UNIVERSITY COLLEGE DUBLIN

NATIONAL UNIVERSITY OF IRELAND, DUBLIN

AGRICULTURE

SESSION 2000/2001

CONTENTS

CONTENTS

NOTE:
All programmes and courses listed in this booklet are offered at the discretion of the Faculty of Agriculture. Minimum or maximum limits may be placed on the numbers of students taking particular programmes or courses.

FACULTY OF AGRICULTURE

DEGREES IN THE FACULTY OF AGRICULTURE

The University may grant the following degrees to students who, under conditions laid down in the Statutes and Regulations, have completed approved courses of study, and have passed the prescribed examinations of the University, and fulfilled all other prescribed conditions.

In the Faculty of Agriculture:
Bachelor of Agricultural Science (BAgrSc)
Master of Agricultural Science (MAgrSc)
Master of Science (Agriculture) (MSc (Agr))
Master of Equine Studies (MEqS) – Interfaculty
Master of Landscape Architecture (MLArch) - Interfaculty
Doctor of Philosophy (PhD)

DEGREE OF BACHELOR OF AGRICULTURAL SCIENCE (BAgrSc)

The approved courses of study for the Degree of Bachelor of Agricultural Science (BAgrSc), including professional work experience, must be pursued during four academic years as set out in the Summary of BAgrSc Degree Programmes.

The BAgrSc Degree (DN010) may be taken in:

I. Animal and Crop Production
II. Animal Science
III. Agribusiness and Rural Development
IV. Agricultural and Environmental Science
V. Food Science
VI. Engineering Technology
VII. Horticultural Science
VIII. Landscape Horticulture
IX. Forestry

The BAgrSc Degree (DN040) is a direct entry to Food Science.
The BAgrSc Degree (DN041) is a direct entry to Landscape Horticulture.

Entry to Food Science and Landscape Horticulture from the DN010 route may be restricted (or may be unavailable) due to the number of places available. Students committed to either the Food Science or Landscape Horticulture programmes are strongly recommended to place DN040 or DN041 as higher preferences than DN010 when filling out their CAO application forms.

PROGRAMME STRUCTURES AND CREDITS

1. The BAgrSc degree programmes and constituent courses listed in this booklet are offered at the discretion of the Faculty of Agriculture.

2. The syllabus for the first year of study is common to each BAgrSc degree programme.

3. The courses for the second, third and fourth years are specific to the individual degree programmes as set out in the Summary of BAgrSc Degree Programmes.

4. Professional work experience in approved degree-related areas, to be taken as an integral component of the third year programme, is mandatory for each BAgrSc Degree programme with the exception of Engineering Technology in which case professional work experience may be integrated into ENGT 4050 (Major Project II) in its fourth year programme.

5. Each degree programme consists of 'required' or 'core' courses which are compulsory for all participating students and 'elective' courses (with the exception of Food Science) which afford students an element of choice within their chosen degree programme (see the Summary of BAgrSc Degree Programmes). The elective courses currently offered by the Faculty are listed in the Syllabus of Elective Courses.

6. All courses offered by the Faculty are unitised and carry a credit rating according to the ECTS model operated by University College Dublin.

   One credit of course work at undergraduate level in the Faculty of Agriculture approximates to eight (8) hours of lectures (or their equivalent) together with the appropriate private study.

7. Sixty (60) credits of course work must normally be completed in each of the four academic years. The credit requirement is comprised of lectures, laboratory exercises, projects, other assignments etc. as specified in the Syllabus of BAgrSc Degree Programmes.

8. Project work (laboratory and/or field assignments; data analyses, reading assignments; essays etc.) is an integral component of each degree programme. Credit allocation for project work complies with Faculty guidelines (see the Summary of BAgrSc Degree Programmes).

GENERAL REGULATIONS

Application Procedure
Details of admission procedures and entry requirements for programmes in the Faculty of Agriculture are contained in the booklet *Information for Applicants to Undergraduate Degree Courses* which is available from the Admissions Office, Michael Tierney Building, University College Dublin. ☎+353.1.7061425 or 7061426.

Mature Years Applications
The Faculty of Agriculture normally offers a number of places to mature applicants. Details are available from the Admissions Office (☎ as above) or from the Agriculture Faculty Office ☎+353.1.7067194

Transfers from Institutes of Technology
The Faculty of Agriculture normally accepts a number of transferees from Institutes of Technology who have completed relevant Certificate/Diploma Programmes. Details are available from the Admissions Office (☎ as above) or from the Agriculture Faculty Office ☎+353.1.7067194

Choice of BAgrSc (DN010) Degree Programmes
Students who have been admitted to the BAgrSc (DN010) degree programme must select their preferred degree option at the end of the first year, following advisory meetings/discussions with the departments responsible. Entry to the degree programme options is a matter of student preference. However, students should note that constraints may arise which may limit the minimum or maximum number of students taking a particular degree programme.

Professional Work Experience
The requirement to acquire professional work experience in approved degree-related areas is mandatory for students in all degree programmes, except Engineering Technology. Professional work experience is an integral part of the requirements of the degree programmes as detailed in the Syllabus of BAgrSc Degree Programmes. Student performance during the professional work experience assignment is assessed and examined by the department responsible. However, it is assessed separately from the academic subjects and does not form part of the assessment for honours in the degree examinations.

The placement, nature and duration of the professional work experience assignment(s), are laid down by the department responsible for the degree programme. Students will be given guidance and assistance in developing their professional work experience programme.

Depending on the particular degree programme, the professional work experience is acquired over periods commencing at the start of the Hilary term or in the middle of the Hilary term or at the start of the Trinity term of third year and continuing through to the start of the Michaelmas term of fourth year (consult the Syllabus of BAgrSc Degree Programmes).

Transfers
Students who have been debarred from continuing in any Faculty because of their failure to pass the examination of that Faculty within the prescribed time cannot enter the Faculty of Agriculture except by special permission of the Faculty.

EXAMINATION REGULATIONS

The University examinations for the Degree of Bachelor of Agricultural Science are:
(1) The First University Examination in Agricultural Science.
(2) The Second University Examination in Agricultural Science.
(3) The Third University Examination in Agricultural Science.
(4) The Fourth University Examination in Agricultural Science.

Before admission to any of the examinations for the degree, students must have attended the courses and performed satisfactorily in all the prescribed class exercises.

The First University Examination may be taken not earlier than the end of the third term.

Students must pass the First University Examination as a whole within six terms of entering upon the programme. Students who fail to do so will thereby become ineligible to proceed. Exceptions to this rule may be granted by the Academic Council for very serious reasons, on the recommendation of the Faculty.

First year students who do not pass the First University Examination will not be permitted to re-attend their first year programme. (They will be allowed to take the examination subsequently and, on passing it, to attend second year programme in so far as this is permitted by the present regulations.) Exceptions to this rule will be made only on grounds of ill-health or for some other grave reason. Students must pass the First University Examination before entry to the courses of the second year.

The Second University Examination must be passed within six terms from the time of entry to the courses of the second year. Exceptions to this rule may be granted by the Academic Council for very serious reasons, on the recommendation of the Faculty. Students must pass the Second University Examination before entry to the courses of the third year.

Students must pass the Third University Examination before entry to the courses of the fourth year. Students who fail at the Third or at the Fourth University Examination, whether or not they hold exemption in some subjects, may be required to re-attend the whole or part of the course before being re-admitted to the examination.

First or Second Class Honours may be awarded on the results of the First, Second and Third University Examinations. The award of First or Second Class Honours in the BAgrSc Degree is based on the combined results of the Third and Fourth University Examinations. The detailed regulations are included in the publication *Marks and Standards.*

GENERAL INFORMATION

Information on registration and fees may be found in leaflets, which can be obtained free from the Registrar's Office, University College Dublin, Michael Tierney Building, Belfield, Dublin 4. For dates of Academic Session 2000/2001 – see page 152.

Location of Courses
The courses of the first year are taken mostly in the Science Building at Belfield. The courses of the second, third and fourth years are taken in the Agriculture and Food Science Building at Belfield and some practicals are also taken at the Lyons Research Farm, Newcastle, Co. Dublin and the Horticultural Unit at Thornfield on the university campus. Part of the third and fourth years of the Engineering Technology programme are taken at the Department of Agricultural and Food Engineering, Earlsfort Terrace, Dublin.

Field Trips
In the second, third and fourth years of the programme, class outings (the cost of which must be borne by students) will constitute part of the instruction in certain subjects.

Bursary in Agriculture Offered for Competition by the National University of Ireland
A Bursary in Agriculture will be offered for competition each year in one of the subject areas in the Faculty of Agriculture.

The Bursary will be awarded on the basis of an examination held in August each year. Candidates must have obtained the BAgrSc Degree with Honours, having also attained Honours standard in the subject of the Bursary.

Further particulars, including dates of entry, are available from the Registrar, National University of Ireland, 49 Merrion Square, Dublin 2.

ERASMUS (European Union Action Scheme for the Mobility of University Students)
In furthering implementation of the Community concept (a People's Europe), the Council of Education Ministers of the European Community introduced the ERASMUS programme in May 1987.

The main objective is to enable students to spend a *recognised* period of study in another member state. Participation in the programme requires adequate preliminary planning by individual students; i.e. a student must identify a university in a member state where he/she wishes to study for three months or more. Agreement must be reached between this university and the one selected by the student so that the period of study is recognised as part of the degree programme.
For further information contact the International Office, University College Dublin.
☎+353.1.7061701.

Student Societies
Agricultural Science Society
This society is conducted by students of the Faculty. Meetings are held regularly throughout the session, and papers on matters of scientific interest are read by specialists. A University public meeting is held for the Inaugural Address. Membership is open to all students of the Faculty.

Forestry Society
This society is conducted by students of Forestry. Membership is open to students who are in attendance for degrees and diplomas. The annual Inaugural Meeting of the society is held during the Michaelmas term. Meetings are held each term, at which guest speakers contribute papers on the science and practice of Forestry.

Horticultural Society
This society is run by students of Horticulture. It gives first year students an opportunity to become involved in pure horticulture and also to meet second, third and fourth year students. Meetings are held regularly throughout the session - mainly on horticultural topics but also on subjects of general interest. Outings are also arranged as well as social occasions.

Macra na Feirme
UCD *Macra* participates in many activities including seminars, charity events and competitions (such as stockjudging, quizzes, ploughing). Within UCD, *Macra* has society status and has representation on the Students' Consultative Forum.

SUMMARY OF PROGRAMMES

FOR THE DEGREE OF

BACHELOR OF AGRICULTURAL SCIENCE

I. ANIMAL AND CROP PRODUCTION

FIRST YEAR

			Credits
AERD	1001	Agricultural Economics I	6
BIOL	1002	Biology	10
CHEM	1002	Chemistry	12
COMP	1602	Introduction to Computing	6
CPSC	1001	Agricultural Science	6
EXPH	1002	Experimental Physics	10
MATH	1800	Mathematics	10
			60

SECOND YEAR

			Credits
AERD	2001	Agribusiness	6
AESC	2001	Agricultural and Environmental Biology	8
AESC	2002	Agricultural Zoology	4
ANSC	2001	Genetics I	2
ANSC	2004	Animal Husbandry I	2
CPSC	2001	Crop Husbandry I	4
CPSC	2002	Statistics	6
ENGT	2011	Principles of Engineering I and II (i) *Principles of Engineering I (2)* (ii) *Principles of Engineering II (2)*	4
FDSC	2007	Agricultural Chemistry I	4
FDSC	2008	Agricultural Chemistry II	6
GEOL	2601	Geology	3
INDM	2005	Agricultural Microbiology	6
SLSC	2003	Soil Science	5
			60

THIRD YEAR

			Credits
AESC	3010	Crop Protection	8
ANSC	3002	Animal Nutrition I	6
ANSC	3011	Animal Husbandry III	8
ANSC	3012	Fundamentals of Biotechnology	2
CPSC	3201	Professional Work Experience	30
SLSC	3001	Soil Science II	6
			60

FOURTH YEAR

			Credits
AERD	4001	Agricultural Policy I	6
AERD	4002	Communications I	4
AERD	4003	Farm Business	6
ANSC	4001	Animal Husbandry IV	16
CPSC	4001	Crop Husbandry III	14
CPSC	4100	Electives	14
			60

II. ANIMAL SCIENCE

FIRST YEAR

As for the degree programme in Animal and Crop Production.

SECOND YEAR

			Credits
AERD	2001	Agribusiness	6
AESC	2001	Agricultural and Environmental Biology	8
AESC	2003	Animal Parasitology	2
ANSC	2002	Genetics I and II (i) *Genetics I (2)* (ii) *Genetics II (2)*	4
ANSC	2004	Animal Husbandry I	2
CPSC	2002	Statistics	6
CPSC	2003	Crop Husbandry II	6
ENGT	2011	Principles of Engineering I and II (i) *Principles of Engineering I (2)* (ii) *Principles of Engineering II (2)*	4
FDSC	2007	Agricultural Chemistry I	4
FDSC	2008	Agricultural Chemistry II	6
INDM	2005	Agricultural Microbiology	6
SLSC	2002	Soil Science I	6
			60

THIRD YEAR

			Credits
ANSC	3002	Animal Nutrition I	6
ANSC	3003	Animal Nutrition II	4
ANSC	3004	Animal Breeding/Genetics	8
ANSC	3005	Animal Physiology	8
ANSC	3006	Anatomical Structure and Function	4
ANSC	3007	Experimental Design and Data Analysis	6
ANSC	3008	Animal Production Enterprises	4
ANSC	3010	Computer Techniques	2
ANSC	3012	Fundamentals of Biotechnology	2
ANSC	3201	Professional Work Experience	12
INDM	3010	Food Microbiology I	4
			60

FOURTH YEAR

			Credits
AERD	4001	Agricultural Policy I	6
AERD	4002	Communications I	4
AERD	4003	Farm Business	6
ANSC	4001	Animal Husbandry IV	16
ANSC	4002	Animal Husbandry V	4
ANSC	4003	Animal Breeding II	6
ANSC	4400	Electives	10
ERM	4004	Environmental Issues in Agriculture	4
FDSC	4009	Fresh and Processed Meat Products I	4
			60

III. AGRIBUSINESS AND RURAL DEVELOPMENT

FIRST YEAR

As for the degree programme in Animal and Crop Production.

SECOND YEAR

			Credits
AERD	2001	Agribusiness	6
AERD	2002	Agricultural Economics II	6
AERD	2003	Communications	6
AESC	2001	Agricultural and Environmental Biology	8
AESC	2002	Agricultural Zoology	4
CPSC	2002	Statistics	6
CPSC	2003	Crop Husbandry II	6
FDSC	2007	Agricultural Chemistry I	4
FDSC	2009	Agricultural Chemistry III	2
INDM	2005	Agricultural Microbiology	6
SLSC	2002	Soil Science I	6
			60

THIRD YEAR

			Credits
AERD	3001	Business Law	2
AERD	3002	Computer Analysis and Information Tecnology	8
AERD	3003	Co-operatives	2
AERD	3006	Financial Planning and Control	4
AERD	3007	Operations and Personnel Management	4
AERD	3008	Quantitative Methods	4
AERD	3009	Rural Development	6
AERD	3011	Farm Business Management I	4
AERD	3200	Professional Work Experience	14
AERD	3300	Electives	4
ANSC	3009	Animal Husbandry II	8
			60

FOURTH YEAR

			Credits
AERD	4004	Agricultural Marketing and Trade	4
AERD	4005	Agricultural Policy II	8
AERD	4006	Communications II	6
AERD	4007	Enterprise Development	4
AERD	4009	Food and Farm Input Marketing	4
AERD	4010	Farm Business Management II	8
AERD	4011	Research Methods/Project	6
AERD	4012	Taxation	2
AERD	4050	Major Project	4
AERD	4100	Electives	10
ECON	4101	National Economics	4
			60

IV. AGRICULTURAL AND ENVIRONMENTAL SCIENCE

FIRST YEAR

As for the degree programme in Animal and Crop Production.

SECOND YEAR

			Credits
AESC	2001	Agricultural and Environmental Biology	8
AESC	2004	Plant Physiology	4
AESC	2005	Impact of Man on the Environment	4
AESC	2006	Applied Zoology I	4
ANSC	2001	Genetics I	2
CPSC	2002	Statistics	6
CPSC	2003	Crop Husbandry II	6
ENGT	2007	Surveying	2
FDSC	2007	Agricultural Chemistry I	4
FDSC	2008	Agricultural Chemistry II	6
GEOL	2601	Geology	3
INDM	2005	Agricultural Microbiology	6
SLSC	2003	Soil Science	5
			60

THIRD YEAR

			Credits
AESC	3003	Applied Zoology II	10
AESC	3004	Plant Pathology	6
AESC	3007	Agrichemicals and Plants	4
AESC	3009	Rural Resource Assessment	8
AESC	3201	Professional Work Experience	12
ANSC	3009	Animal Husbandry II	8
ANSC	3012	Fundamentals of Biotechnology	2
FOR	4005	Experimental Design	4
SLSC	3001	Soil Science II	6
			60

FOURTH YEAR

			Credits
AESC	4003	Plant Protection III	8
		(i) *Plant Disease Management (4)*	
		(ii) *Pest Management (4)*	
AESC	4004	Wildlife Management	4
AESC	4050	Project	14
AESC	4400	Electives	12
ERM	4001	Rural Environmental Management	12
		(i) *Environmental Impact Assessment (4)*	
		(ii) *Environmental Management (8)*	
ERM	4002	Soils, Land Use and the Environment	10
		(i) *Soil Processes (6)*	
		(ii) *Modern Farming and the Soil (4)*	
			60

V. FOOD SCIENCE

FIRST YEAR

As for the degree programme in Animal and Crop Production.

SECOND YEAR

			Credits
AERD	2001	Agribusiness	6
AESC	2001	Agricultural and Environmental Biology	8
CPSC	2002	Statistics	6
CPSC	2003	Crop Husbandry II	6
ENGT	2003	Principles of Engineering II	2
FDSC	2004	Food Science I: Food Physics	4
FDSC	2005	Food Science II: Basic Analysis	8
FDSC	2007	Agricultural Chemistry I	4
FDSC	2008	Agricultural Chemistry II	6
INDM	2005	Agricultural Microbiology	6
LANG	2007	European Language	4
			60

THIRD YEAR

			Credits
ENGT	3004	Food Engineering Principles	6
FDSC	3001	Food Analysis	10
FDSC	3002	Biochemistry I and II	10
		(i) *Biochemistry I (4)*	
		(ii) *Biochemistry II (6)*	
FDSC	3003	Food Chemistry	8
FDSC	3005	Nutrition I	4
FDSC	3200	Professional Work Experience	8
FOR	3005	Computer Applications	4
FOR	4005	Experimental Design	4
INDM	3009	Food Microbiology II	6
			60

FOURTH YEAR

			Credits
ENGT	4002	Food Manufacturing Systems	8
FDSC	4005	Food Process Technology	8
FDSC	4006	Marketing	4
FDSC	4007	Nutrition II	4
FDSC	4008	Food Ingredients	6
FDSC	4010	Fresh and Processed Meat Products II	6
FDSC	4011	Dairy Products	6
FDSC	4012	Cereal Chemistry and Brewing Science	4
FDSC	4013	Sensory Analysis	4
FDSC	4051	Project	10
			60

VI. ENGINEERING TECHNOLOGY

FIRST YEAR

As for the degree programme in Animal and Crop Production.

SECOND YEAR

			Credits
AERD	2001	Agribusiness	6
AESC	2001	Agricultural and Environmental Biology	8
CPSC	2002	Statistics	6
CPSC	2003	Crop Husbandry II	6
ENGT	2004	Food Science and Technology	4
ENGT	2007	Surveying	2
ENGT	2008	Computer and Manufacturing Technology	4
ENGT	2009	Literature Research Project	2
ENGT	2013	Principles of Engineering I, II and III	6
FDSC	2007	Agricultural Chemistry I	4
INDM	2005	Agricultural Microbiology	6
SLSC	2002	Soil Science I	6
			60

THIRD YEAR

			Credits
AERD	3002	Computer Analysis and Information Technology	8
AERD	3006	Financial Planning and Control	4
ANSC	3009	Animal Husbandry II	8
ENGT	3001	Food Engineering Principles	8
ENGT	3002	Power and Machinery I	8
ENGT	3003	Structural and Soil Engineering	8
ENGT	3050	Major Project I	8
ENGT	3300	Electives	4
FOR	3010	Remote Sensing and GIS	4
			60

FOURTH YEAR

			Credits
ENGT	4001	Buildings and Environment	8
ENGT	4002	Food Manufacturing Systems	8
ENGT	4003	Food Process Engineering	8
ENGT	4006	Environmental Engineering	8
ENGT	4007	Power and Machinery II	8
ENGT	4050	Major Project II (including professional work experience)	14
ENGT	4100	Electives	6
			60

VII. HORTICULTURAL SCIENCE

FIRST YEAR

As for the degree programme in Animal and Crop Production.

SECOND YEAR

			Credits
AERD	2001	Agribusiness	6
AESC	2001	Agricultural and Environmental Biology	8
AESC	2004	Plant Physiology	4
ANSC	2001	Genetics I	2
CPSC	2002	Statistics	6
ENGT	2010	Principles of Engineering I	2
FDSC	2007	Agricultural Chemistry I	4
FDSC	2008	Agricultural Chemistry II	6
HORT	2006	Fundamentals of Horticulture	10
INDM	2005	Agricultural Microbiology	6
SLSC	2002	Soil Science I	6
			60

THIRD YEAR

			Credits
AESC	3005	Plant Protection I	12
HORT	3001	Landscape and Turfgrass Management I	4
HORT	3002	Landscape Design Theory	4
HORT	3003	Nursery/Garden Centre Management I	4
HORT	3004	Plant Materials	6
HORT	3005	Pomology I	4
HORT	3006	Protected Horticulture I	4
HORT	3007	Vegetable Crops I	2
HORT	3200	Professional Work Experience	14
SLSC	3002	Soil Science III	6
			60

FOURTH YEAR

			Credits
AERD	4006	Communications II	6
AERD	4007	Enterprise Development	4
CPSC	4003	Crop Breeding	4
HORT	4003	Landscape and Turfgrass Management II	4
HORT	4004	Nursery\Garden Centre Management II	4
HORT	4005	Pomology II	4
HORT	4006	Protected Horticulture II	4
HORT	4007	Vegetable Crops II	2
HORT	4050	Research Project	10
HORT	4400	Electives	18
			60

VIII. LANDSCAPE HORTICULTURE

FIRST YEAR

As for the degree programme in Animal and Crop Production.

SECOND YEAR

			Credits
AERD	2001	Agribusiness	6
AESC	2001	Agricultural and Environmental Biology	8
AESC	2004	Plant Physiology	4
CPSC	2002	Statistics	6
ENGT	2012	Engineering and Surveying (i) *Principles of Engineering III (2 credits)* (ii) *Surveying (2 credits)*	4
HORT	2006	Fundamentals of Horticulture	10
HORT	2007	Landscape Design Studio I	8
HORT	2008	Landscape Design Theory I	8
SLSC	2002	Soil Science I	6
			60

THIRD YEAR

			Credits
ENGT	3006	Landscape Construction	6
ERM	3004	Landscape Ecology	4
ERM	3005	Landscape Interpretation	4
HORT	3004	Plant Materials	6
HORT	3010	Urban Horticulture and Landscape and Turfgrass Management I	6
HORT	3011	Landscape Design Theory II and Professional Practice and Planning Law I	6
HORT	3012	Landscape Design Studio II	12
HORT	3202	Professional Work Experience	12
SLSC	3003	Soil Science IV	4
			60

FOURTH YEAR

			Credits
AERD	4006	Communications II	6
AESC	4002	Plant Protection II	6
ERM	4003	Environmental Impact Assessment	4
HORT	4003	Landscape and Turfgrass Management II	4
HORT	4009	Landscape Planning	4
HORT	4010	Landscape Design Theory III and Professional Practice and Planning Law II	6
HORT	4011	Landscape Design Studio III	12
HORT	4051	Landscape Research Project	10
HORT	4101	Electives	8
			60

IX. FORESTRY

FIRST YEAR

As for the degree programme in Animal and Crop Production.

