor
- Statistical analysis of organoleptic results.

IF5402- Research Project*: (2h/w)**

IF5403- Biochemical Engineering and Yeast Biotechnology: (4h/w)

A) Biochemical Engineering:

- Introduction.
- Scale-up of fermentations:
- Effects of fermentation scale
- Scale-up procedures
- Results of scale-up
- Bioinstrumentation and computer control of fermentation processes:
- Biosensors and bioinstrumentation of fermentation processes.
- Process control of fermentation processes
- Commercial sources
- Establishment of piolt plant:
Pilot plant mission - Construction management and execution-Fermentors Bioreactors-Recovery equipment- laboratory support - Utilities-operations commercial sources.
- Sterilization: Prevention of contamination:

- Concepts and terminology
- Theory of heat sterilization
- Practical heat sterilization
- Sterile operations
- Sterilization of air
- Cost Estimation for Biotechnology Projects:
- Total product cost
- Manufacturing cost estimation
- Capital investment estimation
- Using cost analysis.

B) Yeast Biotechnology:

- Yeast Preservation:
Maintenance of yeasts i.e. subculturing as well as long-term preservation methods i.e. freezing, freezing in liquid nitrogen and freeze-drying.
- Yeast Identification
 - 1- The use of morphology in yeast identification
 - 2- Physiological tests used in yeast identification
 - 3- Chemotaxonomy: The use of lipid composition to fingerprint yeasts
 - 4- Molecular taxonomy: DNA fingerprinting techniques used in yeast identification
 - 5- Quantification of yeasts:
Selective media for the enumeration and isolation of yeasts associated with different commodities and at different environmental conditions.
- Rapid enumeration methods as applied in the industry.

IF5404- Agricultural Laboratories (II)*: (4h/w)**

- Assay of enzymes produced by fermentation.
- Production of starter cultures.
- Fermentor and bioreactor system.
- Nutrients and growth factors additives used in industrial fermentations.
- Theoretical and practical calculations of fermentative efficiency.

IF5405-Statistical Analysis: (2h/w)

1- Descriptive statistics:

Classifications of data - graphic presentation - central mean
Measurement - measure of variation - examples using the
computer.

2- Linear regression and correlation:

Scattering graph - Linear and nonlinear curve fitting for two
groups of data function in two variables - prediction - linear
correlation coefficient (berson) and its relation to the linear
regression coefficient - meaning of linear correlation
coefficient, examples using computer.

3- Distribution:

Binomial – Poisson - Normal distribution, properties and its use.

4- Estimation and Hypotheses Testings:

population “sample -parameter - Point and interval estimation -
confidence interval -difference between two means of normal
distributions - confidence interval around of unit proportion,
difference between two proportions - minimum and alternative
hypothesis - significance level - mean hypothesis test has one
difference between two means of normal distribution - unit
mean hypothesis test and difference between two means -
examples using computer.

Elective Courses

(Second Year - Second Semester)List (A)

IF5406- Instrumental Analysis: (2h/w)

Spectrophotometric techniques – Atomic absorption
spectrophotometry and determination of toxic and non-toxic elements –
Chromatographic techniques –Thermal analysis.

IF5407- Marketing Research: (2h/w)

Examines the principles and procedures associated with the
collection and analysis of relevant information in the context of solving
practical marketing problems. Students have the opportunity to apply
these principles at each stage of marketing research process: Problem
definition, research design, data collection, data analysis, and report
preparation.

IF5408- Design of Industrial Waste Treatment Systems: (2h/w)

***Program of Science and Technology
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Designed to provide the student with the fundamentals of air and water pollution problems and the control technology and legislation associated with these problems.

Elective Courses
(Second Year - Second Semester)List (B)

IF5409- Sanitation of Food Industries: (2h/w)

Preparation bases of standard specification of food – Preparation stages of a standard specification – Characteristic of product – Evolution methods for quality of food products – Egyptian and International standard specification of foods and food products.

IF5410- Plant equipment planning: (2h/w)

Design and building up of chemical plants. The role of chemical engineer at design of chemical plants. Material and heat balance in projection. Utilization of static and dynamic simulations in design. Transport and dimension of traffic in chemical plants. Energy transfer, heating - cooling, Separation processes in inorganic technology. Absorbers and their characteristics. Drying, types and characteristics of driers. Crystallization, types and characteristics of equipments, Reactors, design and bases for calculation. Simple calculation of ideal reactors, Project equations for tube and batch reactors. Calculation of nonisothermal and nonadiabatic tube reactors.

IF5411- Food Packaging Technology: (2h/w)

Historical introduction – Quality parameters of packages – Natural packaging materials – Synthetic packaging materials – Metal cans – Glass cans – Glass bottle – Plastic base packaging – Aluminum foils – Standard specification of food packaging.

IF5412- Project Economics: (2 h/w)

- 1- An overview, the role of projects in economic development.
- 2- Economic Environment.
- 3- Determinants of project efficiency and its indicators.
 - Kinds of efficiency – industry viz project, technical viz economic.
 - Determinants of efficiency.
 - Indicators of efficiency (Productivity & Profitability).
- 4- Pricing methods in theory & practice.
- 5- Demand analysis.
- 6- Project appraisal (financial and commercial studies).
- 7- Cases.