SECOND YEAR

			Credits
AERD	2001	Agribusiness	6
AESC	2001	Agricultural and Environmental Biology	8
AESC	2004	Plant Physiology	4
ENGT	2012	Engineering and Surveying	4
FDSC	2006	Agricultural Chemistry IV	4
FOR	2001	Forest Mensuration and Biometrics	8
FOR	2004	Fundamentals of Forestry	8
FOR	2005	Silviculture I	6
INDM	2005	Agricultural Microbiology	6
SLSC	2002	Soil Science I	6
			60

THIRD YEAR

			Credits
AERD	3010	Communications III	4
AESC	3006	Forest Protection	6
FOR	3002	Forest Harvesting	4
FOR	3005	Computer Applications	4
FOR	3006	Forest Management	4
FOR	3008	Silviculture II	8
FOR	3009	Wood Science	4
FOR	3010	Remote Sensing and GIS	4
FOR	3011	Forest Inventory and Biometrics	4
FOR	3100	Electives	6
FOR	3201	Professional Work Experience	12
			60

FOURTH YEAR

			Credits
FOR	4002	Forest Inventory and GIS Project	10
FOR	4003	Forest Management Plan	12
FOR	4004	Forest Planning	6
FOR	4005	Experimental Design	4
FOR	4051	Research Project	16
FOR	4100	Electives	12
			60

SYLLABUS OF PROGRAMMES

FOR THE DEGREE OF

BACHELOR OF AGRICULTURAL SCIENCE

I. ANIMAL AND CROP PRODUCTION

FIRST YEAR

			Credits
AERD	1001	Agricultural Economics I	6
BIOL	1002	Biology	10
CHEM	1002	Chemistry	12
COMP	1602	Introduction to Computing	6
CPSC	1001	Agricultural Science	6
EXPH	1002	Experimental Physics	10
MATH	1800	Mathematics	10
			60

SECOND YEAR

			Credits
AERD	2001	Agribusiness	6
AESC	2001	Agricultural and Environmental Biology	8
AESC	2002	Agricultural Zoology	4
ANSC	2001	Genetics I	2
ANSC	2004	Animal Husbandry I	2
CPSC	2001	Crop Husbandry I	4
CPSC	2002	Statistics	6
ENGT	2011	Principles of Engineering I and II (i) *Principles of Engineering I (2)* (ii) *Principles of Engineering II (2)*	4
FDSC	2007	Agricultural Chemistry I	4
FDSC	2008	Agricultural Chemistry II	6
GEOL	2601	Geology	3
INDM	2005	Agricultural Microbiology	6
SLSC	2003	Soil Science	5
			60

THIRD YEAR

			Credits
AESC	3010	Crop Protection	8
ANSC	3002	Animal Nutrition I	6
ANSC	3011	Animal Husbandry III	8
ANSC	3012	Fundamentals of Biotechnology	2
CPSC	3201	Professional Work Experience	30
SLSC	3001	Soil Science II	6
			60

FOURTH YEAR

			Credits
AERD	4001	Agricultural Policy I	6
AERD	4002	Communications I	4
AERD	4003	Farm Business	6
ANSC	4001	Animal Husbandry IV	16
CPSC	4001	Crop Husbandry III	14
CPSC	4100	Electives	14
			60

* * * * * * * *

FIRST YEAR

AERD 1001 Agricultural Economics I 6 Credits

Introduction
The nature of economics and agricultural economics - allocation of scarce resources *via* markets.

Price Analysis
Factors affecting the demand for, and supply of, agricultural/horticultural/forestry products; marketing margins; analysis of product price formation. Demand for, and supply of, agricultural/horticultural/forestry inputs; analysis of their price formation.

Macro-economic Topics Relating to Agri-Food and Forestry
The national economy and the role of the agricultural sector in it; the factors of production, value added and the GDP/GNP; the National Accounts and the Agricultural Accounts; returns to factors in the agricultural sector; the food chain.

International Linkages
Agricultural exports/imports; comparative advantage and food imports; terms of trade; forms of protection; the Common Agricultural Policy as an example of protection; trade liberalisation; the General Agreement on Tariffs and Trade.

Money and Banking
Origin, nature and creation of money; the bank as a profit-motivated company; regulation of banking in Ireland; determination of interest rates in Ireland as a Small Open Economy (SOE); the balance of payments and exchange rates; monetary and fiscal policies and exchange rates; the European Monetary System.

Inflation
Definition, measurement and causes in a SOE.

Economic Growth
Definition, measurement, historical record. Its role in the developed countries and in developing countries. Agriculture in economic growth.

Role of Government
The budget; taxation; expenditure; the national debt; fiscal and monetary policy.

BIOL 1002 Biology 10 Credits

A formation course in the basic concepts of biological function and variation. Teaching involves four 1 hour lectures and one 2 1/2-hour practical per week for sixteen weeks based on the following topics:

Structure and function in the major plant and animal groups of primary importance to agriculture with particular reference to: Lower plants, Gymnosperms, Angiosperms, Protozoans, Platyhelminths, Annelides, Nematodes, Arthropods and Chordates.

Cell biology, cell differentiation, cell growth and propagation with particular reference to organellar function and specialisation in relation to photosynthesis, cellular respiration, DNA and RNA metabolism, and protein synthesis and secretion.
Microbiology to include basic virology, bacteriology and mycology.

Anatomy and histology of plants and animals in relation to tissue differentiation and localisation.

Animal physiology related to the major physiological systems and their structural and metabolic inter-relationships: Alimentary, circulatory, respiratory, excretory, endocrine, neuromuscular and reproductive.

Evolutionary biology: Origin of life, variation and natural selection, the biological species concept, evolutionary theory.

CHEM 1002 Chemistry 12 Credits

General and Introductory:
Electronic structure and bonding. Molecular orbitals, polarity and hydrogen bonding. Intermolecular interactions. Chemical formulae and equations; oxidation-reduction.

Physical and Inorganic Chemistry:
Chemical kinetics and equilibria, catalysis. Acids and bases, buffer systems, indicators, hydrolysis, pH and pK_a. Electrochemistry, electrode potential, free energy, Nernst equation. Enthalpies of formation, bond energies, equilibria (with special reference to biological systems). Periodic properties of elements; transition metals and co-ordination complexes, bioinorganic chemistry. Colloid and surface chemistry, membranes.

Organic Chemistry:
Nature of bonding and formulae in organic chemistry. Concept of families and an introductory study to alkanes, alkenes, alkynes, halides, carbonyl compounds, carboxylic acids and amines. Discussion on petrochemicals and their use as starting materials in the manufacture of agrochemicals including fertilisers.

Macromolecules (Plastics and other Synthetics):
Multifunctional compounds, e.g. amino acids and proteins, fats and lipids, carbohydrates treated as a basis for further studies in agricultural chemistry and biochemistry.

COMP 1602 Introduction to Computing 6 Credits

Lectures: Hardware: input, output, storage and communication devices, CPU. Software: operating systems, programming languages, Networking, the Internet, the World Wide Web. Data security and the Data Protection Act.

Skills/Laboratory sessions: logging on, file management, word processing, spreadsheets, data bases.

CPSC 1001 Agricultural Science 6 Credits

Crops and Cropping Systems

Overview of crop production in Ireland, including horticulture and forestry. Historical factors relating to the development of these industries and factors likely to influence future development.

Animal Production Systems

World and EU animal production. Production systems in Ireland relating to dairy, beef, sheep and pigs. Animal welfare and farming. Future developments in animal production.

Food Processing and Food Products

The Irish food industry in an EU and global context. Food ingredients and consumer foods. Food manufacturing systems. Food and consumer health. Food safety and issues of current public interest.

Socio-Economic, Business and Policy

The changing structure of Irish farming. Trends and prospects in income/employment in rural areas with specific reference to the farming community. The importance of the agribusiness sector in the Irish economy. Key aspects of National and European agriculture and rural development policy.

The Environment and Farming

The evolution of the farmed landscape. The need for environmental understanding in farming. The role of the environment in modern European farming.

EXPH 1002 Experimental Physics 10 Credits

Lectures:

Kinematics and dynamics. Gravitation. Statics and hydrostatics. The earth's climate. Surface tension, viscosity and applications.

Heat. Temperature and expansion. Changes of state. Relative humidity. Properties of gases. Diffusion and osmosis. Mechanisms of heat transfer. Energy conservation. Efficiency of heat engines and heat pumps.

Simple harmonic motion. Wave motion. Travelling and standing waves. Sound. Vibration of strings and air columns. Control of sound.

Light. Reflection and refraction. Image formation by mirrors and lenses. Optical instruments. Natural and artificial lighting. Introduction to wave theory. Polarisation. Spectra.

Electrostatics and magnetism. Current electricity. Ohms Law. Magnetic field of an electric current. Electrical measuring instruments. Electromagnetic induction. Alternating currents. Transformers and rectifiers. Transistors and solid state devices.

Atomic and nuclear physics. Production and properties of X-rays. Radioactivity. Radiation detection methods. Radioisotopes in agriculture. Fission and fusion. Nuclear reactors. Environmental radioactivity.

Laboratory: Measurement of the physical quantities encountered in the lecture course.

MATH 1800 Mathematics 10 Credits

Finite Mathematics

Sets, binomial coefficients, finite sample spaces and probability, conditional probability, random variables, expectation and variance.

Linear Algebra

Vectors, matrices, determinants and inverses, linear equations, linear inequalities and convex sets.

Trigonometry and Geometry

Trigonometric functions, addition theorems, formulae connecting sums and products. The straight line. The circle. Graphics of conics. Parametric equations.

Calculus

Functions. Derivative. Rate of change, mean-value theorem. Maxima and minima. Inverse functions. Exponential and logarithm. Exponential growth and decay. Partial derivatives. Elements of integration.

SECOND YEAR

AERD 2001 Agribusiness 6 Credits

Agribusiness Organisation

Nature of agribusiness management in the farm and firm. Business objectives and functions of management. Linkages of farm and firm business activity. Long term and tactical business planning in the agricultural, horticultural and forestry environment. Decision-making and the nature of business risk in the agribusiness sector. Principles of organisation with special reference to agricultural businesses. Role of leadership in agribusiness management including motivation and human resource development. Role of personnel management. Management control.

Agricultural Finance

Basic concepts and principles of financial accounting. Financial statement structure, interpretation and analysis. Financial objectives and performance of Irish agribusiness firms. Comparative analysis of accounts of selected agricultural and forestry businesses. Financial planning systems in agribusiness firms. Asset management in agricultural business. Alternative funding strategies and sources of grant aid, debt and equity funds for agribusiness.

Agribusiness Marketing
Definition of marketing. Marketing in relation to Irish agriculture, food and forestry. Marketing environment in which the Irish agricultural, food and forestry marketing sectors operate and especially the CAP environment. Purchasing behaviour. Marketing analysis for food and agricultural products. Market segmentation, positioning and the marketing mix; product, price, promotion and distribution. Evaluating and controlling agri-food and forestry programmes. The determinants of success in marketing.

AESC 2001 Agricultural and Environmental Biology 8 Credits
(i) Agricultural Botany (5 credits)
This section of the course deals with the taxonomy, biology and physiology of plants of agricultural importance, and reviews the more important diseases which can affect crop plants.

Introduction to the taxonomy, anatomy and morphology of grasses, weeds and poisonous plants; identification in flowering and vegetative phases. Biological basis of breeding systems; characterisation of species, cultivars and other taxa. Seed morphology, anatomy and identification; purity analysis and germination capacity.

Anatomy, morphology, classification and evolutionary histories of crop plants; cultivar identification, photosynthesis and primary productivity. Life cycles in relation to production and yield. Dormancy and germination, leaf expansion and root proliferation, floral development and flowering. Fertilization, fruit and seed production, leaf and fruit senescence. The nature and causes of plant disease; crop/plant losses due to disease attack.

(ii) Agriculture and the Environment (3 credits)
In this section, the basic ecological principles which apply to managed ecosystems and the impact of human activity on them are considered. Review of ecological terminology; biosphere concepts; energy, hydrological and nutrient cycles. Plant environment interactions and ecotypic variation; colonisation, succession and ecosystem development; the effects of competition, interference and symbioses in natural and managed ecosystems. Plant reproductive strategies: seed dispersal, seed banks, seed dormancy and periodicity of germination, and the implications for weed biology.

Agricultural and pollution - energy and fertilizer inputs, pesticides and organic wastes. Soil loss and degradation. Food quality. Water and atmospheric pollution, climate change.

Environmental awareness - farmer perceptions; environmental education. Alternative production systems. Principles of conservation. Agricultural and environmental policies.

Farm water supplies. Management of animal manures. Environmental and planning legislation and protection pertaining to agriculture.

AESC 2002 Agricultural Zoology 4 Credits
Introduction to the biology and ecology of major faunal groups which are important as pests of crops, parasites of livestock and vectors of disease. The classification, structure, physiology and ecology of selected Protozoa, Platyhelminthes, Nematoda, Mollusca, Arthropoda and Chordata will be described.

Basic principles of pest control; nature and incidence of pest outbreaks; regulatory, cultural, chemical, physical and biological control strategies. Properties, formulation and application of pesticides; pesticide resistance; environmental hazards. Integrated pest management strategies.

ANSC 2001 Genetics I 2 Credits
Mendelian genetics: Segregation of alleles. Assortment of genes. Linkage of genes. Mendelian genes in plant/animal breeding.

Biochemical genetics: Molecular structure of genes. Mutations - causes and nature. Gene engineering. Mutations and gene exchange in animal and plant breeding.

Population genetics: Dynamics of single genes. Quantitative inheritance. The effects of inbreeding, crossing and selection in plants and animals. Case histories of genetic improvement of plants and animals.

ANSC 2004 Animal Husbandry I 2 Credits
Digestion and digestive systems in ruminants and monogastric animals; anatomy and function of the rumen; functional anatomy of the excretory systems, circulatory and respiratory systems.

CPSC 2001 Crop Husbandry I 4 Credits
Physical farm planning including land drainage, land reclamation, farm fencing and hedges. Introduction to computer applications with relevance to crop agriculture including crop management packages, GIS applications, word processing and spreadsheets.

CPSC 2002 Statistics 6 Credits
Measures of central tendency and scatter - mean, mode, median, standard deviation and variance. The theory of probability - empirical probability and *a priori* probability, mutually exclusive events, independent events, dependent events, probability in repeated trials, the binomial theorem.

The binomial distribution - its histogram, mean and standard deviation, applications of the binomial distribution to genetic problems and quality control. The normal distribution - its frequency curve and properties, areas under the normal curve, the standard normal distribution, probabilities in a normal distribution.

Sampling - purposes of sampling, distribution of the sample mean and distribution of the difference between two sample means in sample random sampling. Testing hypothesis - definition of the statistical hypothesis, significance level. Type I and Type II error, confidence limits. Student's t-distribution - estimating the standard deviation, testing on hypothesis about the population mean, testing the difference between sample means.

Linear regression - definition, estimating the regression coefficient, analysis of variance in regression, using regression for prediction.

Correlation - definition of correlation, estimating the correlation coefficient, coefficient of determination.

Chi-Square - definition, application in testing goodness-of-fit, contingency tests. Yate's correction.

One-way classification - partitioning the total sum of squares. F-test. LSD test.

Two-way classification - partitioning the total sum of squares. F-test.

ENGT 2011 Principles of Engineering I and II 4 Credits

(i) Principles of Engineering I (2 credits)

Energy: Energy balance and cycles, work, power, torque, efficiency. Application to internal combustion engines, refrigeration, machinery performance. Transmission systems, mechanics and traction theory. Electrical power and uses.

(ii) Principles of Engineering II (2 credits)

Environment: Heat and mass transfer, psychrometrics, control of atmosphere, humidity and temperature. Applications of controlled environment to animal and crop buildings.

FDSC 2007 Agricultural Chemistry I 4 Credits

Chemistry of Biological Compounds:
Occurrence, chemical structures, properties and reactions of the important animal and plant mono- and oligosaccharides. Chemistry of starch, dextrins, glycogen and of plant cell wall structural components including cellulose, hemicellulose, pectic substances and lignin.

Structures, properties and functions of lipids including fats and oils, phospholipids, glycolipids, sphingolipids and waxes.

Classification and properties of amino acids. Primary, secondary, tertiary and quaternary structures of proteins. Relationships between structure and function of selected fibrous and globular proteins. Protein purification and analysis.
Structures, properties and functions of nucleotides and nucleic acids.

FDSC 2008 Agricultural Chemistry II 6 Credits

Cell structures, cell membranes, mitochondrial membranes. Intracellular compartmentation of enzyme systems. Bioenergetics, redox potentials, electron carrier systems. Oxidative and photosynthetic phosphorylation. Enzymes, vitamins and co-enzymes.

Metabolism of carbohydrates, fats and protein – pathways of glycolysis, glycogenolysis, gluconeogenesis, hexose monophosphate shunt, citric acid cycle, lipid oxidation, lipogenesis. Integration of metabolism, metabolic disorders.

Protein synthesis, detoxification, urea and uric acid formation, kidney function, oxygen and carbon dioxide transport in blood, acid/base balance. Chemistry and biological importance of the hormones.

Pesticides:
Chemical and biochemical parameters used to evaluate pesticides. Chemical and physical properties (structures, solubility, volatility, persistence and degradation). Mode of action, basis of selectivity, toxicity and fate in soils

GEOL 2601 Geology 3 Credits
Geological principles and processes of relevance to agriculture, land use and landscape development are considered.

Introduction to the internal and external earth structure and processes; relationships between geology, landforms and agriculture; an introduction to earth history with particular emphasis on the Ice Age; the raw materials for soil formation; hydrogeology and groundwater; the use of stone and other geological resources in agriculture; geology in countryside management.

INDM 2005 Agricultural Microbiology 6 Credits
An introduction to the structure and classification of eukaryotes, prokaryotes and viruses; microbiological techniques - microscope, pure culture, sterilisation and enumeration; growth and death of bacteria, fungi and viruses; the use and abuse of disinfectants and antibiotics; genetics of micro-organisms; symbiosis, parasitism and infectious diseases in plants and animals; the immune system; the microbiology of foods, fodders and other agricultural products; water pollution; microbial involvement in the carbon, sulphur and nitrogen cycles; use of micro-organisms in the biosynthesis of useful products - biotechnology.

SLSC 2003 Soil Science 5 Credits
Introduction: Soil as a medium for plant growth; soil composition and constitution; the soil profile as the unit of study; important Irish soil types.

Soil Physics: Soil texture and textural classification; soil structure and structural classification; development of soil structure; structural management of soils; soil aeration; aerobic and anaerobic behaviour of soils; water retention by soils; characterisation of retained water; water movement in soils under saturated and unsaturated conditions.

Soil Chemistry: Soil mineralogy; fundamentals of layer silicate clay structure; permanent and pH dependent charges on layer silicate clays; charge properties of soil organic matter; ion exchange and cation exchange capacity; nature of soil acidity; buffer capacity of soils; use of lime to control soil acidity; anion behaviour in soils; sources and availability of N, P and K fertilizers; manures and waste materials; legislation for sale of fertilizers and liming materials.

THIRD YEAR

AESC 3010 Crop Protection **8 Credits**

Economic and social impact of diseases on crop production: sources of loss and quality control. Symptoms and signs. Infectious diseases vs. non-infectious disorders. Koch's postulates. Epiphytology and disease forecasting. Symptomatology, etiology and control of important fungal, bacterial and virus diseases of field crops, including seedling and post-harvest diseases. Disease control: regulatory, chemical, biological and integrated control methods and pathogen resistance.

Identification and biology of major invertebrate, bird and mammal pests of field crops and stored products; nature of damage caused and impact on yield; chemical and cultural methods for prevention and control.

ANSC 3002 Animal Nutrition I **6 Credits**

Digestion and metabolism in farm animals; regulation of metabolism (including metabolic disorders); minerals; vitamins; water as nutrient; energy evaluation of feeds; protein evaluation of feeds; feeds and feeding (including sources, composition, nutritional value, effects of processing and feed additives); voluntary food intake by animals; factorial approach to nutrient requirements of livestock.

ANSC 3011 Animal Husbandry III **8 Credits**

Courses in Animal Husbandry are designed to acquaint students with the basic concepts of Animal Husbandry, and the incorporation of these concepts into systems of production and the effective management of these systems at farm level. The courses in Animal Husbandry are allocated between third year and fourth year.

Animal Breeding

The effect of domestication of livestock on redefinition of selection goals. Pre-Mendelian animal breeding and genetic theories. The effects of Mendelian genetics on animal breeding. Contributions of Fisher, Haldane, Wright, Lush and Henderson. Heredity vs. environment as they affect animal performance. Genotype by environment interaction. How to determine if a defect is due to heredity or environment. Strategy for dealing with genetic defects. Emphasis to put on coat colour and horns in selection. Selection for disease and parasite resistance. Measuring variation among animals. Subdivision of this variation into that due to heredity and environment. Subdivision of heredity variation into that due to additive, dominance and epistatic gene effects. Heritability in the broad and narrow sense. Why estimate heritability? Estimation of phenotypic and genetic correlation among traits. Why estimate them?

Principles of selection. Factors influencing genetic response to selection viz., accuracy of selection, intensity of selection, genetic variability and generation length. The value of individual testing, pedigree information, sib information and progeny testing. Principles of constructing selection indexes.

Inbreeding and relationship among animals. Undesirable effects and usefulness of inbreeding. Heterosis and outbreeding. Genetic basis of heterosis. Crossbreeding systems for commercial production.

The remainder of the course deals with the application of these principles to the genetic improvement of farm livestock, viz., dairy cattle, beef cattle, sheep, pigs and horses in the Irish context.

Animal Physiology
Physiological systems in the farm animal; species variations as shown in cattle, sheep, pigs and horses; endocrinology of reproduction, lactation and growth in farm mammals; mammalian phermones; puberty, the breeding season and oestrous cycle; pregnancy, parturition, pregnancy diagnosis and perinatal mortality; artificial insemination in farm animals - embryo transfer; hormonal applications in animal production; reproductive behaviour of farm animals.

ANSC 3012 Fundamentals of Biotechnology 2 Credits
This course will familiarise students with the basic concepts used in plant and animal biotechnology. The course will include the principles and methods used for manipulating and measuring the activities of plant and animal cells. This will include chromosomes, the structure and properties of nucleic acids, DNA repair and replication, RNA transcription, protein translation, the genetic code, manipulation of DNA (including cloning), nucleic acid modification and nucleic acid measurement techniques (including PCR).

CPSC 3201 Professional Work Experience 30 Credits
This will take place from the start of the Hilary term in the third year until the start of the Michaelmas term in fourth year. During the programme, students gain appropriate experience on approved dairy, cattle, sheep, pig and tillage farms. Students are also encouraged to gain experience in appropriate aspects of the agricultural industry/agribusiness. Experience may be gained abroad. In all cases, the student's work experience programme must be approved beforehand by the Professional Work Experience Programme supervisor.

SLSC 3001 Soil Science II 6 Credits
Soil Genesis, Classification and Land Use
Soil as a three-dimensional natural body; soil description in the field; horizon identification and designation; soil profile composition; internal soil forming processes; the soil environment - discussion of five main factors of soil formation; soil classification and distribution of major Irish soils; soil maps and reports; land suitability classification for agricultural and non-agricultural uses.

Soil Biology and Biochemistry
Origin and components of soil organic matter; decomposition of plant and other residues and formation of soil humus; influence of organic matter on soil properties; organic matter in Irish soils; effects of microorganisms on soil nutrients.

Soil Fertility and Soil-Plant Relations
Factors affecting soil nutrient levels; nutrient transformations and reactions of N, P, K fertilizers in soils; movement of nutrients to plant roots; assessment of soil fertility, trace elements.

FOURTH YEAR

AERD 4001 Agricultural Policy I **6 Credits**
Part I
Agriculture in the national economy: Measurement of the agricultural sector - output, non-factor inputs, value added, income, factor inputs. Linkages between agriculture and the rest of the economy; the food value added chain. Measurement of, and trends in, volumes, productivity, prices and incomes. Review of supply-demand principles relating to agricultural product and factor markets. The Treadmill Model of agricultural adjustment and its policy implications. Rationale for market intervention. History of agricultural protection. Policy formation. The European Union - origin and evolution.

Part II
The Common Agricultural Policy (CAP) and its funding. Economic surplus analysis of gains and losses at EU level and in Ireland attributable to the CAP; the "small country" and "large country" cases. Objectives of the CAP and their attainment, especially in relation to incomes. CAP Reform: Economic surplus analysis of price reduction and supply control. Other approaches including demand-side policies, deficiency payments and tiered pricing.
Direct payments: Rationale, coupling, funding and duration. Socio-structural Policy and Rural Development. The Uruguay Round Agreement and its implications. Future developments in agricultural policy, such as enlargement to the East, the trade liberalisation. Agricultural Policy in Developing Countries.

AERD 4002 Communications I **4 Credits**
The development of communications skills which are most commonly used in professional careers. These include individual, group and mass media methods of communication such as: advising/counselling; lecturing and public speaking; facilitating group meetings and discussions; organising demonstrations; scripting and presenting for local radio; and writing skills (lecture handouts, technical reports, press articles, CV).
Project work to include: lecture presentation and accompanying handout and radio scripting and recording.

AERD 4003 Farm Business **6 Credits**
Accounting procedures and systems. Farm record keeping, preparation and completion of farm accounts. Farm record and accounts analysis. Generation of financial and management accounts and the use of computerised accounting systems. Farm case project.

Comparative accounts analysis; gross margin analysis; budgeting - partial complete, break-even and capital. The farm planning and control process. Farm planning assignment detailing a development plan for a farm visited during the year. Farm finance: capital and credit - sources, types and use. Farm insurance and farm taxation.

ANSC 4001 Animal Husbandry IV 16 Credits

Animal Health

Parasitology of common farm animals. Different stages of production of farm animals in intensive and non-intensive systems of farming; legislation covering disease control, including EU regulations.

Beef Cattle Husbandry

Structure and importance of the beef industry in the national economy; historical perspective, current position and possible future trends; principles and practice of different systems of beef production under Irish conditions, including feeding and disease prevention and control; natural advantages and limitations in beef production; current developments in systems of beef production and possible implications for Ireland; costs and returns.

Dairy Husbandry

The dairy industry at farm and national levels; changes in the structure of the industry; milking and milking installations; milk quality; breeding and rearing dairy replacements; feeding dairy cows; management in milk production, including disease prevention and control; costs and returns.

Swine Husbandry

Structure and importance of the pig industry in Ireland; pig production as a major or minor farm enterprise; pig co-operatives; pig production management; critical aspects in pig production; carcase of pork and bacon pigs; outlook for profitable pig production, including disease prevention and control; costs and returns.

Sheep Husbandry

The sheep industry at farm, national and EU level; place of sheep in different farming systems; systems of lamb production; sheep production management, including disease prevention and control; sheep housing and handling facilities; selection and marketing of lamb for the various markets; wool properties and characteristics; wool grading appraisal and yield; shearing, handling and marketing of wool; costs and returns in sheep production.

Farm Buildings/Animal Wastes/Mechanisation

Farm structures, environmental control in animal housing, planning and layout of farm buildings. Slurry storage and handling, disposal of farm wastes, fertilizer planning and pollution control. Mechanisation of forage handling, feeding systems and effluent disposal. REPS schemes and implications for animal production.

CPSC 4001 Crop Husbandry III 14 Credits

The fourth year courses in Crop Husbandry include not only a study of the production systems relating to the major crop species used in Irish farming but also examine the maintenance of these systems with adequate machinery, building and other service inputs.

All of the systems are evaluated in a Farm Management context with attention being given to the management of the farm as a working unit. This involves decisions concerning the relative profitability of enterprises both in relation to other crops and to alternative animal and other farm enterprises. It also involves: (i) the storage and processing facilities to optimize return from the farm as a whole; and (ii) the adjustment of production programmes to meet changes in market, technology and other variables.

Crop Breeding: Crop breeding objectives; modes of reproduction in crop species; modes of reproduction and population structure; variation (hereditary and environmental); methods of generation of variability; classical breeding methods; biotechnology in crop breeding; legislation.

Farm Mechanisation: The application of mechanical, electrical and hydraulic equipment in agricultural production: tractors; tillage techniques and systems; seeding and planting; artificial fertilizer application; spraying techniques; crop harvesting and storage; farmyard manure and liquid manure handling; grass conservation systems.
Cereal Production: Factors determining optimum yield and quality in cereals; production factors - from soil preparation to crop harvest; holding systems, drying, storage; alternative uses for cereals; factors determining optimum net return from cereal systems; use of cereals, e.g. maize, rye as forage crops.

Root and Green Crops: Selection of species and varieties to grow; rotations; seed bed preparation; fertility improvement; seeding; weed control; pest and disease prevention and control; harvesting; by-products for use on the farm; labour and machinery requirements; conservation and storage; costs and returns.

Grassland: Characteristics of forages determining economic value. Quality considerations. Sward establishment and maintenance. Management practices and utilization systems. Fertilizer programmes in grassland systems. Weeds. Pests and diseases. Conservation and crops for conservation. Renovation. Forage seed production. Complementary crops.

Alternative Cropping Systems: The role of alternative crops in Irish farming systems. Alternative low-input arable systems. Quality, market and other constraints. Organic farming systems.

CPSC 4100 Electives 14 Credits

II. ANIMAL SCIENCE

FIRST YEAR

As for the degree programme in Animal and Crop Production.

SECOND YEAR

			Credits
AERD	2001	Agribusiness	6
AESC	2001	Agricultural and Environmental Biology	8
AESC	2003	Animal Parasitology	2
ANSC	2002	Genetics I and II (i) *Genetics I (2)* (ii) *Genetics II (2)*	4
ANSC	2004	Animal Husbandry I	2
CPSC	2002	Statistics	6
CPSC	2003	Crop Husbandry II	6
ENGT	2011	Principles of Engineering I and II (i) *Principles of Engineering I (2)* (ii) *Principles of Engineering II (2)*	4
FDSC	2007	Agricultural Chemistry I	4
FDSC	2008	Agricultural Chemistry II	6
INDM	2005	Agricultural Microbiology	6
SLSC	2002	Soil Science I	6
			60

THIRD YEAR

			Credits
ANSC	3002	Animal Nutrition I	6
ANSC	3003	Animal Nutrition II	4
ANSC	3004	Animal Breeding/Genetics	8
ANSC	3005	Animal Physiology	8
ANSC	3006	Anatomical Structure and Function	4
ANSC	3007	Experimental Design and Data Analysis	6
ANSC	3008	Animal Production Enterprises	4
ANSC	3010	Computer Techniques	2
ANSC	3012	Fundamentals of Biotechnology	2
ANSC	3201	Professional Work Experience	12
INDM	3010	Food Microbiology I	4
			60

FOURTH YEAR

			Credits
AERD	4001	Agricultural Policy I	6
AERD	4002	Communications I	4
AERD	4003	Farm Business	6
ANSC	4001	Animal Husbandry IV	16
ANSC	4002	Animal Husbandry V	4
ANSC	4003	Animal Breeding II	6
ANSC	4400	Electives	10
ERM	4004	Environmental Issues in Agriculture	4
FDSC	4009	Fresh and Processed Meat Products I	4
			60

* * * * * * * * *

FIRST YEAR

As for the degree programme in Animal and Crop Production.

SECOND YEAR

AERD 2001 Agribusiness **6 Credits**
As for the degree programme in Animal and Crop Production.

AESC 2001 Agricultural and Environmental Biology **8 Credits**
As for the degree programme in Animal and Crop Production.

AESC 2003 Animal Parasitology **2 Credits**
This course deals with the scientific basis of parasite control in agricultural animals, consisting of an introduction to parasitology and a review of the main parasite groups, the epidemiology of major parasitic diseases in sheep, cattle, horses, pigs and poultry, the principles and practicalities of chemotherapy, applied immunology (diagnostics and vaccination) and aspects of integrated control.

ANSC 2002 Genetics I and II **4 Credits**
(i) *Genetics I (2 credits)*
As for 'Genetics I' in the Animal and Crop Production degree programme.

(ii) *Genetics II (2 credits)*
Animal karyotypes and chromosomal aberrations. Single gene disorders in animal. Immunogenes - red-cell and MHC antigens. Major genes for colour, size, shape and fertility. Genetic mapping and DNA sequencing. Genetic basis of disease resistance in farm animals. Genetic transgenesis in animals - progress and potential.

ANSC 2004 Animal Husbandry I **2 Credits**
As for the Animal and Crop Production degree programme.

CPSC 2002 Statistics **6 Credits**
As for the degree programme in Animal and Crop Production.

CPSC 2003 Crop Husbandry II **6 Credits**
As for the degree programme in Agribusiness and Rural Development.

ENGT 2011 Principles of Engineering I and II **4 Credits**
As for the degree programme in Animal and Crop Production.

FDSC 2007 Agricultural Chemistry I **4 Credits**
As for the degree programme in Animal and Crop Production.

FDSC 2008 Agricultural Chemistry II **6 Credits**
As for the degree programme in Animal and Crop Production.

INDM 2005 Agricultural Microbiology **6 Credits**
As for the degree programme in Animal and Crop Production.

SLSC 2002 Soil Science I **6 Credits**
Introduction: Soil as a medium for plant growth; soil composition and constitution; the soil profile as the unit of study; important Irish soil types.

Soil Physics: Soil texture and textural classification; soil structure and structural classification; development of soil structure; structural management of soils; soil aeration; aerobic and anaerobic behaviour of soils; water retention by soils; characterisation of retained water; water movement in soils under saturated and unsaturated conditions.

Soil Chemistry: Soil mineralogy; fundamentals of layer silicate clay structure; permanent and pH dependent charges on layer silicate clays; charge properties of soil organic matter; ion exchange and cation exchange capacity; nature of soil acidity; buffer capacity of soils; use of lime to control soil acidity; anion behaviour in soils; sources and availability of N, P and K fertilizers; manures and waste materials; legislation for sale of fertilizers and liming materials.

THIRD YEAR

ANSC 3002 Animal Nutrition I **6 Credits**
As for the degree programme in Animal and Crop Production.

ANSC 3003 Animal Nutrition II **4 Credits**
Feed processing and ration formulation for ruminant and non-ruminant livestock. Systems of evaluation of the energy and protein value of feeds. Detailed discussion of factors affecting the intake, utilization and metabolism of nutrients in ruminant and ruminant-like animals and how these processes relate to efficiency of production and quality of product. Metabolic disorders in livestock under intensive and extensive systems of production. Nutrition and disease.

ANSC 3004 Animal Breeding/Genetics 8 Credits

Animal Breeding

As for Animal Breeding in ANSC 3011 'Animal Husbandry III' for the degree programme in Animal and Crop Production.

Genetics

This course is based on the text *Introduction to Quantitative Genetics* by D.S. Falconer. It deals with the basic principles of population and quantitative genetics as they apply to animal reproduction and breeding.

ANSC 3005 Animal Physiology 8 Credits

Physiological and endocrinological systems in the farm animal; endocrinology and physiology of reproduction, lactation and growth in farm mammals; environmental physiology; mammalian phermones; artificial insemination and modern developments in reproductive technology including embryo transfer, micromanipulation of embryos, in vitro maturation and fertilization of oocytes, in vitro culture of embryos, cloning, sexing and recombinant DNA technology as applied to farm animals. Controlled reproduction in farm animals. Reproductive behaviour. Controlled reproduction in alternative animal farming systems. Physiology of the newborn; growth and development of the animal body.

ANSC 3006 Anatomical Structure and Function 4 Credits

Systematic anatomy of cattle, sheep and pigs with particular emphasis on the skeletal, muscular, digestive and urinogenetical systems; histology of the four primary tissues; microscopic anatomy of organs.

ANSC 3007 Experimental Design and Data Analysis 6 Credits

Experimental Design

This section of the course deals with the design and interpretation of animal experiments.

Data Analysis

This section of the course will cover material required for both crop and animal experiments. It includes least squares principles of fitting constants; application of least squares principles to the analysis of non-orthogonal data from various experimental designs, viz., single and multi-way classifications, with and without covariates; testing hypotheses in these analyses using the F-test. Students' t-test, Duncan's MRT etc., tests for homogeneity of variance: estimation of components of variance and covariance; definition of 'fixed' vs. 'random' effects in the model and consideration of their influence on tests of hypotheses.

ANSC 3008 Animal Production Enterprises 4 Credits

The course will be concerned with management practices in animal production enterprises which will not be available during their period of professional work experience, e.g. winter management of beef, dairy and sheep enterprises. Students will visit a number of modern animal production enterprises and service industries and prepare reports and assignments on these visits. In addition, lectures on enterprises not included in Animal Husbandry IV (ANSC 4001) such as poultry production will be included in the course.

ANSC 3010 Computer Techniques **2 Credits**
The objective is to provide the student with a working knowledge of computer systems used in science and the agricultural industry. Emphasis will be placed on basic computer skills and will include file management, word processing, the use of spread sheets, plotting graphs and the structure and use of the Internet. An introduction to specific software used in the agricultural industry will also be included (e.g. management programmes used in pork, beef and dairy industries, least cost feed formulation programmes).

ANSC 3012 Fundamentals of Biotechnology **2 Credits**
As for the degree programme in Animal and Crop Production.

ANSC 3201 Professional Work Experience **12 Credits**
Normally this will take place from the start of the Trinity term in Third Year until the start of the Michaelmas term in Fourth Year. During the programme, students gain appropriate experience on approved dairy, beef, sheep and pig farms. Students are also encouraged to gain experience in appropriate aspects of the agricultural industry/agribusiness. Experience may be gained abroad. In all cases, the student's work experience programme must be approved beforehand by the Professional Work Experience Programme Supervisor.

INDM 3010 Food Microbiology I **4 Credits**
This course includes most elements of INDM 3009 'Food Microbiology II' in the Food Science degree programme.

FOURTH YEAR

AERD 4001 Agricultural Policy I **6 Credits**
As for the degree programme in Animal and Crop Production.

AERD 4002 Communications I **4 Credits**
As for the degree programme in Animal and Crop Production.

AERD 4003 Farm Business **6 Credits**
As for the degree programme in Animal and Crop Production.

ANSC 4001 Animal Husbandry IV **16 Credits**
As for the degree programme in Animal and Crop Production.

ANSC 4002 Animal Husbandry V **4 Credits**

Animal Behaviour/Health/Welfare

This course complements the Animal Health section of the subject, Animal Husbandry IV. The course deals with principles of disease control and prevention; control of diseases in Ireland; animal health problems associated with intensive animal production; legislation covering disease control including EU regulations. Behaviour of the newborn, acquired or innate behaviour, social, sexual, aggressive, ingestive and other forms of behaviour. Factors affecting behaviour and the role of behaviour in animal production. Definition of animal welfare. Areas of concern. Transport of animals. Role of behaviour/abnormal behaviour in assessing welfare.

ANSC 4003 Animal Breeding II **6 Credits**

This course covers the application of the following topics to farm livestock. Prediction of genetic progress in single trait selection with overlapping generations using Hill's transition matrix. Estimating breeding values using BLUP. Defining the breeding objectives. Economic weights. Selecting for several traits using selection indexes. Investment appraisal of breeding programmes. Criteria for optimising breeding programmes. Discounted geneflow techniques.

ANSC 4400 Electives **10 Credits**

Elective choice is subject to approval by the Head of the Department of Animal Science and Production.

ERM 4004 Environmental Issues in Agriculture **4 Credits**

In this course selected issues which were introduced in the core course, Agricultural and Environmental Biology (AESC 2001), are developed.

Topics discussed include: countryside management (the Irish landscape; wildlife habitats and their management, wildlife conservation); fertilizer and waste management (pollution control, risk assessment, landspreading of farm and non-agricultural wastes and effluents, statutory regulations, eg Waste Management Act, Water Pollution Acts, Nitrate Directive REPS, and their implications, nutrient management, codes of practice); environmental impact assessment (EIA concepts and practice, EU Directives, EIA and EIS for agricultural, projects, IPC licensing); REPS (raison d'être, provisions, roles of consultant/advisor/farmer).

FDSC 4009 Fresh and Processed Meat Products I 4 Credits
Definition of meat. Composition of muscle. Myofibrillar proteins. Thick and thin filaments. Regulatory and cytoskeletal proteins. Connective tissue. Collagen structure. Age-related toughening. Formation of gelatin. Cell sarcotubular system. Muscle contraction. Conversion of muscle to meat. Normal, PSE and DFD conditions. Cold shortening. Thaw rigor. Electrical stimulation. Meat quality. Myoglobin and meat colour. Factors affecting meat colour. Water holding capacity. Meat tenderisation. Calpains and cathepsins. Factors affecting and structural effects of tenderisation. Meat flavour. Key flavour impact compounds. Species effects on flavour. Non-sensory meat quality attributes. Pre-slaughter factors affecting meat composition and quality. Genetics. Plane of nutrition. Effects of dietary fat on meat quality. Boar taint. Sex and slaughter weight effects on meat quality. Stunning and slaughter operations. Beef and lamb carcass classification. Pig grading. Meat chilling. Meat cuts. Hot-boning. Poultry meat processing. Processed meats. Classification of processed meats. Curing processes. Massaging/tumbling. Fresh pork sausage manufacture. Emulsion-type meat products. Myofibrillar protein functionality. Effect of salt and phosphates on functionality. Low fat meat products. Least Cost Formulation. Sausage casings. Meat by-products. Fat rendering systems.

III. AGRIBUSINESS AND RURAL DEVELOPMENT

FIRST YEAR

As for the degree programme in Animal and Crop Production.

SECOND YEAR

			Credits
AERD	2001	Agribusiness	6
AERD	2002	Agricultural Economics II	6
AERD	2003	Communications	6
AESC	2001	Agricultural and Environmental Biology	8
AESC	2002	Agricultural Zoology	4
CPSC	2002	Statistics	6
CPSC	2003	Crop Husbandry II	6
FDSC	2007	Agricultural Chemistry I	4
FDSC	2009	Agricultural Chemistry III	2
INDM	2005	Agricultural Microbiology	6
SLSC	2002	Soil Science I	6
			60

THIRD YEAR

			Credits
AERD	3001	Business Law	2
AERD	3002	Computer Analysis and Information Technology	8
AERD	3003	Co-operatives	2
AERD	3006	Financial Planning and Control	4
AERD	3007	Operations and Personnel Management	4
AERD	3008	Quantitative Methods	4
AERD	3009	Rural Development	6
AERD	3011	Farm Business Management I	4
AERD	3200	Professional Work Experience	14
AERD	3300	Electives	4
ANSC	3009	Animal Husbandry II	8
			60

FOURTH YEAR

			Credits
AERD	4004	Agricultural Marketing and Trade	4
AERD	4005	Agricultural Policy II	8
AERD	4006	Communications II	6
AERD	4007	Enterprise Development	4
AERD	4009	Food and Farm Input Marketing	4
AERD	4010	Farm Business Management II	8
AERD	4011	Research Methods/Project	6
AERD	4012	Taxation	2
AERD	4050	Major Project	4
AERD	4100	Electives	10
ECON	4101	National Economics	4
			60

* * * * * * * * *

FIRST YEAR

As for the degree programme in Animal and Crop Production.

SECOND YEAR

AERD 2001 Agribusiness **6 Credits**

As for the degree programme in Animal and Crop Production.

AERD 2002 Agricultural Economics II **6 Credits**

Demand functions and their properties, data requirements, methods of estimation and interpretation of results. Production and supply functions and their properties; solutions for optimum input and production levels with numerical examples; price expectation and technical adjustment in supply models. Product price analysis under perfect competition. Analysis of factor markets. Imperfect competition: monopoly, oligopoly and monopsony. Welfare analysis. Market failure. Resource and environmental issues: use of renewable and non-renewable resources, externalities, pollution and environmental control, natural resource scarcity and economic growth.

AERD 2003 Communications **6 Credits**

Definition of communications and its role in agricultural and rural development and in agribusiness organisations.

The human communication process and factors influencing the effectiveness of interpersonal communication.

Written communication methods: principles of effective writing; essay and technical report writing; business writing – letters and business reports; the CV; writing for the press.

AESC 2001 Agricultural and Environmental Biology **8 Credits**

As for the degree programme in Animal and Crop Production.

AESC 2002 Agricultural Zoology **4 Credits**
As for the degree programme in Animal and Crop Production.

CPSC 2002 Statistics **6 Credits**
As for the degree programme in Animal and Crop Production.

CPSC 2003 Crop Husbandry II **6 Credits**
Overview of the relative importance of crops on a world, Europe and national basis. The concept of *yield* is considered from the point of its accumulation and distribution, potential and components. Crop *quality* is assessed under various headings. Consideration of the various factors involved in the production of a crop and their effect on yield, quality and net return. Equipment for crop production, handling and storage. Species and varietal selection and improvement. Grass and forage production and management. Input control, output value and maximisation of net return in crop and grassland production systems.

FDSC 2007 Agricultural Chemistry I **4 Credits**
As for the degree programme in Animal and Crop Production.

FDSC 2009 Agricultural Chemistry III **2 Credits**
Cell structures, cell membranes, mitochondrial membranes. Intracellular compartmentation of enzyme systems. Bioenergetics, redox potentials, electron carrier systems. Oxidative and photosynthetic phosphorylation. Enzymes, vitamins and co-enzymes.

General composition of the body - approximate elementary composition, composition of individual tissues, mineral composition of individual tissues.

Digestion - composition of saliva, gastric juices, pancreatic juices, bile.

Absorption from intestine, transport of nutrients, utilization of nutrients.

Metabolism of carbohydrates, fats and proteins - pathways of glycolysis, glycogenolysis, gluconeogenesis, hexomonophosphate shunt, citric acid cycle, oxidation, lipogenesis. Integration of the pathways of metabolism, metabolic disorders.

INDM 2005 Agricultural Microbiology **6 Credits**
As for the degree programme in Animal and Crop Production.

SLSC 2002 Soil Science I **6 Credits**
As for the degree programme in Animal Science.

THIRD YEAR

AERD 3001 Business Law **2 Credits**

Legal persons: sole trader, partnership, companies and co-operatives. Laws applicable; common law and legislation including EU legislation. Law of contract; definition of a contract in terms of offer, acceptance and consideration. Law of tort; duty of care and negligence. EU law; mechanisms and instruments by which EU law becomes a source of Irish law. Legal issues in retention of title and in insurances.

AERD 3002 Computer Analysis and Information Technology **8 Credits**

Use of microcomputers in agribusiness; emphasis on spreadsheets, graphics and databases; "hands-on" experience with these systems; applications including financial analysis and planning, financial control, data analysis and presentation; maintenance and management of database information systems.

Information technology to include: introduction to IT; importance of IT in agribusiness and rural development; systems of IT including computer-based systems, Teletext, Videotex and Minitel; the World Wide Web; the development of telecottages, teleworking and the use of video conferencing.

AERD 3003 Co-operatives **2 Credits**

Description and evaluation of structural, conduct and performance characteristics of alternative forms of agribusiness firms; historical development of agricultural co-operation in Ireland and world-wide; size and growth trends of agricultural co-operatives in terms of value added, membership, sectoral penetration, resources and profitability; legal aspects and rules; roles and responsibilities of shareholders, management and board members; co-operatives in non-traditional agricultural activities, in non-agricultural industries and in developing countries.

AERD 3006 Financial Planning and Control **4 Credits**

Methods of investment and project analysis, cost classification, cost/volume/profit relationships, cost and revenue control systems, financial planning and budgetary control.

AERD 3007 Operations and Personnel Management **4 Credits**

Production/operations, management and human resource development; introduction to production management and materials handling functions in food processing and other agribusiness firms; principles and techniques of human resource management; industrial relations structures and the collective bargaining process.

AERD 3008 Quantitative Methods **4 Credits**

A study of the quantitative methods commonly employed in the analysis of economic and business problems, including multiple regression, covariance analysis, time series analysis, linear programming and simulation; applications of the various methods using computer programmes.

AERD 3009 Rural Development 6 Credits
Definitions and indicators of development. Economic reasons for underdevelopment of rural areas. The process of economic growth and development in Developed Countries and in Less Developed Countries; the role of agriculture in economic growth; industry-led versus agriculture-led growth strategies. The population problem.

Sociological theories of rural development; modernisation and marginalisation; the process of rural change in Ireland and Developing Countries; culture and stratification in rural societies; decision-making in different societies; issues arising from land tenure systems and the spread of new technology.

Planning rural development; approaches and strategies in action; communications and extension in development. Rural development in Ireland, the EU and Developing Countries - policies, agencies and programmes.

AERD 3011 Farm Business Management I 4 Credits
Objectives and goals of the farm manager, farm management functions, farm family life cycle. Introduction to farm accounts, terminology and definitions, uses of accounts for financial and management analysis; forms of accounts required for (a) management and (b) taxation purposes. Law and the farmer, farm registration and taxes, forms of farm ownership, succession and inheritance.

AERD 3200 Professional Work Experience 14 Credits
This will be acquired between the start of Trinity term of the third year and the start of Michaelmas term of the fourth year.

AERD 3300 Electives 4 Credits

ANSC 3009 Animal Husbandry II 8 Credits
This course is designed to provide an overview of animal science and production in Ireland, the EU and on a world basis. Its focus will be on the main animal production enterprises in Ireland. The topics covered will include: the structure and importance of the individual enterprises at farm, national and international level; an outline of the principles of breeding, reproduction, feeding and management of the animal production enterprises, seasonality of production; product quality and implications for processing and marketing; costs and returns and factors affecting profitability.

FOURTH YEAR

AERD 4004 Agricultural Marketing and Trade 4 Credits

Marketing

Marketing from the viewpoint of the farmer and the agribusiness sector; factors within and outside the sector's control; special characteristics and problems of agricultural marketing and the methods and institutions - such as co-operatives - employed to deal with these problems; Irish agricultural marketing by commodity; the consequences of alternative commodity marketing systems for farmers, agribusiness, consumers and taxpayers; CAP mechanisms both in general and in relation to particular commodities; assessment of current developments in the CAP and prospects for the future.

Trade

The basis of trade; demand and supply aspects including comparative advantage; terms of trade; tariffs and customs unions; GATT - origins, structure, principles and achievements; agricultural trade and the balance of payments.

AERD 4005 Agricultural Policy II 8 Credits

Syllabus as for Agricultural Policy in the Animal and Crop Production degree programme plus additional theoretical material and literature assignments.

AERD 4006 Communications II 6 Credits

The development of communications skills which are most commonly used in professional careers. These include individual, group and mass media methods of communication such as: advising/counselling; lecturing and public speaking; facilitating group meetings and discussions; organising demonstrations; scripting and presenting for local radio; and writing skills (lecture handouts, technical reports, press articles, CV).

Project work to include: lecture presentation and accompanying handout; group work; individual consultation and radio scripting and recording.

AERD 4007 Enterprise Development 4 Credits

Study of the importance of innovation and renewal in agribusiness; the entrepreneurial process, sources of venture ideas, success and failure factors, market entry strategies and venture evaluation and enterprise planning. The subject is project based and each student will be required to identify a new venture, conduct an appraisal of its potential and draw up a strategy for its implementation.

AERD 4009 Food and Farm Input Marketing 4 Credits

Extent and characteristics of the food and farm inputs markets served by Irish agribusiness firms; structures of the industries serving these markets, competitive issues and appropriate business and marketing strategies; operational aspects of marketing such as selling techniques and distribution and sales force management in these agribusiness sectors.

AERD 4010 Farm Business Management II 8 Credits
Management of the farm as a business; farm financial analysis; farm labour, part time farming, farm household and farm safety. Farm planning and investment appraisal techniques and control. Methods of allocating costs, farm machinery and farm buildings. Farm protection and security, models for asset transfer. Direct payments, grants, schemes and alternative enterprises. Farm computerisation and IT; production contracts and quality assurance; risk and uncertainty and case studies.

AERD 4011 Research Methods/Project 6 Credits
Introduction to problem investigation focusing on agricultural economic, marketing, extension and rural development issues. Review of sampling principles and methods of data collection with particular emphasis on questionnaire design and administration. Outline of analytical techniques, statistical tests and appropriate computing systems. Procedures for preparation and input of data for computer analysis. Techniques for the minimisation of sampling and data errors. Reporting and presentation of survey results.

Research project relating to an agribusiness, agricultural economic or rural development topic with staff guidance on methodology, analysis and reporting.

AERD 4012 Taxation 2 Credits
Taxation principles and issues of equity and incentive; assessment of income and corporation tax liability; tax planning for effective use of allowances and investment incentives by farmers and agricultural businesses; systems of capital taxation and methods of minimising capital gains tax.

AERD 4050 Major Project 4 Credits

AERD 4100 Electives 10 Credits

ECON 4101 National Economics 4 Credits
The Supply side and the Demand side of the economy.

The Demand side in more detail: fiscal, monetary, exchange rate and incomes policies.

The Supply side in more detail: the labour market, capital market distortions, industrial policy, and product market distortions. Issues in European integration: Monetary union, CAP reform, structural funds and decentralised versus centralised decision making. The performance of the Irish economy: growth, unemployment, inflation, external balance, budget balance and sectoral balances.

IV. AGRICULTURAL AND ENVIRONMENTAL SCIENCE

FIRST YEAR

As for the degree programme in Animal and Crop Production.

SECOND YEAR

			Credits
AESC	2001	Agricultural and Environmental Biology	8
AESC	2004	Plant Physiology	4
AESC	2005	Impact of Man on the Environment	4
AESC	2006	Applied Zoology I	4
ANSC	2001	Genetics I	2
CPSC	2002	Statistics	6
CPSC	2003	Crop Husbandry II	6
ENGT	2007	Surveying	2
FDSC	2007	Agricultural Chemistry I	4
FDSC	2008	Agricultural Chemistry II	6
GEOL	2601	Geology	3
INDM	2005	Agricultural Microbiology	6
SLSC	2003	Soil Science	5
			60

THIRD YEAR

			Credits
AESC	3003	Applied Zoology II	10
AESC	3004	Plant Pathology	6
AESC	3007	Agrichemicals and Plants	4
AESC	3009	Rural Resource Assessment	8
AESC	3201	Professional Work Experience	12
ANSC	3009	Animal Husbandry II	8
ANSC	3012	Fundamentals of Biotechnology	2
FOR	4005	Experimental Design	4
SLSC	3001	Soil Science II	6
			60

FOURTH YEAR

			Credits
AESC	4003	Plant Protection III	8
		(i) *Plant Disease Management (4)*	
		(ii) *Pest Management (4)*	
AESC	4004	Wildlife Management	4
AESC	4050	Project	14
AESC	4400	Electives	12
ERM	4001	Rural Environmental Management	12
		(i) *Environmental Impact Assessment (4)*	
		(ii) *Environmental Management (8)*	
ERM	4002	Soils, Land Use and the Environment	10
		(i) *Soil Processes (6)*	
		(ii) *Modern Farming and the Soil (4)*	
			60

* * * * * * * * *

FIRST YEAR

As for the degree programme in Animal and Crop Production.

SECOND YEAR

AESC 2001 Agricultural and Environmental Biology 8 Credits
As for the degree programme in Animal and Crop Production.

AESC 2004 Plant Physiology 4 Credits
Growth and development in plants; biology and mode of action of plant growth regulators (PGR); regulation of principal stages in the life cycle by endogenous and exogenous PGRs; growth analysis and modelling.

Principles and practices of crop nutrition; nutrient uptake and mobility; water relations in relation to yield; stress physiology in crops including nutrient, drought, waterlogging, saline, temperature (high and low) and other forms.

AESC 2005 Impact of Man on the Environment 4 Credits
This course will develop environmental topics introduced in Agricultural and Environmental Biology (AESC 2001). Topics to be covered include: Historical review of man's impact on the environment; implications of growth in energy use and human population; critical impacts on environmental sustainability. Selected issues of global importance (e.g. soil degradation; hazardous wastes; groundwater pollution; eutrophication; atmospheric deposition; air pollution; climate change) and their impact on natural ecosystems, agricultural productivity, human welfare and land use - environmental relationships will be highlighted. Environmental awareness, education and protection.

AESC 2006 Applied Zoology I **4 Credits**
Introduction to the biology and ecology of terrestrial and aquatic invertebrate groups of interest in agricultural and environmental science. Taxonomy of major groups with emphasis on recognition in the field.

ANSC 2001 Genetics I **2 Credits**
As for the degree programme in Animal and Crop Production.

CPSC 2002 Statistics **6 Credits**
As for the degree programme in Animal and Crop Production.

CPSC 2003 Crop Husbandry II **6 Credits**
As for the degree programme in Agribusiness and Rural Development.

ENGT 2007 Surveying **2 Credits**
As for the degree programme in Engineering Technology.

FDSC 2007 Agricultural Chemistry I **4 Credits**
As for the degree programme in Animal and Crop Production.

FDSC 2008 Agricultural Chemistry II **6 Credits**
As for the degree programme in Animal and Crop Production.

GEOL 2601 Geology **3 Credits**
As for the Animal and Crop Production degree programme.

INDM 2005 Agricultural Microbiology **6 Credits**
As for the degree programme in Animal and Crop Production.

SLSC 2003 Soil Science **5 Credits**
As for the Animal and Crop Production degree programme.

THIRD YEAR

AESC 3003 Applied Zoology II **10 Credits**

Factors influencing the structure and dynamics of animal populations and communities. Animal/plant interactions. Role of animals in terrestrial ecosystems; influence on primary production, decomposition and nutrient cycling, and on soil structure.

General theory of pest control: pest types, pest damage relationships. Pesticides; nature, mode of action, application. Pesticide toxicity and environmental hazards. Pesticide resistance. Rational use of pesticides, monitoring and forecasting schemes. Non-chemical pest control strategies; cultural, physical and biological approaches. Integrated pest management.

Review of major invertebrate and vertebrate pests of field crops, protected crops and stored products, and strategies for their control.

Principles of control of animal parasites in livestock including introductory immunology, development and use of drugs; anti-coccidials, anthelmintics, insecticides, delivery systems, marketing strategies, immunodiagnostics, vaccines, cultural methods, integrated approaches. Principles of epidemiology with special emphasis on zoonotic infections.

AESC 3004 Plant Pathology **6 Credits**

This is an introductory course in plant pathology in which diseases of field and protected crops are dealt with in lectures and laboratory classes.

Economic and social impact of diseases on crop production; sources of loss and quality control. Symptoms and signs. Infectious vs. non-infectious agents. Koch's postulates. Host-pathogen-environment interactions: epiphytology and disease forecasting. Symptomatology, etiology and control of important fungal, bacterial and viral diseases of field and protected crops including seedling and post-harvest diseases. Disease control: regulatory, chemical, biological and integrated control methods, and pathogen resistance.

AESC 3007 Agrichemicals and Plants **4 Credits**

History, rationalisation and integration of agrichemicals in crop production; pathways of foliar and root uptake; uptake and translocation of plant metabolites and exogenous chemicals; formulation of agrichemicals; metabolism of xenobiotic materials; toxicology, residues and statutory regulations; environmental and biological fate of agrichemical residues; basic chemical properties and modes of action of herbicides, fungicides and insecticides; biological tolerance and resistance; chemical regulation of the plant life cycle, foliar nutrition; miscellaneous agrichemical products.

AESC 3009 Rural Resource Assessment 8 Credits
The identification, description and evaluation of landscape resources; countryside management.

Ecology and Biodiversity of Habitats in the Farmed Landscape
Historical introduction: the nature and development of natural and semi-natural ecosystems in Ireland - farming, nature and biodiversity. Global ecosystems; development of the Irish flora; phytosociology and classification of communities; plant-insect interactions; speciation, extinction and natural selection; succession; plants as bioindicators; plant strategies and population studies; conservation and habitat management. Landscape ecology: definitions; patches; corridors; networks, matrices and mosaics; land transformation and fragmentation; sustainable environments.

Identification, description and general management of rural habitats: woodland, boglands, grasslands, aquatic habitats.

Farming and the heritage of cultural landscape.

Water in the Farmed Landscape
The role and ecology of aquatic environments with particular reference to water quality assessment and monitoring. Hydrogeology; water in the landscape: the hydrological cycle; supply and drainage; soils and water; climatic aspects. Forestry, water and landscape.

Characteristics and ecology of standing waters; characteristics and ecology of flowing waters; eutrophication; acidification of freshwaters; freshwater pollution; biological assessment of freshwater; effects of land use on freshwater biota; water quality standards, water supply, sewage treatment; littoral environments. Elemental analysis in water and soil: chemical assessment (including the practical measurement of BOD, nitrate, phosphate in the field).

Managing the Rural Landscape for Diversity
The Rural Environmental Protection Scheme and its context in Europe.

AESC 3201 Professional Work Experience 12 Credits
This comprises appropriate aspects of practical agriculture and environmental management. The work experience assignment(s) are undertaken from the start of the Trinity term of Third Year until the start of the Michaelmas term of the Fourth Year, as directed by the Professional Work Experience Programme director.

ANSC 3009 Animal Husbandry II 8 Credits
As for the degree programme in Agribusiness and Rural Development.

ANSC 3012 Fundamentals of Biotechnology 2 Credits
As for the Animal and Crop Production degree programme.

FOR 4005 Experimental Design **4 Credits**

Basic concepts of experimentation and hypothesis testing. Two-sample t tests. Fundamental equation of analysis of variance (ANOVA). Analysis, interpretation and reporting of data from univariate experimental designs including the completely randomized, the randomized block, the Latin square and factorial designs with and without replication. Hypothesis testing of main and interaction effects.

Simultaneous inference using Scheffe, Tukey and Student-Newman-Keuls multiple range tests. Concept of repeated measures designs. Autocorrelation. Analysis, interpretation and reporting of all experimental techniques.

Software: Microsoft Word and Excel. Windows 95.

SLSC 3001 Soil Science II **6 Credits**

As for the degree programme in Animal and Crop Production.

FOURTH YEAR

AESC 4003 Plant Protection III **8 Credits**

(a) Plant Disease Management (4 credits)

Relevance of epidemiology to disease management; disease epidemics; disease build-up; pathogen dispersal; quantification of disease - phytopathometry and the analysis of epidemics; modelling and forecasting epidemics; genetics and epidemiology - strategies for the use of resistant cultivars; management of virus diseases: novel plant breeding, molecular biology and genetic engineering techniques for the production of virus resistant transgenic plants; developments in chemical control of plant disease; fungicide groupings and modes of action, application techniques, legislation, food residues; pathogen resistance to fungicides.

(b) Pest Management (4 credits)

This course examines the pest management concept as an alternative to more traditional approaches to pest control. Basic principles and tactics are examined, including establishment and implementation of economic injury thresholds and the integration of biological, cultural and chemical approaches. Case studies based on programmes which have been put into operation will be considered.

AESC 4004 Wildlife Management **4 Credits**

Wildlife management is the application of management techniques for the conservation and use of our wildlife resource. The course will examine: resident and migrant species; population census and analysis; habitat evaluation, monitoring and analysis; management for conservation and hunting; impact of man on wildlife with emphasis on the conservation/damage interface; the role and importance of wildlife law.

Course projects will include an essay and a management plan.

AESC 4050 Project **14 Credits**

AESC 4400 Electives **12 Credits**

ERM 4001 Rural Environmental Management 12 Credits

(a) Environmental Impact Assessment (4 credits)

Attitudes to environmental management, dominance and control; planning vs. control; sustainable development.

The relationship between EU and national controls; EU regulations, directives, policies, etc; the European Environmental Agency (EEA); freedom of environmental information.

Environmental policies, programmes and plans; strategic environmental assessment (SEA).

Environmental impact assessment (EIA) at the project level; the North American experience; the EU directive; Irish regulations.

Environmental Protection Agency (EPA); pollution and control legislation; integrated pollution licences; tradeable licences.

Concepts of environmental audit.

Case-study based tutorials, seminars and EIA simulation.

(b) Environmental Management (8 credits)

Biodiversity and its management and conservation in the rural landscape: environmental values in the rural landscape; global biodiversity; biodiversity in Ireland; the valuation of natural and cultural diversity; issues in conservation biology; conservation strategies; putting a price on natural diversity.

Techniques for managing the rural environment: traditional management of the rural landscape; remote sensing and geographical information systems; modelling. Strategies for the maintenance and protection of environmental integrity and diversity: information and training; legislation: nitrate and habitats directives; NHAs, SACs and their context; environmental designations. Incentive schemes: REPS in Ireland, ESAs in the UK; approaches in other countries; cross-compliance.

Economic issues concerning the use of renewable resources, externalities, pollution and environmental control, and natural resource scarcity and economic growth. The nature and role of rural resources in economic growth and development. The concept of sustainability and sustainable development.

Diversity as resource: alternative enterprise identification; payments for environmentally-friendly farming and land use management; rural tourism.

ERM 4002 Soils, Land Use and the Environment 10 Credits

(a) Soil Processes (6 credits)

Mineral and organic fractions in soils: organic matter turn-over; air-water relationships; the soil atmosphere and soil oxygen status.

Essential nutrients for growth (functions and sources).

Land use and land use limitations.

Soil fertility/soil fertility assessment.

Lime and liming; fertilizers and fertilizer use in Ireland; soil-root-fertilizer environment; crop response, nutrient off-take and longevity of response.

Reactions of major fertilizer nutrients in soils; water quality.

Trace elements and heavy metals in Ireland; nature of nutrient deficiency/toxicity tolerance; adaption to nutrient stress.

Field visits to assess significance of nutrient transport processes re. rivers, lakes, soils and atmosphere: assessment of quality status of soils and water.

(b) Modern Farming and the Soil (4 credits)

Soil associations of Ireland - potential and limitations.

Soil suitability and capability classifications: production indices.

Soil properties important to soil management: physical and mechanical aspects of soil use (tillage, traffic, drainage, irrigation).

Integrated land use: fertilizer and pesticide management.

Land spreading of animal manures and sewage sludges (hydraulic, chemical and biological loading capacities of soils).

Sociological, educational and legal aspects of agricultural pollution control.

V. FOOD SCIENCE

FIRST YEAR

As for the degree programme in Animal and Crop Production.

SECOND YEAR

			Credits
AERD	2001	Agribusiness	6
AESC	2001	Agricultural and Environmental Biology	8
CPSC	2002	Statistics	6
CPSC	2003	Crop Husbandry II	6
ENGT	2003	Principles of Engineering II	2
FDSC	2004	Food Science I: Food Physics	4
FDSC	2005	Food Science II: Basic Analysis	8
FDSC	2007	Agricultural Chemistry I	4
FDSC	2008	Agricultural Chemistry II	6
INDM	2005	Agricultural Microbiology	6
LANG	2007	European Language	4
			60

THIRD YEAR

			Credits
ENGT	3004	Food Engineering Principles	6
FDSC	3001	Food Analysis	10
FDSC	3002	Biochemistry I and II	10
		(i) *Biochemistry I (4)*	
		(ii) *Biochemistry II (6)*	
FDSC	3003	Food Chemistry	8
FDSC	3005	Nutrition I	4
FDSC	3200	Professional Work Experience	8
FOR	3005	Computer Applications	4
FOR	4005	Experimental Design	4
INDM	3009	Food Microbiology II	6
			60

FOURTH YEAR

			Credits
ENGT	4002	Food Manufacturing Systems	8
FDSC	4005	Food Process Technology	8
FDSC	4006	Marketing	4
FDSC	4007	Nutrition II	4
FDSC	4008	Food Ingredients	6
FDSC	4010	Fresh and Processed Meat Products II	6
FDSC	4011	Dairy Products	6
FDSC	4012	Cereal Chemistry and Brewing Science	4
FDSC	4013	Sensory Analysis	4
FDSC	4051	Project	10
			60

* * * * * * * * *

FIRST YEAR

As for the degree programme in Animal and Crop Production.

SECOND YEAR

AERD 2001 Agribusiness **6 Credits**
As for the degree programme in Animal and Crop Production.

AESC 2001 Agricultural and Environmental Biology **8 Credits**
As for the degree programme in Animal and Crop Production.

CPSC 2002 Statistics **6 Credits**
As for the degree programme in Animal and Crop Production.

CPSC 2003 Crop Husbandry II **6 Credits**
As for the degree programme in Agribusiness and Rural Development.

ENGT 2003 Principles of Engineering II **2 Credits**
As for Principles of Engineering II of ENGT 2011 in the degree programme in Animal and Crop Production.

FDSC 2004 Food Science I: Food Physics **4 Credits**
An introduction to basic food physics covering the theory, functionality and measurement of the following physical properties of foods: rheology, mechanical properties, optical properties (colour, etc), electrical properties, thermal properties, water activity, diffusivity etc. Food structure and texture, sensory properties and sensory evaluation. Correlation of instrumental and sensory measurements.

FDSC 2005 Food Science II: Basic Analysis **8 Credits**
An introduction to the general principles of chemical analysis applied to foods. Topics covered include acids and bases, titrimetry, indicators, standard solutions, pH measurement, buffers and their preparation, strength and buffering capacity, halide titrations, oxidation-reduction reactions, redox indicators, potentiometry, complexiometric titration, electrochemical analytical methods, proximate analysis, visible-UV spectrophotometry.

FDSC 2007 Agricultural Chemistry I **4 Credits**
As for the degree programme in Animal and Crop Production.

FDSC 2008 Agricultural Chemistry II **6 Credits**
As for the degree programme in Animal and Crop Production.

INDM 2005 Agricultural Microbiology **6 Credits**
As for the degree programme in Animal and Crop Production.

LANG 2007 European Language **4 Credits**

THIRD YEAR

ENGT 3004 Food Engineering Principles **6 Credits**
An introduction to basic principles of heat and mass transfer with detailed treatment of selected processes such as heat exchange, membrane processing, distillation, leaching/extraction etc. The basic principles of psychrometrics and its application to dehydration and atmosphere control.

FDSC 3001 Food Analysis **10 Credits**
Principles and application of modern laboratory techniques used in the analysis of agricultural and food products.

FDSC 3002 Biochemistry I and II **10 Credits**
(i) Biochemistry I (4 credits)
The chemical properties, distribution and importance of primary and secondary plant products. Detailed metabolism involved in the biosynthesis and degradation of these compounds. Changes in chemical composition activity during development.

(ii) Biochemistry II (6 credits)
This course deals with: the structure and function of membranes, mitochondria, enzyme localisation, active and passive transport systems; mechanism of phosphorylation; shuttle systems; inborn errors of metabolism. Regulation of blood and urine pH; function of the lungs, kidneys; oxygen and carbon dioxide transport; urea formation. Detailed regulation and integration of the pathways of carbohydrate, fat and protein metabolism in monogastric and ruminant animals. Special significance of gluconeogenesis in ruminants, sources of carbon, ketone formation. Milk fat synthesis, sources of carbon, reducing equivalents. Structure and biochemistry of muscle.

FDSC 3003 Food Chemistry **8 Credits**

Food Carbohydrates

Simple carbohydrates including sugar alcohols, structure and functional properties in fresh and processed foodstuffs of important natural and chemically modified polysaccharides including starches, celluloses, pectins, alginates, carrageenans, etc.

Food Lipids

Structure and properties of natural and chemically modified fats, polymorphism, chemistry of lipid deterioration, its effects and methods of control.

Food Proteins

Structure and functional properties in foods of selected native and modified proteins of animal and plant origin, including their role as gelling, emulsifying and foaming agents.

Other Topics

The role of water in foods and water activity. Properties of colloidal systems in foods. Natural and synthetic food colorants. The chemistry of taste and aroma. Non-enzymatic browning processes in heated foodstuffs. Review of food additives not included above.

FDSC 3005 Nutrition I **4 Credits**

Structure and function of the human gut. Nutrient digestion and absorption. Metabolism of protein, fat and carbohydrate. Protein requirements, consequence of deficiency. Lipid transport and cholesterol metabolism. Energy metabolism, energy values of foods and energy requirements. Thermogenic mechanisms. Appetite and regulation of intake. Minerals and vitamins, consequences of deficiency and excess.

FDSC 3200 Professional Work Experience **8 Credits**

This will be acquired between the end of the Trinity term of the third year and the start of the Michaelmas term of the fourth year.

FOR 3005 Computer Applications **4 Credits**

Spreadsheets, databases, word processing, graphics.

FOR 4005 Experimental Design **4 Credits**

As for the Agricultural and Environmental Science degree programme.

INDM 3009 Food Microbiology II **6 Credits**

Incidence and types of micro-organisms in foods; the principles underlying spoilage; pathogens transmitted through food; methods of food preservation; role of micro-organisms in the production of food and food supplements; biotechnology; quality assurance microbiological standards; factory hygiene and waste disposal.

FOURTH YEAR

ENGT 4002 Food Manufacturing Systems **8 Credits**
As for the degree programme in Engineering Technology.

FDSC 4005 Food Process Technology **8 Credits**
The heating and cooling of foods; sterilization; microwave and dielectric heating; freezing; evaporation. Dehydration of solids and liquids; extraction; emulsification; homogenisation; filtration; centrifugation; mixing.

FDSC 4006 Marketing **4 Credits**
An introduction to the basic principles of marketing including advertising and promotion.

FDSC 4007 Nutrition II **4 Credits**
Foodstuffs and their contribution to the national diet. Diet and health: Primary nutritional disorders (e.g. obesity, malnutrition). Diet-related disorders (e.g. coronary heart disease, cancer, food allergies). Dietary fibre, vegetarianism. Recommendations for healthy eating. Diet and the needs of special groups. Nutrient intakes at the national level. Changes in the national diet.

FDSC 4008 Food Ingredients **6 Credits**
Industrial processing technologies involved in producing a range of functional ingredients for the food industry including: protein based ingredients; fat derivatives and replacers; emulsifiers/stabilisers/starches – flavours/herbs/spices; texturised food ingredients and food colours. Functional properties of the individual ingredients and their application technology in food systems such as bakery, confectionery, soups, sauces, dairy products, meats and restructured food.

FDSC 4010 Fresh and Processed Meat Products II **6 Credits**
Definition of meat. Muscle tissue structure. The muscle cell. Composition of muscle. Banding patterns. Myofibrillar proteins. Thick and thin filament formation. Regulatory and cytoskeletal proteins. Sarcoplasmic and stromal proteins. Connective tissue. Collagen structure. Age-related toughening of meat. Formation of gelatin. Cell sarcotubular system. Muscle contraction. Conversion of muscle to meat. Postmortem glycolysis. Normal, PSE and DFD conditions. Cold shortening. Thaw rigor. Electrical stimulation. Meat quality. Myoglobin and meat colour. Factors affecting meat colour, including oxidation-reduction reactions, oxygen partial pressure, packaging. Measurement of meat colour. Water holding capacity. Measurement of water holding capacity. Meat tenderisation. Calpains and cathepsins. Factors affecting and structural effects of tenderisation. Measurement of tenderisation. Meat flavour. Strecker degradation, lipid oxidation, and Maillard reactions. Key flavour impact compounds. Species effects on flavour. Measurement of meat flavour. Non-sensory meat quality attributes. Pre-slaughter factors affecting meat composition and quality. Genetics. Plane of nutrition. Effects of dietary fat on meat quality. Boar taint. Sex and slaughter weight effects on meat quality. Stunning and slaughter operations. Beef and lamb carcass classification. Pig grading. Meat chilling. Meat cuts. Hot-boning. Poultry meat processing. Processed meats. Classification of processed meats. Curing processes.

Chemistry of cured meat colour. Massaging/tumbling. Fresh pork sausage manufacture Emulsion-type meat products. Myofibrillar protein functionality. Effect of salt and phosphates on functionality. Least Cost Formulation. Low fat meat products. Sausage casings. Cooking and Smoking. Meat by-products. Fat rendering systems.

FDSC 4011 Dairy Products 6 Credits

A. Milk

Introduction to milk compositions and the factors which affect it. Detailed chemistry of the major milk components and their behaviour during processing. Casein, whey proteins, lipids and lactose. Minor milk constituents and their significance. Analysis of milk.

B. Dairy Products

Chemistry and technology of dairy products including: liquid milk products, cheese and fermented milks, concentrated and dehydrated milk products, butter and spreads. Milk protein products.

FDSC 4012 Cereal Chemistry and Brewing Science 4 Credits

A number of case studies will be used to facilitate discussion on the process of converting cereals into food products. The main emphasis will be on discussing the impact of raw material quality, food processing, transport and storage on the quality of the food that is produced. The study of the brewing process will form a major component of the course with a small number of examples drawn from the following production processes: whiskey, flour, bread, biscuits, cakes and pasta.

FDSC 4013 Sensory Analysis 4 Credits

The role of sensory science in assessing food quality will be discussed. Some of the sensory techniques used to evaluate the quality of food products will be studied. These will include difference testing, preference testing and profile taste testing. The course will involve practical tasting sessions and the analysis of data using appropriate statistical techniques.

FDSC 4051 Project 10 Credits

A major project will be undertaken which will include some course work in project management.

VI. ENGINEERING TECHNOLOGY

FIRST YEAR

As for the degree programme in Animal and Crop Production.

SECOND YEAR

			Credits
AERD	2001	Agribusiness	6
AESC	2001	Agricultural and Environmental Biology	8
CPSC	2002	Statistics	6
CPSC	2003	Crop Husbandry II	6
ENGT	2004	Food Science and Technology	4
ENGT	2007	Surveying	2
ENGT	2008	Computer and Manufacturing Technology	4
ENGT	2009	Literature Research Project	2
ENGT	2013	Principles of Engineering I, II and III	6
FDSC	2007	Agricultural Chemistry I	4
INDM	2005	Agricultural Microbiology	6
SLSC	2002	Soil Science I	6
			60

THIRD YEAR

			Credits
AERD	3002	Computer Analysis and Information Technology	8
AERD	3006	Financial Planning and Control	4
ANSC	3009	Animal Husbandry II	8
ENGT	3001	Food Engineering Principles	8
ENGT	3002	Power and Machinery I	8
ENGT	3003	Structural and Soil Engineering	8
ENGT	3050	Major Project I	8
ENGT	3300	Electives	4
FOR	3010	Remote Sensing and GIS	4
			60

FOURTH YEAR

			Credits
ENGT	4001	Buildings and Environment	8
ENGT	4002	Food Manufacturing Systems	8
ENGT	4003	Food Process Engineering	8
ENGT	4006	Environmental Engineering	8
ENGT	4007	Power and Machinery II	8
ENGT	4050	Major Project II (including professional work experience)	14
ENGT	4100	Electives	6
			60

* * * * * * * * *

FIRST YEAR

As for the degree programme in Animal and Crop Production.

SECOND YEAR

AERD 2001 Agribusiness **6 Credits**
As for the degree programme in Animal and Crop Production

AESC 2001 Agricultural and Environmental Biology **8 Credits**
As for the degree programme in Animal and Crop Production.

CPSC 2002 Statistics **6 Credits**
As for the degree programme in Animal and Crop Production.

CPSC 2003 Crop Husbandry II **6 Credits**
As for the degree programme in Agribusiness and Rural Development.

ENGT 2004 Food Science and Technology **4 Credits**
Physical properties of foods and food contacting materials including stainless steel, plastics, timber and concrete. Experimental analysis of food composition and properties.

ENGT 2007 Surveying **2 Credits**
Chain surveying, surveys of small areas and buildings, levelling, ordnance survey maps, theodolite and angular measurements, areas, volumes and contouring.

ENGT 2008 Computer and Manufacturing Technology **4 Credits**
Computer aided drafting: principles of drafting, principles of CAD, two-dimensional drawing, three-dimensional drawing. Manufacturing technology: welding, turning, milling, tools, materials, stock control.

ENGT 2009 Literature Research Project **2 Credits**
Students will be required to carry out a literature survey in a selected aspect of agricultural and food engineering.

ENGT 2013 Principles of Engineering I, II and III **6 Credits**
(i) Principles of Engineering I (2 credits)
As for Principles of Engineering I of ENGT 2011 in the Animal and Crop Production degree programme

(ii) Principles of Engineering II (2 credits)
As for Principles of Engineering II of ENGT 2011 in the Animal and Crop Production degree programme.

(iii) Principles of Engineering III (2 credits)
Mechanics: Forces, moments, equilibrium, internal forces, free-body diagrams, stress and strain, bending, deflection, torsion, bending moment and shear stress diagrams, moment of inertia, elementary dynamics, elementary fluid mechanics. Application to structures and machinery.

FDSC 2007 Agricultural Chemistry I **4 Credits**
As for the Animal and Crop Production degree programme.

INDM 2005 Agricultural Microbiology **6 Credits**
As for the Animal and Crop Production degree programme.

SLSC 2002 Soil Science I **6 Credits**
As for the Animal Science degree programme.

THIRD YEAR

AERD 3002 Computer Analysis and Information Technology **8 Credits**
As for the Agribusiness and Rural Development degree programme.

AERD 3006 Financial Planning and Control **4 Credits**
As for the Agribusiness and Rural Development degree programme.

ANSC 3009 Animal Husbandry II **8 Credits**
As for the Agribusiness and Rural Development degree programme.

ENGT 3001 Food Engineering Principles **8 Credits**
As for the Food Science degree programme.

ENGT 3002 Power and Machinery I 8 Credits
Internal combustion engines. Power transmission. Traction. Tractor-implement mechanics. Tractor performance. Design of mechanical elements in food and agricultural equipment including power transmissions, shafting, beams, brakes, bearings and welded joints. Stress analysis and fatigue. Hydraulic systems. Tillage and cultivation machinery.

ENGT 3003 Structural and Soil Engineering 8 Credits
Soil classification. Phase relations. Failure theory. Retaining walls. Slope stability. Foundation pressures. Consolidation and compaction.

Structural analysis. Estimation of loading on structures including wind load. Steel, reinforced concrete and wood as structural materials. Design for bending, shear, deflection, compression and buckling in basic structural elements including beams, slabs, walls, columns, trusses and simple frames.

ENGT 3050 Major Project I 8 Credits
Students will carry out a comprehensive project involving experimentation, systems analysis and/or design in an approved topic in agricultural and food engineering. The project will include: (i) a survey of the literature; (ii) oral progress report (seminar style); (iii) the presentation of a preliminary report; and (iv) a component of professional work experience.

ENGT 3300 Electives 4 Credits

FOR 3010 Remote Sensing and GIS 4 Credits
Fundamental concepts of remote sensing and Geographic Information Systems (GIS).
Digital interpretation of OS raster maps and orthophotos. Development of hands-on GIS computer skills of point, line and polygon theme and attribute table creation within ArcView 3.1. GIS skills of joining dbf databases to theme attribute tables. Building GIS queries. Integration of vector, raster and attribute GIS databases. Specification of GIS database structure. Digital area and perimeter estimation.

Application of remote sensing and GIS in forest, agricultural and environmental resource inventory. Applications of GIS skills in forest inventory, the Rural Environmental Protection Scheme (REPS) and spatial resource inventory and design. Development and group presentation of individual GIS projects in ArcView.

Software: ArcView 3.1. Microsoft Excel. Windows 95.

FOURTH YEAR

ENGT 4001 Buildings and Environment 8 Credits
Farmyard design and layout. Animal production buildings including environmental control systems. Milking parlours. Management of animal manures. Crop storage buildings. Reinforced concrete and structural steel in agricultural buildings. Farm water supplies. Environmental and planning legislation and protection pertaining to agriculture.

ENGT 4002 Food Manufacturing Systems 8 Credits
Plant layout with reference to grain drying, meat processing, milk processing. In-plant computerised control. Energy use in processing. Boilers and steam plant, plant specification, selection and operation. Water and waste-water treatment services. Solid waste disposal. Electrical installations. Classification and characteristics of pumps, fans and compressors. Measurement and analysis of noise and methods of noise control.

ENGT 4003 Food Process Engineering 8 Credits
Unit processes, heat transfer systems and mass transfer systems in food processing including dehydration, freezing, centrifugation, crystallisation, emulsification, extraction and irradiation with the applications of each. Physical, chemical and microbiological changes in foods. Packing and storage. Integrated food processing systems

ENGT 4006 Environmental Engineering 8 Credits
Legislation, water and waste-water treatment, solid waste, atmospheric emissions, noise, IPC licensing, environmental management and auditing. Land as a waste treatment and disposal medium, hydrology, treatment processes in the soil, design. Tutorials.

ENGT 4007 Power and Machinery II 8 Credits
Students may take any *two* of the following modules:
Mechanisation (4 credits)
Agricultural machinery, system selection and operation: including tractors, tillage, seeding and planting; artificial fertiliser application: spraying techniques; crop harvesting.

Precision Agriculture (4 credits)
Global Positioning Systems (GPS), Geographic Information Systems (GIS) sensors, yield maps, variable rate technology, satellite imagery, decision support, soil and environmental properties.

Control (4 credits)
Modelling dynamic systems, system response, feedback control. Instrumentation, measurement of pressure, flow and temperature, compact data loggers. Programmable logic controller (PLC) technology.

Forest Engineering (4 credits)
Forest machinery design, selection and operation. Timber transport. Environmental impact. Central tyre inflation (CTI) and telemetric control systems.

ENGT 4050 Major Project II 14 Credits
(including Professional Work Experience)
Students will continue to carry out a comprehensive project involving experimentation, systems analysis and/or design in an approved topic in agricultural and food engineering. The project will include: (i) a survey of the literature; (ii) oral progress report (seminar style); (iii) the presentation of a comprehensive report; (iv) a component of professional work experience.

ENGT 4100 Electives 6 Credits

VII. HORTICULTURAL SCIENCE

FIRST YEAR

As for the Animal and Crop Production degree programme.

SECOND YEAR

			Credits
AERD	2001	Agribusiness	6
AESC	2001	Agricultural and Environmental Biology	8
AESC	2004	Plant Physiology	4
ANSC	2001	Genetics I	2
CPSC	2002	Statistics	6
ENGT	2010	Principles of Engineering I	2
FDSC	2007	Agricultural Chemistry I	4
FDSC	2008	Agricultural Chemistry II	6
HORT	2006	Fundamentals of Horticulture	10
INDM	2005	Agricultural Microbiology	6
SLSC	2002	Soil Science I	6
			60

THIRD YEAR

			Credits
AESC	3005	Plant Protection I	12
HORT	3001	Landscape and Turfgrass Management I	4
HORT	3002	Landscape Design Theory	4
HORT	3003	Nursery/Garden Centre Management I	4
HORT	3004	Plant Materials	6
HORT	3005	Pomology I	4
HORT	3006	Protected Horticulture I	4
HORT	3007	Vegetable Crops I	2
HORT	3200	Professional Work Experience	14
SLSC	3002	Soil Science III	6
			60

FOURTH YEAR

			Credits
AERD	4006	Communications II	6
AERD	4007	Enterprise Development	4
CPSC	4003	Crop Breeding	4
HORT	4003	Landscape and Turfgrass Management II	4
HORT	4004	Nursery/Garden Centre Management II	4
HORT	4005	Pomology II	4
HORT	4006	Protected Horticulture II	4
HORT	4007	Vegetable Crops II	2
HORT	4050	Research Project	10
HORT	4400	Electives	18
			60

* * * * * * * * *

FIRST YEAR

As for the degree programme in Animal and Crop Production.

SECOND YEAR

AERD 2001 Agribusiness **6 Credits**
As for the Animal and Crop Production degree programme.

AESC 2001 Agricultural and Environmental Biology **8 Credits**
As for the Animal and Crop Production degree programme.

AESC 2004 Plant Physiology **4 Credits**
As for the Agricultural and Environmental Science degree programme.

ANSC 2001 Genetics I **2 Credits**
As for the Animal and Crop Production degree programme.

CPSC 2002 Statistics **6 Credits**
As for the degree programme in Animal and Crop Production.

ENGT 2010 Principles of Engineering I **2 Credits**
As for 'Principles of Engineering I' of ENGT 2011 in the Animal and Crop Production degree programme.

FDSC 2007 Agricultural Chemistry I **4 Credits**
As for the Animal and Crop Production degree programme.

FDSC 2008 Agricultural Chemistry II **6 Credits**
As for the Animal and Crop Production degree programme.

HORT 2006 Fundamentals of Horticulture 10 Credits

(i) *Introduction to the Principles and Concepts of Horticultural Science*

The importance of site selection for plant production under field and protected environments. Greenhouse structures and function, design, construction, heating, ventilation and environmental control. Growing media, sterilization, nutrition/conductivity and irrigation systems. Classic propagation techniques - cuttings, grafting, budding, layering and stooling. Production technologies for fruit, vegetables and protected crops.

An overview of the art and science of landscape horticulture. Criteria governing the selection of vegetation for a range of landscape situations.

(ii) *Agricultural Climatology/Meteorology*

Meteorological elements and their measurement; climate of Ireland; the moisture balance - evaporation, soil storage, run-off, drainage; the energy balance - radiation, conduction, convection, evaporation. Climate and soil management; plant requirements of mositure and heat; drought, irrigation. Soil fertility implications, accretion, leaching, volatilization, run-off; timing soil-related activities. Weather and crop production; crop-weather interactions, photosynthesis, respiration, canopy development, growth rates; horticultural and protected crops. Wind and shelter. Plasticulture. Diseases of field and horticultural crops. Climate change.

INDM 2005 Agricultural Microbiology 6 Credits

As for the degree programme in Animal and Crop Production.

SLSC 2002 Soil Science I 6 Credits

As for the degree programme in Animal Science.

THIRD YEAR

AESC 3005 Plant Protection I 12 Credits

Plant Pests

Introduction to the classification, structure, physiology and biology of the major animal groups of horticultural importance - Annelida, Nematoda, Mollusca, Arthropoda and Chordata.

Nature and incidence of pest outbreaks and principles of control. Properties, formulation and application of pesticides; pesticide resistance and environmental hazards. Non-chemical pest control: cultural, physical and biological methods. Pest management concepts.

The biology, ecology and control of the major invertebrate, bird and mammal pests of fruit, vegetables and ornamental crops, and a variety of soil pests and pests of turf grass are studied. Coverage includes identification of the major species, recognition of the damage caused, biology and population dynamics and the agents and management techniques available for their control.

Plant Pathogens
Economic and social impact of diseases on crop production; sources of loss and quality control. Symptoms and signs. Infectious vs. non-infectious agents. Koch's postulates. Host-pathogen-environmental interactions: epiphytology and disease forecasting. Symptomatology, etiology and control of important fungal, bacterial and virus diseases of field and protected crops including seedling and post-harvest diseases. Disease control: regulatory, chemical, biological and integrated control methods, and pathogen resistance.

HORT 3001 Landscape and Turfgrass Management I 4 Credits
As for the relevant section of HORT 3010 in the Landscape Horticulture degree programme.

HORT 3002 Landscape Design Theory 4 Credits
An introduction to landscape theory. The landscape design process from project inception through to completion. A study of the materials of the designed landscape. The implementation of landscape proposals.

HORT 3003 Nursery/Garden Centre Management I 4 Credits
Nursery Management
Tree and shrub production emphasising the practices and principles involved in the production of such plants for wholesale, retail and landscape markets. Lecture topics cover aspects such as initiation and developing a business from a green-field site, nursery design and its impact on profitability. Plant propagation methods, growing-on methods, irrigation systems, composts, plant nutrition, weed control, growth regulation and crop scheduling.

HORT 3004 Plant Materials 6 Credits
As for the degree programme in Landscape Horticulture.

HORT 3005 Pomology I 4 Credits
Fruit Production
Fruit production, emphasising management practices and practical manipulations for the important top and soft fruits. The lectures cover aspects such as site, cultivar and systems selection, diagnosis and adjustment of nutritional status and the use of physical and chemical cultural aids. Practical sessions are devoted to clone propagation, pruning and management of fruit species and cultivars and to the organisation of the harvesting, handling and marketing operations. (This course is taught in alternate years).

HORT 3006 Protected Horticulture I 4 Credits
Greenhouse Food Crop Production.
Overview of protected food crop production in Ireland. National and international production, distribution, retailing and consumption patterns. Consideration of the various factors involved in the production of the main protected food crops and alternative food crops, with emphasis on the production of quality products. There is particular emphasis on a system approach to programmed growing for long season production and the application of recent technology and research findings. The lecture course is supplemented by demonstrations and industry visits. (This course is taught in alternate years).

HORT 3007 Vegetable Crops I **2 Credits**
Examination of the vegetable industry nationally and internationally in relation to conventional and sustainable production systems. Assessment of consumption patterns and trading practices with particular emphasis on the influence of retailing strategies and quality systems. A study of vegetable crop management practices including plant establishment techniques and crop planning.

HORT 3200 Professional Work Experience **14 Credits**
This will be acquired between the start of Trinity term of the third year and the start of the Michaelmas term of the fourth year. Students are required to obtain two placements and must submit a work diary and journal at monthly intervals. The quality of the submitted materials and the actual time spent gaining experience will be taken into consideration in awarding the final grade.

SLSC 3002 Soil Science III **6 Credits**
Soil Genesis, Classification and Land Use
Soil description in the field; horizon identification and designation; soil profile composition; internal soil forming processes; external factors of soils' environment; soil classification and distribution of major Irish soils; soil suitability classification and interpretation for agricultural and non-agricultural uses.

Soil Fertility and Soil-Plant Relationships
Soil fertility and soil-plant relationships with particular reference to the characteristics of the soil solution; soil acidity and liming; soil testing and nutrient availability; interactions of fertilizer nutrients in soils; nutrient mobility; nutrient absorption by plants and nutrient interactions in the absorption process.

Soil and Land Drainage
Causes and effects of impeded drainage; principles of drainage improvement systems.

FOURTH YEAR

AERD 4006 Communications II **6 Credits**
As for the degree programme in Agribusiness and Rural Development.

AERD 4007 Enterprise Development **4 Credits**
As for the degree programme in Agribusiness and Rural Development.

CPSC 4003 Crop Breeding **4 Credits**
(i) Crop Breeding (2 credits)
As for the relevant section of CPSC 4001 'Crop Husbandry III' in the Animal and Crop Production degree programme.

(ii) Genetic Engineering (2 credits)
Genotyping of plant species, genera and varieties; gene cloning; gene modification; plant transformations; reporter genes; use of antisense constructs; RFLPs, RAPDs, PCR; coupled reverse transcription and PCR; diagnostic uses of DNA and RNA probes.

HORT 4003 Landscape and Turfgrass Management II **4 Credits**
As for the Landscape Horticulture degree programme.

HORT 4004 Nursery/Garden Centre Management II **4 Credits**
Garden Centre Management
The course details the practices and methods used in retailing and marketing of green, dry and speciality goods. Topics covered include - garden centre design and its impact on customer flow; garden centre layout; product age and merchandising. The display of plants in the plantaria, A to Z; plant function/themes; pricing, pricing strategy, price position; plant labelling, computer labelling, label ledge systems; signage, Kendrew signs, information points, demonstration gardens, computerised point of sale equipment, bar codes, selling strategy and selling aids; the role of advertising and training. Garden centre security and security systems. The course will be supplemented by visits to selected production tree and shrub nurseries and garden centres.

HORT 4005 Pomology II **4 Credits**
Post-harvest Physiology
The principles and practices involved in handling, storage, transportation and packaging of fruits. Lectures cover aspects of bruising physiology, pre- and post-harvest fruit physiology, pre-cooling, refrigerated and controlled atmosphere storage, refrigerated transportation, container environments and physiological disorders. Practical sessions include handling exercises, pressure and laceration tolerance of fruits, atmosphere manipulations and artificial induction of physiological disorders.
(This course is taught in alternate years).

HORT 4006 Protected Horticulture II **4 Credits**
Mushroom Production/Technology
This course deals with the following aspects of mushroom production and technology: Development and importance of the industry; design and construction of production units; general biology of the mushroom; compost as a substrate and its preparation; spawns and spawn making; cropping systems; spawn running and casing; crop production and harvesting; post-harvest physiology and marketing; pest and disease control; economics of mushroom production. The lecture course is supplemented by demonstrations and one industry visit.
(This course is taught in alternate years).

HORT 4007 Vegetable Crops II **2 Credits**
This course involves a study of the principles and practices of vegetable production and crop management for the fresh market and for primary processing. The course will emphasise cultural techniques, growing programmes, harvesting methodologies and quality systems for selected tuber, root, cole, bulb and legume crops.

HORT 4050 Research Project **10 Credits**

HORT 4400 Electives **18 Credits**

VIII. LANDSCAPE HORTICULTURE

FIRST YEAR

As for the degree programme in Animal and Crop Production.

SECOND YEAR

			Credits
AERD	2001	Agribusiness	6
AESC	2001	Agricultural and Environmental Biology	8
AESC	2004	Plant Physiology	4
CPSC	2002	Statistics	6
ENGT	2012	Engineering and Surveying (i) *Principles of Engineering III (2 credits)* (ii) *Surveying (2 credits)*	4
HORT	2006	Fundamentals of Horticulture	10
HORT	2007	Landscape Design Studio I	8
HORT	2008	Landscape Design Theory I	8
SLSC	2002	Soil Science I	6
			60

THIRD YEAR

			Credits
ENGT	3006	Landscape Construction	6
ERM	3004	Landscape Ecology	4
ERM	3005	Landscape Interpretation	4
HORT	3004	Plant Materials	6
HORT	3010	Urban Horticulture and Landscape and Turfgrass Management I	6
HORT	3011	Landscape Design Theory II and Professional Practice and Planning Law I	6
HORT	3012	Landscape Design Studio II	12
HORT	3202	Professional Work Experience	12
SLSC	3003	Soil Science IV	4
			60

FOURTH YEAR

			Credits
AERD	4006	Communications II	6
AESC	4002	Plant Protection II	6
ERM	4003	Environmental Impact Assessment	4
HORT	4003	Landscape and Turfgrass Management II	4
HORT	4009	Landscape Planning	4
HORT	4010	Landscape Design Theory III and Professional Practice and Planning Law II	6
HORT	4011	Landscape Design Studio III	12
HORT	4051	Landscape Research Project	10
HORT	4101	Electives	8
			60

* * * * * * * * *

FIRST YEAR

As for the degree programme in Animal and Crop Production.

SECOND YEAR

AERD 2001 Agribusiness **6 Credits**
As for the degree programme in Animal and Crop Production.

AESC 2001 Agricultural and Environmental Biology **8 Credits**
As for the degree programme in Animal and Crop Production.

AESC 2004 Plant Physiology **4 Credits**
As for the degree programme in Agricultural and Environmental Science.

CPSC 2002 Statistics **6 Credits**
As for the degree programme in Animal and Crop Production.

ENGT 2012 Engineering and Surveying **4 Credits**
(i) *Principles of Engineering III (2 credits)*
As for 'Principles of Engineering III' of ENGT 2013 in the Engineering Technology degree programme.
(ii) *Surveying (2 credits)*
As for ENGT 2007 in the Engineering Technology degree programme.

HORT 2006 Fundamentals of Horticulture **10 Credits**
As for the Horticultural Science degree programme.

HORT 2007 Landscape Design Studio I 8 Credits

(i) Graphics
An introduction to graphic presentation, demonstration of graphic media, lettering techniques, graphic conventions and landscape architectural symbols

(ii) Computer Aided Design
The use of computers including an introduction to AutoCAD and LandCAD

(iii) Design Studio
An introduction to the design studio, basic design projects including a clay modeling exercise.

HORT 2008 Landscape Design Theory I 8 Credits

(i) History of Designed Landscapes
This course examines how, from earliest times, parks and gardens have been influenced by the environment, both natural and cultural in which they were created. This study includes the history of art and history of architecture and their relationship with landscape design. Topics include: ancient civilisations, Islamic gardens, medieval gardens, Renaissance and Mannerist gardens, Baroque and Rococo gardens, English landscape parks. The picturesque and gardenesque. The Parks Movement in Europe and the United States. Parks and gardens of the Orient. Ireland's Garden Heritage. Twentieth century designed landscapes. Restoration of period landscapes.

(ii) Landscape Design Theory
An introduction to landscape theory and the process of landscape design.

(iii) Introduction to Sociology
An introduction to Sociological Theories. The process of social change in Ireland; Culture and Stratification in society.

SLSC 2002 Soil Science I 6 Credits
As for the degree programme in Animal Science.

THIRD YEAR

ENGT 3006 Landscape Construction 6 Credits
Construction Techniques: Grading; earth works, cut and fill techniques; circulation and grading (pedestrian/cyclist); site drainage, pervious and impervious surfaces; storm water management; site utilities/site servicing water supply; outdoor lighting; bioengineering techniques.

Materials: Geotextiles; concrete; asphalt; masonry; wood; metals.
Structures: Walls - retaining and free standing; paving - flexible and rigid; timber structures; pedestrian bridge; water bodies; pools and fountains.

ERM 3004 Landscape Ecology 4 Credits

This course provides an understanding of landscape ecological patterns, with emphasis on the processes of colonisation and succession, and the relationships and interface between habitats.

Plant Ecology

Geographic control of plant distribution: biomes and global ecosystems. The development of the post-glacial flora and fauna in Ireland. Plant ecophysiology. Phytosociology and the classification of communities in the landscape. Biodiversity. Natural and anthropogenic ecosystems, ecotones; principles of ecosystem and habitat management.

The structure, development, management and landscape legacy of specific 'native' ecosystems (eg alluvial wetlands, salt marshes, sand dunes, moor/heathlands, hedgerows, woodlands).

ERM 3005 Landscape Interpretation 4 Credits

The course will cover the following topic areas:

Review of physical geology; geological and geomorphical evolution of the Irish landscape; relationships between geology, soils and flora; the evolution of the Irish flora; nature and development of the cultural landscape palimpsest; the role of water in landscape horticulture; special landscape assessment - landscape affinity, historic, 'cultural', 'outstanding', natural and semi-natural landscapes. The course will comprise lectures, field visits and practical exercises.

HORT 3004 Plant Materials 6 Credits

Planting design, plant identification, cultivation and maintenance of a range of park and garden features to include shrubberies, ground cover schemes, climbers, rose, herbaceous borders, spring and summer bedding.

HORT 3010 Urban Horticulture and Landscape and Turfgrass Management I 6 Credits

Urban Horticulture

The effect of plants on the urban environment and vice versa. Selection, establishment and management of vegetation in difficult sites. Use of vegetation for soil reclamation and stabilisation. Motorway planting schemes. Wildflower meadows. Weed control, mulches. Machinery in urban horticulture.

Landscape and Turfgrass Management I

Landscape Management:

Management plans, maintenance schedules, cost estimation, computers and management. Case studies.

Arboriculture:

Tree selection, tree planting, post planting management, tree surveys, tree surgery, trees and the law. Trees on development sites. Mechanisation and arboriculture. Urban woodland.

HORT 3011 Landscape Design Theory II and Professional Practice and Planning Law I **6 Credits**

(i) *Landscape Design Theory II (4 credits)*

The landscape design process from project inception through to completion. Perception of landscape. Landscape processes. Landscape design principles for specific situations and specialised areas of design. A study of the materials of the designed landscape, considering the selection, specification and detailing of elements of the hard landscape.

(ii) Professional Practice and Planning Law I (2 credits)

The concept of professionalism and the landscape consultant. An introduction to professional organisations relevant to the landscape consultant (ILI, LI, IOH). Office organisation and administration. An introduction to contracts. Project costing. The preparation of specifications and bills of quantity. Contract administration and site supervision.

HORT 3012 Landscape Design Studio II **12 Credits**

Students undertake a range of design projects under the guidance of staff in Landscape Horticulture. These include studio projects of various lengths which aim to encourage and develop the ability to translate design theory and principles into practical landscape design exercises.

HORT 3202 Professional Work Experience **12 Credits**

This will be acquired between the start of the Trinity Term of the third year and the start of the Michaelmas term of the fourth year. Students are required to obtain two placements, preferably one in landscape management and one in landscape design. Students must submit a work diary, journal and a series of sketches.

SLSC 3003 Soil Science IV **4 Credits**

An outline of the morphological, physical and chemical properties of soils (both organic and mineral) with special reference to their potentials and limitations for amenity, recreational and engineering uses; soil genesis and the relationship between soils and geology, landscape features, hydrology and climate; discussion on soil surveys and classification systems; land capability and engineering classification systems; fertilizers in landscape horticulture; soil-root-fertilizer interactions. Soil management and interpretation for town and country planning.

FOURTH YEAR

AERD 4006 Communications II **6 Credits**
As for the degree programme in Agribusiness and Rural Development.

AESC 4002 Plant Protection II **6 Credits**
Plant Pests
Introduction to the classification, structure, physiology and biology of the major animal groups of horticultural importance - Annelida, Nematoda, Mollusca, Arthropoda and Chordata.

Nature and incidence of pest outbreaks and principles of control. Properties, formulation and application of pesticides; pesticide resistance and environmental hazards. Non-chemical pest control: cultural, physical and biological methods. Pest management concepts.

Identification, biology and ecology of the arthropod, nematode, avian and mammalian pests of herbaceous and ornamental plants in the interior and exterior landscape. Pests of turf sports and recreational areas. Nature of damage caused and control options.

Plant Pathogens
Economic and social impact of plant diseases: sources of loss and effects on the landscape. Symptoms and signs; infectious disease vs. non-infectious disorders. Koch's postulates. Symptomatology, etiology and control of diseases of ornamental and landscape plants. Epiphytology. Disease control: regulatory, cultural and biological methods, protective and eradicative chemicals.

ERM 4003 Environmental Impact Assessment **4 Credits**
As for Environmental Impact Assessment of ERM 4001 in the degree programme for Agricultural and Environmental Science.

HORT 4003 Landscape and Turfgrass Management II **4 Credits**
Turfgrass Management
This course will deal with the taxonomy and physiology of amenity and sports turfgrass, grass identification; choosing grasses for turf use; seed quality and mixtures for intensive/non-intensive use; seeding versus turfing.

Cultural practices to include earthworks, grading, drainage and construction of sports pitches, bowling greens, tennis courts, golf courses and artificial playing surfaces. Mechanisation to include mechanical operations - mowers and mowing, aeration and equipment, thatch removal and control, top dressing applicators, irrigation and irrigation systems, line marketing and methods, rolling and its effects.
Fertilizer and lime application, running repairs and renovation, maintenance of specific areas.

Pest, disease and weed control in turf - cultural and chemical methods.

HORT 4009 Landscape Planning 4 Credits
An introduction to planning. A study of the development of landscape planning internationally and in Ireland. The emergence of Statutory Planning. An introduction to the relevant planning acts and environmental designations. Landscape assessment as part of landscape planning.

HORT 4010 Landscape Design Theory III and Professional Practice and Planning Law II 6 Credits

(i) Landscape Design Theory III (4 credits)
Examination of the contemporary issues in landscape design involving a study of a range of specific landscapes including housing, industrial and business parks, roads, landscapes associated with leisure activities, utilities and waterways.

(ii) Professional Practice and Planning Law II (2 credits)
General principles of law, professional responsibilities and liability, law of contract, warranties, bankruptcy, disputes, claims, nominated subcontractors, landscape contracts, bonds, arbitration, private land law, public land law, development plans and development control, special rights over land, basic principles of tort.

HORT 4011 Landscape Design Studio III 12 Credits
Students undertake a series of design-based projects aimed at developing a range of design skills in relation to relatively large scale and complex landscape issues and problems demonstrating a combination of technical, aesthetic, social and economic competence and realism. Students work individually and in groups. Each student undertakes an individual design thesis.

HORT 4051 Landscape Research Project 10 Credits
Students select a research project in the area of Landscape Horticulture or a related subject.

HORT 4101 Electives 8 Credits

IX. FORESTRY

FIRST YEAR

As for the degree programme in Animal and Crop Production.

SECOND YEAR

			Credits
AERD	2001	Agribusiness	6
AESC	2001	Agricultural and Environmental Biology	8
AESC	2004	Plant Physiology	4
ENGT	2012	Engineering and Surveying	4
FDSC	2006	Agricultural Chemistry IV	4
FOR	2001	Forest Mensuration and Biometrics	8
FOR	2004	Fundamentals of Forestry	8
FOR	2005	Silviculture I	6
INDM	2005	Agricultural Microbiology	6
SLSC	2002	Soil Science I	6
			60

THIRD YEAR

			Credits
AERD	3010	Communications III	4
AESC	3006	Forest Protection	6
FOR	3002	Forest Harvesting	4
FOR	3005	Computer Applications	4
FOR	3006	Forest Management	4
FOR	3008	Silviculture II	8
FOR	3009	Wood Science	4
FOR	3010	Remote Sensing and GIS	4
FOR	3011	Forest Inventory and Biometrics	4
FOR	3100	Electives	6
FOR	3201	Professional Work Experience	12
			60

FOURTH YEAR

			Credits
FOR	4002	Forest Inventory and GIS Project	10
FOR	4003	Forest Management Plan	12
FOR	4004	Forest Planning	6
FOR	4005	Experimental Design	4
FOR	4051	Research Project	16
FOR	4100	Electives	12
			60

* * * * * * * * *

FIRST YEAR

As for the degree programme in Animal and Crop Production.

SECOND YEAR

AERD 2001 Agribusiness **6 Credits**
As for the degree programme in Animal and Crop Production.

AESC 2001 Agricultural and Environmental Biology **8 Credits**
As for the degree programme in Animal and Crop Production.

AESC 2004 Plant Physiology **4 Credits**
As for the degree programme in Agricultural and Ennvironmental Science.

ENGT 2012 Engineering and Surveying **4 Credits**
As for the Landscape Horticulture degree programme.

FDSC 2006 Agricultural Chemistry IV **4 Credits**
As for sections of 'Agricultural Chemistry II' in the Animal and Crop Production degree programme.

FOR 2001 Forest Mensuration and Biometrics 8 Credits

Mensuration

Land parameter estimation. The National Grid. Use of a compass. Slope correction factor. Mapping resources. Concept of a geographic information system (GIS).

Individual tree, diameter, height, form, volume, assortment and value estimation. Volume-basal area theory and application. Volume estimation for sale. Complete enumeration. Tariff system. Volume and length assortments.

Biometrics

Principles of sampling forest populations, parameter estimation and statistical inference. Simple random sampling with and without replacement. Estimation of the mean, variance, standard deviation, variance of the mean and standard error of the mean, and the 95% confidence intervals for the mean for continuous and discrete weighted variables. Sample size theory and application.

Bivariate statistics: sum of cross products, covariance and correlation. Discrete and continuous probability density functions. The uniform, normal, standard normal, and student probability distributions.

Forest mensuration and biometrics applications of Microsoft Word and Excel.
Software: Microsoft Word and Excel. Windows 95.

FOR 2004 Fundamentals of Forestry 8 Credits

Natural forests. Plantations. The structure and growth of trees. Stand development. The forest environment. Ecological conditions of forest development. Evolution, conservation and management of naturala woodlands. Forest land in Ireland. Silvicultural characteristic and natural range of tree species. Species selection. Forest seed supply. Provenances. Tree breeding programmes. Certification of forest reproductive material. Dendrology. Wayside and woodland trees in spring, summer, autumn, winter. Characteristics of leaf, twig, bud, bark and stem. Varieties, cultivars, hybrids and provenances. Keys to the common broadleaaved and coniferous trees. The silvicultural management of a range of tree species including oak, beech, sycamore, ash, spruce, pine, fir and minor species.

FOR 2005 Silviculture I 6 Credits

Site evaluation. Site classification systems. Site factors and species productivity. Nursery practice. Planting stock production. Site amelioration. Plantation establishment. Stand management.

INDM 2005 Agricultural Microbiology 6 Credits

As for the degree programme in Animal and Crop Production.

SLSC 2002 Soil Science I 6 Credits

As for the degree programme in Animal Science.

THIRD YEAR

AERD 3010 Communications III **4 Credits**

Definition of communications and its role in agricultural and rural development and in agribusiness organisations.

Written communication methods: principles of effective writing; essay and technical report writing; business writing – letters and business reports; the CV; writing for the press.

AESC 3006 Forest Protection **6 Credits**

Concept of plant disease. Symptoms and signs. Biotic agents (fungi, bacteria, viruses, mycoplasma-like organisms) causing disease. Epiphytology. Symptomatology, and etiology of important tree diseases.

Control and assessment of diseases in forest nurseries and plantations. Biology and control of the major groups of pests of importance in forestry. Mammals and birds in forest areas - biology, pest status and damage control measures.

FOR 3002 Forest Harvesting **4 Credits**

Harvesting systems: Harvest planning. Mechanisation: machine reliability. Ergonomics. Work/time study techniques. Forest machine costings. Amenity constraints in harvesting. Forest roads: Optimal road spacing. Road construction and maintenance. Drainage. Forest operations analysis: Model building. Introduction to linear programming. Transportation and assignment algorithms. Computer analysis of forestry applications. Sensitivity analysis.

FOR 3005 Computer Applications **4 Credits**

As for the Food Science degree programme.

FOR 3006 Forest Management **4 Credits**

Forest valuation: Valuation principles. Purpose of valuation. Economic basis for valuation. Interest and calculation of interest. Financial criteria in forest valuation and management. Costs and revenues. Price-size relationships. Calculation of net discounted revenue and soil expectation value. Application to land purchase. The financial rotation. Effect of time scale and discount rate. The felling decision. Valuation of non-timber products in forestry. Intangible benefits. Management of forests: Historical development of forest management. The scope of forest management. Objects of management. Functions of the forest: Environmental, socio-cultural and production. Types of produce. The rotation. Kinds of rotation. Sustained yield. The normal forest. Organisation of forests: Administrative and territorial organisation. Growing stock and increment. The yield and its regulation. The preparation of management plans.

FOR 3008 Silviculture II **8 Credits**

Silvicultural systems. Forest regeneration, timber production, forest protection, amenity preservation and landscape maintenance using various silvicultural systems. Farm forestry. Urban forestry. Agriforestry. Shelterbelts. Biomass plantations. Windthrow. Frost. Fire.

Each student must undertake a case study examination of a selected site for the purpose of evaluating its potential for afforestation. Factors of site productivity and accessibility will be taken into consideration in preparing a financial analysis for valuation purposes. A development plan for the site will be prepared with emphasis upon plantation design and scheduling of operations. A written report must be lodged with the Professor of Forestry.

FOR 3009 Wood Science **4 Credits**

Structure and properties of wood. The chemical structure of wood. Saws and sawmilling. Recovery, waste management, finishing and value-added. Wood drying, wood preservation. Pulping methods. Board materials.

FOR 3010 Remote Sensing and GIS **4 Credits**

Fundamental concepts of remote sensing and Geographic Information Systems (GIS).
Digital interpretation of OS raster maps and orthophotos. Development of hands-on GIS computer skills of point, line and polygon theme and attribute table creation within ArcView 3.1. GIS skills of joining dbf databases to theme attribute tables. Building GIS queries. Integration of vector, raster and attribute GIS databases. Specification of GIS database structure. Digital area and perimeter estimation.
Application of remote sensing and GIS in forest, agricultural and environmental resource inventory. Applications of GIS skills in forest inventory, the Rural Environmental Protection Scheme (REPS) and spatial resource inventory and design. Development and group presentation of individual GIS projects in ArcView.
Software: ArcView 3.1. Microsoft Excel. Windows 95.

FOR 3011 Forest Inventory and Biometrics **4 Credits**

Inventory: Concept of yield class, marginal thinning age, age of maximum mean annual increment and biological maturity. Use of yield models for forest management. Thinning types, marginal thinning intensity and normal thinning period and yield. Thinning control.
Volume estimation for inventory purposes using fixed area plots, yield models, stand volume alignment charts, crop form height, point samples and abbreviated tariffing.
Application of volume estimation techniques in the forest inventory.

Biometrics: Fundamental equation of regression analysis. Method of least squares and parameter estimation. Hypothesis testing and biological interpretation of the analysis of variance. Volume and volume assortment estimation using regression.
Variance of discrete distributions and linear functions. Theory and application of stratified random, systematic and double sampling. Probability proportional to size (PPS). Probability proportional to prediction (3P). Point sampling.
Application of volume estimation techniques in the forest inventory. Analysis and reporting of archive forest inventory data using Microsoft Excel.
Software: Microsoft Word and Excel. Windows 95.

FOR 3100 Electives **6 Credits**

FOR 3201 Professional Work Experience **12 Credits**

Each student is required to undertake professional work experience in the period between the end of the Hilary term in the Third Year and the beginning of the Michaelmas term in the Fourth Year.

The work experience normally includes: Nursery practice, plantation establishment and management, harvesting, wood processing and forest amenity. Students' initiative to organise work experience within the private forest sector, both in Ireland and abroad, is greatly encouraged.

FOURTH YEAR

FOR 4002 Forest Inventory and GIS Project **10 Credits**

An inventory is carried out of an environmentally sensitive commercial forest estate as a group exercise. The group will objectively quantify the spatial distribution, composition and dynamics of the forest resources including the growing stock, the roads, the water, the soils and the vegetation.

Spatial distribution: Digital interpretation of OS raster maps, orthophotos and satellite imagery. Digital creation and updating of integrated vector, raster and attribute forest inventory GIS databases in ArcView 3.1. Digital polygon, line and point theme updating of external, compartment and subcompartment boundaries, forest road, watercourse and sample point locations.

Spatial composition: Creation of a sampling area frame and specification of a sampling methodology.

Application of stratified random sampling in the forest. Estimation of the diameter distribution, the parameters of the volume-basal area relationship, the volume, assortment and value distribution at plot, subcompartment and stratum levels.

Creation and analysis of plot, subcompartment and strata attribute databases in Microsoft Excel including quantification of the associated precision of the estimates.

Spatial dynamics: Creation and analysis of the spatial dynamics database of forest growing stock parameters including planting year, age, top height, general yield class, average growing stock, marginal thinning age and age of maximum mean annual increment.

Joining selected components of the spatial distribution and dynamic databases as dbf files to selected themes within ArcView 3.1. Creation and printing of maps of the main forest parameters from the GIS.

Reporting: Production and presentation of two forest inventory and GIS reports. The first report should concentrate on the methodology used with numerous illustrative examples. The second report should present the forest inventory and GIS results for the entire forest including interoperation of the results and digital databases.

Software: ESRI Arcview 3.1. Microsoft Word and Excel. Windows 95.

FOR 4003 Forest Management Plan 12 Credits

Forest Management Case Study: Each student must undertake a case study of an actual forest area and in compliance with stated resource and financial constraints produce a written management plan for a prescribed period. The plan will incorporate a description of the site and an inventory of growing stock, analyses of the data and prescriptions for the planning period relating to yield regulation, harvest scheduling, silvicultural practices and forest protection. The report must be lodged with the Professor of Forestry.

FOR 4004 Forest Planning 6 Credits

Principles of forest planning. Methods of planning. The fundamentals of decision-making. Applications of decision-making techniques to forest management. Decision Theory and Decision Trees: expected value of perfect information; utilities and decision-making under conditions of risk and uncertainty; sensitivity analysis; sequential decisions; decision trees; dynamic programming. Capital Budgeting: evaluation and ranking of investment proposals for purchase and replacement of harvesting equipment. Break-Even Models in Forest Harvesting: graphic and algebraic solutions; use of break-even analysis in forestry. Linear Programming: applications in harvest scheduling and yield regulation, forest road construction and transhipment problems. Integer and goal programming. Network Analysis in Forest Harvesting: transportation networks; minimum flow, shortest distance, minimum spanning tree. Project Management: critical path method; project evaluation and review technique, project crashing. Inventory Control in Forestry: the economic order quantity model; quantity discounts; production lot size model.

FOR 4051 Research Project 16 Credits

Each student must undertake an approved project and write a dissertation. Projects may be from any of the following Forestry areas: Forest Zoology, Forest Soils, Forest Chemistry, Forest Botany, Forest Economics, Forest Engineering, Forest Mensuration, Forest Management, Silviculture, Plant Pathology, Wood Technology, Wood Anatomy, Forest Harvesting and Forest Products. The report must be lodged with the Professor of Forestry.

Regulations for Research Project:

1. The student will submit his/her proposal to the Professor of Forestry.
2. A Project Committee appointed by Faculty and consisting of the Professor of Forestry (who will be Convenor) and Heads of other Departments will consider the submissions.
3. Where the approved topic is taken in a Department other than the Department of Crop Science, Horticulture and Forestry, the Project Committee will arrange the necessary facilities and for the joint supervision and examination of the project.
4. The student will write a dissertation on the approved topic.
5. The project will normally consist of:
   (a) A literature review.
   (b) A laboratory or field study.
   (c) Supporting course work if available and appropriate.
   (d) Written report or dissertation.
6. The dissertation must be lodged with the Professor of Forestry.
7. The examination will be conducted by the Professor of Forestry and the Forestry Extern.

FOR 4005 Experimental Design **4 Credits**
As for the Agricultural and Environmental Science degree programme.

FOR 4100 Electives **12 Credits**

SYLLABUS OF ELECTIVE COURSES

The elective courses offered by the various Departments of the Faculty are listed below. Students may select from these courses to fulfil the elective requirement of their chosen degree programmes (see the 'Syllabus of BAgrSc Programmes).

While all courses listed will normally be available for student selection, on occasion individual elective courses may be withdrawn at the discretion of the Faculty. Students should also note that choice of elective courses may be restricted by reason of one or more of the following:

(a) Prerequisite requirement for certain electives;
(b) Timetabling constraints;
(c) Minimum or maximum limits on the number of students taking a particular elective course.

Note:
Certain 'core' courses in individual degree programmes are available as elective courses to students not taking the degree programme concerned; selection of such 'core' courses as electives is subject to approval by the Heads of the Departments concerned and the constraints listed above.

AGRIBUSINESS, EXTENSION AND RURAL DEVELOPMENT

AERD 3001 Business Law **2 Credits**
As for the Agribusiness and Rural Development degree programme.

AERD 3003 Co-operatives **2 Credits**
As for the Agribusiness and Rural Development degree programme.

AERD 3007 Operations and Personnel Management **4 Credits**
As for the Agribusiness and Rural Development degree programme.

AERD 3008 Quantitative Methods **4 Credits**
As for the Agribusiness and Rural Development degree programme.

AERD 4012 Taxation **2 Credits**
As for the Agribusiness and Rural Development degree programme.

AERD 4101 Project Development and Management **4 Credits**
Projects and programmes as tools of development. Identifying development needs at community and area level. Project components and project cycle. Planning the project (including feasibility and appraisal). Management of the project; managing time and people; monitoring; liaison with support bodies and groups. Evaluation criteria and methods. The content of this course is supported throughout by examples of development projects.

AERD 4104 Farm Input Marketing **2 Credits**
Extent and characteristics of farm supply markets served by Irish agribusiness firms; structures of the industries serving these markets, competitive issues and appropriate business and marketing strategies; operational aspects of marketing such as selling techniques, distribution and salesforce management.

AERD 4106 Food Marketing **2 Credits**
Extent and characteristics of food markets served by Irish agribusiness and food firms; structures of the industries serving these markets, competitive issues and appropriate business and marketing strategies; operational aspects of marketing such as selling techniques, distribution and salesforce management.

AERD 4110 Farm Management **2 Credits**
Objectives and goals of the farm manager, farm management functions, farm family life cycle. Farm accounting definitions and analysis techniques; planning and enterprise budgets, direct payments, REPS and other State supports. Farm management control, computerisation and IT; alternative enterprises, farm labour and risk analysis, part-time farming.

AERD 4150 Elective Project I **2 Credits**

AERD 4151 Elective Project II **4 Credits**

AGRICULTURAL AND FOOD ENGINEERING

ENGT 4107 Buildings for Animal Production and Crop Storage **4 Credits**
Farmyard design and layout. Animal production buildings including environmental control systems. Milking parlours. Management of animal manures. Crop storage buildings. Structural elements in agricultural buildings. Services. Environmental and planning legislation and protection pertaining to agriculture.
Note: This course has a basic input with regard to 'Crop Storage Buildings' at present.

ENGT 4108 Forest Engineering **4 Credits**
As for Forest Engineering section of ENGT 4007 in the Engineering Technology degree programme.

ENGT 4150 Elective Project I **2 Credits**

ENGT 4151 Elective Project II **4 Credits**

ANIMAL SCIENCE AND PRODUCTION

ANSC 3012 Fundamentals of Biotechnology 2 Credits
As for the Animal and Crop Production degree programme.

ANSC 4101 Advanced Beef Production 4 Credits
This course addresses current changes in beef production practices as affected by developments in science and technology relating to all aspects of production and evolving market demands. Specific areas dealt with include: (i) veal production; (ii) cereal beef; (iii) bull beef; (iv) cull cows and replacement strategies; (v) manipulation of growth and efficiency; and (vi) update on nutritional and metabolic problems.

ANSC 4102 Advanced Dairy Production 4 Credits
This course develops selected topics from the Dairy Husbandry section of Animal Husbandry IV which is a prerequisite. Topics selected usually include grassland management, concentrate feeding, dairy breeding, economics/management and diseases/disorders. The course includes a project usually based on a case study of a dairy farm.

ANSC 4103 Advanced Sheep Husbandry 4 Credits
This elective covers in greater depth the areas covered in the core course and also includes new topics. The major components include energy and protein nutrition, sheep production in northern Europe and in the Mediterranean areas, store lamb finishing, breeding from ewe lambs, intensive lamb production, ingredients used in sheep rations and wool growth, wool faults and characteristics.

ANSC 4104 Advanced Swine Production 4 Credits
This course will deal more comprehensively with the science and practice of pig production than what is studied in the core course. This course will also address areas which are not covered in the core course as well as dealing with changes in swine production as affected by development in research relating to all aspects of pig production.

ANSC 4105 Applied Animal Physiology 4 Credits
This course deals with aspects of applied reproductive technology in farm animals, examining means of improving reproductive efficiency. A literature review will account for 50% of the marks.

ANSC 4106 Equine Husbandry 4 Credits
This course is designed to give the student a basic understanding of horse production in Ireland. The topics covered in the course are: evolution of the horse; development of the horse in Ireland; anatomy of skeletal and digestive systems; systems of horse production; nutrition and feeding of horses; grassland management for horses; housing for horses; reproduction and breeding management; artificial insemination and embryo transfer; dentition and ageing; the sport horse industry; marketing the Irish horse.

ANSC 4107 Feed Formulation and Quality Control 2 Credits
This course deals with the compound feed industry in Ireland, dealing with aspects such as the structure of the compound feed industry, raw materials, formulation of rations, legislation governing ration formulation, quality control/assurance and plant layout and design. While Animal Nutrition I is not an absolute prerequisite, it is strongly recommended.

ANSC 4109 Animal Behaviour & Welfare 2 Credits
This course corresponds to the Animal Behaviour and Welfare sections of the course ANSC 4002 Animal Husbandry V.
Behaviour of the newborn, acquired or innate behaviour, social, sexual aggressive, ingestive and other forms of behaviour. Factors affecting behaviour and the role of behaviour in animal production. Definition of animal welfare. Areas of concern. Transport of animals. Role of behaviour/abnormal behaviour in assessing welfare.

ANSC 4113 Elective Project I 2 Credits

ANSC 4114 Elective Project II 4 Credits

CROP SCIENCE, HORTICULTURE AND FORESTRY

CPSC 4101 Developments in Cereal Production 4 Credits
An in-depth study of development and innovation in cereal production; trial work in Ireland and abroad; varietal evaluation at national and international level; cereal holding and storage systems; optimum disposal of cereal products; critical examination of cereal quality and the factors influencing it under Irish conditions. Students prepare a paper on an aspect of cereal production and topical interest. They visit processing plants and laboratories, seed testing and certification plants and commercial cereal farms.

CPSC 4102 Developments in Grassland 2 Credits
Detailed examination of certain topics outlined in the 'Grassland' section of CPSC 4001 Crop Husbandry III in the Animal and Crop Production degree programme.

CPSC 4103 Organic Agriculture and Horticulture 2 Credits
Definition and role of organic farming; organic standards; converting to an organic system; rotations, cultivations, soil fertility; manure management, composting, green manuring; pest, weed and disease control; marketing organic produce; principles of organic livestock management.

CPSC 4104 Root and Alternative Crop Development 4 Credits
Detailed examination of specific aspects of the core course in Crop Husbandry; attention to research data on potatoes and sugar beet; critical evaluation of the production and utilization of forage and root crops for animal feed, e.g. fodder beet, swedes, kale and catch crops. Details and potential of crops not commercially grown, e.g. flax, lupins, triticale, durum wheat etc; consideration of factors such as climatic suitability, rotation, yield reliability, marketing and end product usage.

CPSC 4105 Weed Control 4 Credits
Origin, dispersal and establishment of weeds; effect of weeds on crop yields; factors influencing the spreading of weeds; emphasis placed on control measures, both cultural and chemical.

CPSC 4109 Agricultural Climatology and Meteorology 2 Credits
As per the Agricultural Climatology/Meteorology section of HORT 2006 'Fundamentals of Horticulture'.

CPSC 4150 Elective Project I 2 Credits

CPSC 4151 Elective Project II 4 Credits

FOR 3010 Remote Sensing and GIS 4 Credits
As for the core couse in the Forestry degree programme.

FOR 4105 Forest Landscape Design 2 Credits
Aesthetic and amenity design guidelines for forestry. Landscape assessment procedures for use in forest landscape planning and design control. Management and economic implications of design prototypes. Introduction to the possibility of diversifying silvicultural systems to maximise aesthetic quality but taking cognisance of commercial concerns. Consideration of public attitudes and preferences regarding forest landscape issues.

FOR 4106 Forest Management Techniques 2 Credits
Advanced Operations Research Techniques for use in forest management. Multiple-use management, goal programming, harvest scheduling and timber allocation. Integration of GIS system in forest management. Risk analysis.

FOR 4108 Forest Policy 2 Credits
The history of forestry in Ireland. Indigenous tree species and forests. Early clearance. Planting from middle ages onwards. Planting in Ireland and forest policy from the foundation of the State to the present day. Land-use policy from the middle ages to the present. Forest law. The 1946 Forestry Act. The 1990 Forestry Act. The Forestry Service and Coillte Teo.

Forest policy in the EU. EU incentive schemes and their impact upon forestry in Ireland. Environmental guidelines and sustainable development.

FOR 4109 Forest Roads 2 Credits
Forest road location and construction will be covered. The interaction between plantation design and road network layout will be analysed. Examples of computer-aided road network location will be discussed. Road construction methods, road building materials and equipment will be covered.

FOR 4110 Forest Tree Improvement 2 Credits
Population genetics: natural selection, gene frequencies, natural variation among populations, causes and kinds of genetic variability, natural hybridisation. Tree improvement: genetic variation due to provenance, provenance testing, intra-specific tree breeding – the concept of heritability and genetic gain, classical tree breeding strategies, modern tree breeding strategies. Intra-specific tree breeding – constraints to breeding, the crop and tree idiotype.

FOR 4111 Modelling in Forestry **2 Credits**

Fundamental equation of regression analysis. Assumptions of regression analysis. Basic descriptives and plotting. Simple linear regression. Simple linear model in volume and volume assortment estimation. Multiple regression in matrix notation. Significance tests. Extra sum of squares principle. Partial F tests. Model building strategies. Applications of multiple regression models to forest parameters.

Non-linear parameter estimation. Differential and integral form of growth models: Simple Exponential, Monomolecular, Logistic, Von Bertallanfy, Chapman-Richards. Applications of non linear models. Growth and yield models. Report on modelling in forestry.

FOR 4112 Multiple Use Management **2 Credits**

Forest recreation and conservation valuation, contingency valuation, travel cost method, stated preference method, multiple objectives, goal programming, non-timber incentives, biodiversity.

FOR 4114 Multivariate Analysis in Forestry II **2 Credits**

Discriminant analysis. Eigenvalue and eigenvector estimation and interpretation. Testing the significance of non-zero eigenvalues and dimensionality. Linear discriminant functions. Reduction of dimensionality. Classification criteria. Minimum distance. Mahalanobis distance. Cluster analysis, Bayes rule. Adapted Bayes rules. Applications of multivariate techniques in forestry, agriculture, environment and remote sensing.
Use of Excel. SAS. Mathematica. Report on multivariate analysis in forestry.

FOR 4115 Physiological Ecology of Forest Production **2 Credits**

Environment and plant growth and development. Carbon utilisation and dry matter production. Forest ecophysiology - succession, competition etc. Case studies in seed biology. Tree improvement; nurseries.

FOR 4117 Remote Sensing for Stand Management **2 Credits**

Sampling of stands from preplanting, establishment, thinning and clearfelling. Stratification of sites suitable for forestry using remote sensing. Sampling stocking and rate of canopy closure using satellite remote sensing. Classification of closed canopy forests using satellite imagery and ground sampling. Standing crop and thinning volume estimation using remote sensing. Quantitative thinning control in the forest. Report on sampling and remote sensing for forest stand management.

FOR 4118 Silvicultural Systems **2 Credits**

High forest systems, selection systems and coppice systems. Clear cutting systems. The uniform system, group systems, wedge systems and irregular shelterwood systems. The selection system of silviculture. Two storied high forest. The coppice system and coppice with standards.

FOR 4119 Special Forestry Crops **2 Credits**

Christmas tree production; biomass production; growing hurley ash; the silviculture of mixtures; veneer oak.

FOR 4120 Stress Grading of Timber 2 Credits

The grading of sawn softwood timber for the construction industry has become the norm in Ireland.

This course will provide basic information on the current methods used to grade timber. It will broadly reflect the Forbairt course which industrial growers are obliged to follow before being allowed to grade timber for the Irish market.

Students will use commercial timber material during the course and learn to appreciate the importance of the skill of timber grading. Information on international grading systems will also be provided.

FOR 4121 The Biology, Silviculture & Management of Sitka Spruce 2 Credits

Taxonomy; natural distribution. Provenance studies; physiology. Nutrition. Ecology. Silviculture. Pathology. Vegetative propagation. Wood properties.

FOR 4122 Wood Utilisation 2 Credits

This course will deal with wood structure and properties. The impact of wood structure and properties in utilisation will also be explored. The microstructure of the major tree species planted in Ireland will be examined and related to the utilisation of these species.

FOR 4123 Advanced Nursery Practice I 2 Credits

The course will focus on bare root nurseries.

Developing a forest nursery - site selection, layout and development, nursery soil characteristics. Managing the soil and water - plant nutrition, use of fertilisers, tissue analysis, organic matter, water management, including irrigation and drainage. Seeds and seedling culture - seedling growth and physiology, bed preparation, seed sowing and early seedling growth, production of transplants, production of other bare-root stock types, cultural practices used to manipulate seedling growth (undercutting, wrenching, top pruning etc.), mycorrhizae management, genetic implication of nursery practices, pest management, weed management. Plant handling and seedling quality. Lifting, including physiological conditions, culling and grading, storage, physical handling, packing and dispatch, evaluating seedling quality.

FOR 4124 Advanced Nursery Practice II 2 Credits

This course will focus on seed biology and container nursery culture.

Seed – provenance, forest reproductive material regulations, seed procurement, seed biology (including dormancy), seed storage and testing. Container production of tree seedlings. Container systems, nursery facilities, seedling nutrition, seedling growth and crop scheduling. Vegetative propagation. Methods of propagation, future developments. Plant handling.

FOR 4125 Agro-Forestry 2 Credits

Classification and concepts, silvoarable, silvopastoral, windbreaks, tropical agro-forestry, economics of agro-forestry systems.

FOR 4126 Biology Silviculture and Management of Broadleaves 2 Credits
Species distribution, natural variation, provenance. Biology and ecology. Tree Improvement. Nutrition and silviculture. Wood properties. Diseases and pests.

FOR 4127 Familiarisation with Forestry 2 Credits
This course is designed to provide advanced undergraduates with a familiarisation of forestry terminology and practices. The course will consist of a series of field trips to sites of forest interest. Field visits will include familiarisation with the common conifer and broadleaved tree species, forest nursery practices, establishment techniques, farm forestry, commercial and environmental forest management. Each student will be required to submit a one page report the day after each field trip which should emphasise an accurate understanding of forest terminology and practices.

FOR 4128 Forest Harvest Scheduling Systems 2 Credits
The course will consist of an overview of harvest scheduling (and timber allocation) systems developed world-wide, including New Zealand, Finland, USA and Ireland. The methodology and relevance for Ireland of each system will be discussed.

FOR 4129 Forestry in Europe 2 Credits
The course will consist of an in-depth analysis of the forestry sector in a number of selected European countries. This analysis will include the resources and their use, the silvicultural systems, forest production, forest economics, management and policy. The main current conflicts and challenges facing forestry in each country are also discussed.

FOR 4130 Sustainable Forest Management 2 Credits
The legal framework; the economic and policy framework; criteria and indicators; measures; certification.

FOR 4150 Elective Project I 2 Credits
Students will carry out a minor project in an approved topic in Forestry.

FOR 4151 Elective Project II 4 Credits
Students will carry out a minor project in an approved topic in Forestry.

HORT 4102 Computer Aided Design **2 Credits**
This elective is directed to students who have an interest in Computer Aided Design. The course is based around a series of demonstrations explaining and carrying out commands which are coupled with a number of class assignments. Candidates will use Computer Aided Design applications on two platforms, both 'Apple' and 'IBM' computers. Students must complete a drawing project for assessment on completion of the course.

HORT 4103 Desk Top Publishing **2 Credits**
This course is designed to introduce students to page design and layout techniques. These are necessary skills for the production of professionally presented documents that would include both textual and graphical information. Quark Xpress is the software application that is demonstrated throughout this elective.

HORT 4104 Exotic Trees and Shrubs **2 Credits**
This is an advanced course and expands on the range of plants suitable for use in the landscape industry, particularly in private work.
Genera to be considered include Magnolia, Erica, Camellia, Rhododendron, Pinus, Acer, Sorbus and lesser known species. The history of plant introduction.
Field trips and project are also included.
This course is taught in alternate years in the Hilary term.

HORT 4105 Floriculture **4 Credits**
Examination of the national and international floriculture industry, including consumption patterns and trading practices. A study of the principles and practices governing the production and marketing of primary, secondary and speciality cut flowers, container grown plants, indoor and outdoor "bulb" crop production and bedding plants, will emphasise the application of recent biotechnologies in variety development and post harvest handling.

Practical sessions will involve demonstrations and industry visits.

HORT 4106 Interior Plantscaping **2 Credits**
This course deals with all aspects of interior plantscaping including the organisation of interior spaces; design criteria of planting and interior decor; construction requirements for planting; preparation of specifications and job costing; environmental factors affecting climatisation and growth; care and maintenance of planting; plant selection and identification.

HORT 4107 Introduction to Landscape Studio **2 Credits**
This elective is available for Horticultural Science students who have completed HORT 3002. It provides an introduction to graphic presentation. Students will undertake studio exercises in presentation and garden design.

HORT 4108 Leisure and Recreation Facilities 2 Credits
Definition of leisure and recreation; leisure and the individual, leisure and society; planning and management of recreational resources for outdoor activities, sports centre management; interpretation of designed landscapes.
This course is taught in alternate years.

HORT 4109 Nursery/Garden Centre Management* 8 Credits
(a) Nursery Management (4 credits)
(b) Garden Centre Management (4 credits)
Syllabus as for the degree programme in Horticultural Science.
** Applies to Landscape Horticulture students only.*

HORT 4110 Photographic Image Editing 2 Credits
The students' first encounter is with a scanning device, with which they will learn the methods involved in converting a hard copy image into a digital photo image. The course also instructs the student how to operate the many and varied art tools for retouching a digital photo image. This is an excellent computer application for producing many different variations of the original image.

HORT 4111 Photography 2 Credits
Intensive course on photographic techniques and equipment taught by staff of the Audio-Visual Centre.

HORT 4112 Plant Biotechnology 4 Credits
An introduction to the principles and practices of micropropagation as applied to commercially important plants. Lectures deal with media composition; explant excision and inoculation, propagule multiplication and establishment on heterotrophic media. Laboratory sessions will cover aseptic technique, medium preparation and explant manipulation.

HORT 4113 Urban Design 2 Credits
Definitions of urban design in the public realm. The concept of design as applied to projects of long duration and large scale. Urban design in history. The concept of civilisation. Early cities, Medieval town plans, ideal cities of the Renaissance, nineteenth- and twentieth-century urban theory. Urban design in detail – historic urban space, modern and contemporary urban space.

HORT 4114 Advanced Pomology 4 Credits
This course covers ten selected concepts in Pomology in detail. Topics may include root, shoot and fruit physiology of temperate, sub-tropical and tropical fruits, microclimatology, micropropagation and aspects of market organisation and regulation. Reading material consists of recently published research papers.

HORT 4115 Garden Restoration 2 Credits
A project based course, researching the history of a garden, park, open space, the contribution of a particular designer, gardener, plant collector or nursery, from documentary and published sources.

ENVIRONMENTAL RESOURCE MANAGEMENT

AESC 4004 Wildlife Management **4 Credits**
As for the Agricultural and Environmental Science degree programme.

AESC 4101 Apiculture **2 Credits**
Scientific basis of bee-keeping; taxonomy, morphology, genetics and behaviour of bees; diseases, management and commercial aspects; demonstration and handling of bee colonies.

AESC 4102 Biology of Zoonoses **2 Credits**
This course deals with the epidemiology and control of human and livestock diseases that involve a significant free-living, vector-borne or zoonotic stage and for which environmental considerations are especially important. The emphasis will be on diseases encountered in Ireland, but where necessary for illustration of principles, tropical diseases such as malaria will also be dealt with. The course will consist of the following components:

Ecology of major parasitic infections of livestock, ecology of parasitic zoonoses, ecology of major non-parasitic zoonoses, immunobiology, principles of epidemiology, epidemiological tools including diagnostics and mathematical models, control measures including general principles, chemotherapy, vaccination and environmental management.

AESC 4103 Forest Pathology **2 Credits**
A lecture and field course concentrating on the recognition, impact and management of the major diseases in Irish forestry. Root and butt rots of plantation and amenity species. Decay and strain in standing and felled trees. Nursery diseases and pathogens of Christmas tree plantations. The potential threat to Irish trees from non-indigenous diseases.

AESC 4104 Livestock Health Products **2 Credits**
The veterinary pharmaceutical industry in relation to the discovery, marketing and use of drugs, vaccines and antibiotics; brief review of the target organisms and their economic importance; a profile of the major companies involved; discovery and marketing strategies; current use of products; drug resistance problems; environmental concerns and innovative approaches for the future.

AESC 4105 Plant Disease Diagnosis **4 Credits**
A laboratory/lecture course on conventional and molecular techniques used in the detection, classification, identification, and quantification of fungal, bacterial and viral plant pathogens. The topics covered in this course include field observations, symptomatology, pathogen isolation and purification, virus inoculation, transmission and host range studies, light and electron microscopy, biochemical assays, immunological assays, DNA and RNA technology and future trends in plant disease diagnosis. The techniques experienced are used in diagnosing selected diseases caused by a range of pathogens.

AESC 4107 Reclamation of Marginal and Damaged Land 2 Credits
General concepts of 'reclamation', 'marginality', 'damage', 'dereliction'; the nature and scale of the problem. Irish incentives and controls regarding habitats, reclaimed, derelict and contaminated land.

Case study analyses: (a) Combating desertification; water availability and irrigation, approaches to salinity problems, flood water farming; (b) Reclaiming land from the sea: small-scale salt marsh reclamation, polders, coastal mangroves; (c) Industrial reclamation: the nature of industrial dereliction, strategies for reclamation, amelioration, revegetation schedules; (d) Pernicious contamination problems: hydrocarbon contamination, chronic ionic toxicity, radioactive residues.

AESC 4108 Remote Sensing and GIS in Environmental Management 4 Credits
The implementation of GIS and remote sensing in specific studies relating to environmental management.

AESC 4109 Molecular Biology and the Environment 4 Credits
A lecture/laboratory course designed to provide a basic understanding of the molecular techniques currently used in studies of environmental biology. The topics covered in this course will include the use of DNA diagnostics, immunodiagnostics, molecular variability and molecular markers in environmental biology. The techniques will include DNA diagnostic, immunodiagnostic, DNA variation, DNA marker, protein marker and protein variation analyses.

ERM 4004 Environmental Issues in Agriculture 4 Credits
As for the Animal Science degree programme.

ERM 4101 Forest Wildlife Management 2 Credits
This course will evaluate the forest habitats for wildlife management and conservation. The course will discuss: (i) the management of individual species, (ii) the general management of the forest area for wildlife, (iii) the importance of tree species, forest structure and age to wildlife, (iv) the value of the forest area for the future conservation of Irish wildlife.

ERM 4102 Forestry and the Environment 2 Credits
Plantation forestry is a relatively new and extensive land use. As such, it is inevitably a matter of controversy and concern. The course will cover the principal issues including atmospheric deposition, its interaction with the forest, the impact of the forest on streamwater ecosystems and the role of forestry in the global carbon cycle. This course includes a one-day field trip.

ERM 4103 Peatland Forestry 2 Credits

Peatland forests are an important component of our plantation forest resource. The course describes the major peatland types, including cutaway peatlands and the techniques used for their afforestation. All aspects of forestry practice, as they relate to peatlands, will be discussed. The environmental aspects of peatland forestry will also be considered including both the impact of harvesting operations and the contribution of peatland forestry to the global carbon cycle. This course includes one full-day field trip.

ERM 4104 Peatland Management 4 Credits

Origin of peat soils, development and distribution of peatlands, classification; stratigraphy, pollen analysis, subpeatian archaeology.

Properties of peat soils for plant growth; degree of decomposition, cation exchange capacity, nutrient relations; moisture characteristics, hydraulic conductivity.

Conservation of peatlands; identification of significant features, characteristics of principal peatland types; impact of arterial and local drainage schemes on hydrological balance.

Mining of peatlands; hand cutting, private machine, industrial; character of operations; nature of residues; drainage systems impact on landscape.

Utilisation for agriculture/horticulture; site selection and suitability, reclamation techniques, deep peat shallow peat areas; development of cutover peatland, nature and significance of subpeat mineral soils; design of drainage systems, installation, incorporation of traditional techniques; cost benefit aspects, problems of peatland agriculture; grass utilization, trafficability, surface subsidence, infrastructure deficiencies.

Afforestation of peatlands; site selection and preparation, crop establishment techniques; management objectives, potential harvesting problems; impact on landscape, interaction with conservation interests; options in relation to peatland utilization; socio-economic aspects, aesthetics, conservation interests.

SLSC 4101 Tree Nutrition and Forest Fertilisation 2 Credits

Nutrient deficiency in forest crops is confined to a limited number of elements. A knowledge of the behaviour of these elements in the soil can assist in the diagnosis of deficiency. Deficiencies are generally site-specific and often predictable. Specific deficiencies can be identified by visual inspection of the foliage. Foliar and soil analysis are useful in the confirmation of deficiency and for the prescription of fertiliser treatment. A limited number of the many fertilisers available on the market today are appropriate for forestry use.

FOOD SCIENCE

FDSC 4009 Fresh and Processed Meat Products I **4 Credits**
As for the Animal Science degree programme.

APPLIED LANGUAGE CENTRE

LANG	**4101**	**Beginners French**	**4 Credits**
LANG	**4102**	**Advanced French**	**4 Credits**
LANG	**4103**	**Beginners German**	**4 Credits**
LANG	**4104**	**Advanced German**	**4 Credits**
LANG	**4105**	**Spanish**	**4 Credits**

POSTGRADUATE
DEGREE/HIGHER DIPLOMA/CERTIFICATE
PROGRAMMES

DEGREE OF DOCTOR OF PHILOSOPHY (PhD)

Candidates for the degree of PhD are required to be admitted by the Faculty on the recommendation of the Professor, or, where appropriate, the Head of Department; their admission must then be confirmed by the Academic Council. Candidates who have not graduated in this University may be admitted if suitably qualified.

No candidate can be allowed to enter on a programme of study and research for the degree of PhD unless he/she has reached a high Honours standard at the examination for the primary degree or presented such other evidence as will satisfy the Professor, or, where appropriate, the Head of Department, and the Faculty of his/her fitness.

Candidates applying for admission to the PhD degree may initially be required to register for the MAgrSc or MSc(Agr) degree. Subject to satisfactory performance on the master's programme and the approval of the Faculty and the Academic Council, such applicants may have their registration upgraded to the PhD degree. This requirement applies particularly to applicants who do not hold a primary degree of high honours standard.

Candidates who are applicants for admission to the degree of PhD in the Faculty of Agriculture and who are not graduates of University College Dublin are required to supply an official academic transcript of their primary and other degrees. Candidates for the PhD degree whose first or native language is not English must provide evidence of competence in both written and spoken English.

The research work for the degree of PhD must be pursued in an area of relevance to Agriculture and under the direction of one or more of the Professors or Lecturers of the academic departments of the Faculty of Agriculture.

The Academic Council, on the nomination of the Professor, or, where appropriate, the Head of Department, and the recommendation of the Faculty, will assign a member of staff to supervise the candidate's research.

Unless permission is given to the candidate by the Academic Council, on the recommendation of the Faculty, to work elsewhere under the general direction of the Supervisor, the research for the degree will be carried out in the department mainly responsible for the subject area concerned.

The candidate shall pursue research for a period of nine terms and shall also follow such programme of study in the University as may be prescribed by the Academic Council on the advice of the Supervisor and the recommendation of the Faculty, unless the Academic Council accepts a period of six instead of nine terms in the case of any such candidate whose attainments, in the Academic Council's opinion, justify it.

The candidate's research must be carried out, and the thesis for the degree must be prepared, under the direction of the Supervisor.

A candidate shall not submit his/her PhD thesis to the University until the final draft of the thesis has been approved for examination by the Supervisor, and such approval has been notified, on the prescribed form, by the Supervisor to (a) the Nominating Professor, or, where appropriate, the Head of Department and (b) the Registrar of University College Dublin. Where a candidate considers that such approval has been withheld unreasonably, he/she may appeal to the President of the University.

Candidates are normally allowed six years (18 terms) from the date of registration to complete the degree. If the degree is not completed within the six years, the candidate must re-apply to the Faculty, presenting justification for an extension.

DEGREE OF MASTER OF AGRICULTURAL SCIENCE (MAgrSc)

Holders of the BAgrSc Degree with Honours shall be eligible to enter for the Degree of MAgrSc. The Faculty may, at its discretion, in certain circumstances, permit the holder of a BAgrSc Degree without Honours, to enter for the MAgrSc Degree. Such a candidate may be required to pass a special entry test.

DEGREE OF MASTER OF SCIENCE (AGRICULTURE) (MSc(Agr))

Candidates for the MSc (Agr) Degree must have the permission of the Faculty of Agriculture to enter the programme and must be holders of a primary degree with First or Second Class Honours (or equivalent) in a Science or other subject of relevance to Agriculture. Candidates who have taken their primary degree in another University may be admitted. Such candidates are required to supply an official transcript of their primary and other degrees. Candidates whose first or native language is not English must provide evidence of competence in both written and spoken English.

REGULATIONS FOR MAgrSc AND MSc(Agr) DEGREES

In addition to the above requirements, the following regulations apply to both the MAgrSc and MSc(Agr) Degrees:

Research work or courses of study for the MAgrSc and the MSc(Agr) Degrees must be pursued in an area of relevance to Agriculture and under the direction of one or more of the Professors or Lecturers of the academic departments of the Faculty of Agriculture.

The MAgrSc and the MSc(Agr) Degrees may be obtained *(a) by thesis (Mode I)* or *(b) by examination (Mode II).*

Mode I: By Thesis

Candidates for the MAgrSc and the MSc(Agr) Degrees *by thesis* must engage for at least three terms, full-time, on prescribed research in the University, or at an approved centre

outside the University, and must submit a thesis on such research. The examiners may require the candidate to submit to an oral examination on the subject matter of the thesis. In cases where the candidate cannot devote his/her full time to research, a minimum of six terms will be required as fulfilment of the requirements.

Candidates for the MAgrSc and MSc(Agr) Degrees will normally be allowed twelve terms (4 years) from the date of registration in which to complete the degree. If they have not done so within that period, they must re-apply to the Faculty, presenting justification for an extension.

Mode II: By Examination

Candidates for the MAgrSc and the MSc(Agr) Degrees *by examination* must attend a prescribed programme in the University for at least three terms and pass a written examination set on the programme. Where candidates are not following one of the 'designated areas of study' (eg Food Science), they must follow a prescribed programme of study approved by one or more of the Professors or Lecturers of the academic departments of the Faculty of Agriculture, the Faculty and the Academic Council and subject to the relevant Marks and Standards for the MAgrSc Degree and MSc(Agr) Degree (Mode II). Candidates may be required to submit a dissertation on a project undertaken as part of their programme and this dissertation will be taken into account by the examiners in making their recommendation.

Candidates for the MAgrSc and the MSc(Agr) degrees by examination (Mode II) will normally be allowed three years (nine terms) from the date of registration in which to complete the degree. If they have not done so within that period the candidate must re-apply to the Faculty, presenting justification for an extension.

HIGHER DIPLOMA

Candidates for a Higher Diploma must have the permission of the Faculty of Agriculture to enter the programme. Candidates must normally be holders of a primary degree or its equivalent in an area of relevance. In specific programmes additional criteria may be required for registration. Candidates who have taken their primary degree in another University may be admitted. Such candidates are required to supply an official transcript of their primary and other degrees. Candidates whose first language is not English must provide evidence of competence in both written and spoken English.

Candidates for Higher Diplomas will normally be allowed two years (six terms) from the date of registration in which to complete the Higher Diploma. If they have not done so within that period candidates must re-apply to the Faculty, presenting justification for an extension.

MASTER OF SCIENCE (AGRICULTURE) IN ENGINEERING TECHNOLOGY

A postgraduate programme in Engineering Technology is offered by the Faculty in conjunction with the Department of Agricultural and Food Engineering leading to the Degree of MSc(Agr) by Mode II. Entry requirements are as for the MSc(Agr) Mode II degree.

The programme is designed to provide a comprehensive understanding of the engineering technology involved in food processing and manufacture, food production and natural resources.

The programme comprises lectures, tutorials and project with a duration of one academic year followed by a project completion period of three months.

Applications should be submitted to the Academic Director, Engineering Technology Programme, Faculty of Agriculture, University College Dublin, Belfield, Dublin 4.

PROGRAMME

AFEN 3001 Process Engineering Principles 8 Credits
Basic modes of heat transfer in foods. Heat exchangers. Heat transfer with phase change. Mass balances in food separation processes including: distillation, leaching, filtration, ultrafiltration, reverse osmosis, electrodialysis, centrifugation. Psychrometrics in food systems. Process laboratory practicals. Computer applications.

ENGT P001 Product and Process Development 12 Credits
Food product and process development incorporating sensory analysis, colour measurement, principal component analysis, statistical analysis, new products, shelf life analysis, plant layout, process engineering, quality control. Laboratory practicals.

ENGT P002 Project 24 Credits
Each student undertakes a major project under the direction of a supervisor, the findings of which are presented in the form of a written dissertation.

36 Elective Credits from the following:

ENGT P003 Food Process Engineering 12 Credits
Unit processes, heat and mass transfer systems in food processing including pasteurisation, sterilisation, dehydration, freezing, fermentation, crystallisation, extrusion, emulsification, microwave and dielectric heating. Physical, chemical and microbiological changes in foods. Packaging and storage. Integrated food processing systems. Assignments.

ENGT P004 Food Manufacturing Technology 12 Credits
Plant layout with reference to food processing systems. Environmental impact. Food legislation. Energy in processing. Boilers and steam plant. Refrigeration. Water and waste water services. Electrical installations. Quality assurance in food processing. ISO 9000. Sensors in food process automation. Assignments.

ENGT P005 Buildings and Environment 12 Credits
Siting of food facilities. Environmental control systems. Food storage. Reinforced concrete. Structural steel. Animal production buildings. Milking parlour design. Building services. Management and disposal of animal manures. Technologically advanced methods of manure management. Rural roads. Computer applications. Assignments.

ENGT P008 Environmental Engineering 12 Credits
Legislation, water and waste-water treatment, solid waste, atmospheric emissions, noise, IPC licensing, environmental management and auditing. Land as a waste treatment and disposal medium, hydrology, treatment processes in the soil, design. Tutorials. Assignments.

ENGT P009 Precision Agriculture and Control 12 Credits
*Precision Agricul*ture
Global Positioning Systems (GPS), Geographic Information Systems (GIS), sensors, yield maps, variable rate technology, satellite imagery, decision support, soil and environmental properties. Assignments.

Control
Modelling dynamic systems, system response, feedback control. Instrumentation, measurement of pressure, flow and temperature, compact data loggers. Programmable logic controller (PLC) technology. Assignments.

MASTER OF SCIENCE (AGRICULTURE) IN ENVIRONMENTAL RESOURCE MANAGEMENT

This one year, full-time programme leads to the Degree of MSc(Agr) (Mode II) in Environmental Resource Management and provides postgraduate training in the development and utilization of land resources in an environmentally sensitive manner. The programme is concerned with the nature, utilization and conservation of land and biological resources, the impact of agricultural and industrial activities on the environment, and the planned development and management of the rural resource.

The programme is designed to accommodate candidates with a variety of academic qualifications including primary degrees in Agriculture, Engineering, Geography, Economics and Science. Insofar as is feasible, the programme content will be adjusted to take account of the background, interests and long-term aspirations of individual students.

Entry requirements are as for the MSc(Agr) Mode II degree. The programme comprises nine months of formal teaching followed by a three month project.

Applications should be submitted to the Academic Director, Environmental Resource Management Programme, Department of Environmental Resource Management, Faculty of Agriculture, University College Dublin, Belfield, Dublin 4.

PROGRAMME

ERM P001 Environmental Management Sciences 12 Credits
Principles of ecology and conservation; wildlife management; environmental ethics and education; management concepts; conservation strategies; sustainability and biodiversity; environmental engineering; environmental monitoring and analysis; data processing and ecological modelling.

ERM P002 Land Utilization 12 Credits
The nature and properties of land and landscapes; remote sensing and GIS; landscape evaluation; soil suitability and land use options; soil conservation; land improvement; fundamentals of major land management systems; land reclamation.

ERM P003 Resource Planning 12 Credits
Principles and techniques of rural-planning and design; criteria in countryside management; environmental policy and legislation; environmental impact assessment; resource allocation; resource and environmental economics; EU funding; local development; alternative enterprise; rural tourism.

ERM P004 Field Study 12 Credits
A nine month guided group project addressing a topic of relevance to some local community, culminating in the production of a report and recommendations for local implementation.

ERM P005 Special Topics and Assignments 8 Credits
Students are required to prepare essays and seminars on a number of specially chosen topics.

ERM P006 Research Project 24 Credits

MASTER OF SCIENCE (AGRICULTURE) IN FOOD SCIENCE

A postgraduate programme in Food Science is offered in the Faculty leading to the Degree of MSc(Agr) by Mode II. Candidates will be recommended for admission to the programme following an interview.

Applicants may be required, at the discretion of the Faculty, to undertake and successfully complete preliminary courses in specified subjects. Up to twenty applicants may be accepted to attend each course. The programme consists of three terms of formal teaching followed by a project period of four months. Other conditions pertaining to the MSc(Agr) Degree apply.

Applications should be submitted to the Academic Director, Food Science Programme, Faculty of Agriculture, University College Dublin, Belfield, Dublin 4.

PROGRAMME

Practical classes and demonstrations will be held where appropriate. In addition, each student will be required to carry out a research project.

FDSC P001 Food Chemistry 12 Credits
Chemistry of the major organic constituents of foods with emphasis on relationships between chemical structure and functional properties in their unmodified and chemically/ enzymatically modified forms. Minor components of sensory importance in foods including flavour compounds and pigments; selected aspects of chemical/biochemical processes of importance in relation to cooking, processing and storage; food additives; chemistry of major food groups, including dairy, meat, cereals, fruit and vegetable products.

FDSC P002 Food Engineering 8 Credits
Principles and practice of industrial processes of importance to the food industry; heat transfer; mass transfer; fluid flow; heat processing; sterilisation; freezing; centrifugation; crystallisation; emulsification; irradiation; drying; food plant and services; waste treatment; plant layout.

INDM P003 Food Microbiology 8 Credits
The incidence and types of micro-organisms in foods and factors affecting their growth; preservation of foods; spoilage of food; food poisoning and food-borne disease; sanitation of food plants; bacteriology of water supplies; quality assurance including an introduction to quality systems, sampling and inspection; establishment and implementation of HACCP; the role of micro-organisms in the production of food and food supplements; the microbiology of dairy, meat, cereal, fruit and vegetable products.

FDSC P003 Nutrition 8 Credits

Digestion and metabolism; nutrient availability; recommended intake; effects of processing and storage; nutrition and public health; problems associated with deficiencies and excesses of specific factors; metabolic disorders; errors of metabolism.

BMGT P655 Agribusiness 6 Credits

Role of the manager; types of business in the food sector; analysis of agribusiness resources; developing a strategy in the food business. The operation of technological and engineering systems; studies of production and process with quantitative methods supporting decision making in these areas; statistical quality control; operations research; other analytical approaches.

AGRD P001 Food Production and Legislation 8 Credits

(i) *CPSC P001: Food Production (4 credits)*

Supply, quality and wholesomeness of raw materials; developments in manufacturing and processing; on-line control; by-product processing; storage; product evaluation; consumer protection; information sources; data retrieval on finished products. This course will be divided equally between animal and plant products.

(ii) *FDSC P004: Food Legislation (4 credits)*

Structure of food law in Ireland and the European Union; consumer protection; enforcement systems. Alimentarius Commission. US Food Law.

AGRD P002 Marketing, Economics, Administration and Management 10 Credits

(i) *MKT P619: Marketing (4 credits)*

Marketing applications in the food production system; market research and assessment; strategic marketing; pricing decisions and international marketing including national and international price stabilisation; new products for new markets; legal issues; future developments in international food marketing.

(ii) *AERD P002: Economics (4 credits)*

The economics of the food production and distribution system and of consumer behaviour and trends; the impact of government interaction in that system in the form of the Common Agricultural Policy (CAP); the reform and future of the CAP.

Factors affecting the demand for food (identification and description, changes, quantified relationships with food consumption); product attributes and consumers; product attributes and food scientists; pricing of product attributes (hedonic pricing); food consumption patterns and trends in the EU; evolving structural characteristics of food chains and implications of these; individual Irish food processing sectors (size, growth, characteristics).

(iii) *HRM P615: Administration and Management (2 credits)*

(a) Personnel/Human Resource Management – An overview; the economic background; selection; employment law; industrial relations.

(b) Finance and Accounting: An introduction to the basic concepts of finance; financial control and accounting.

FDSC P005 Project 20 Credits

MASTER OF AGRICULTURAL SCIENCE/ MASTER OF SCIENCE (AGRICULTURE)/ HIGHER DIPLOMA IN AGRICULTURE (FORESTRY)

The Department of Crop Science, Horticulture and Forestry offers programmes leading to a Higher Diploma in Agriculture (Forestry) or to the Degrees of MAgrSc and MSc(Agr) by Mode II. The Higher Diploma is an intensive part-time programme lasting one academic year. Study schedules are designed to facilitate participants with work commitments. The programme combines academic course work with particular projects which are designed to develop and enhance skills in a wide range of relevant areas of interest.

Entry to the Higher Diploma is restricted to applicants who hold a primary degree in Forestry or in another subject of relevance to Forestry, or equivalent qualifications. The Higher Diploma will be awarded at pass and honours level.

In the case of the MAgrSc and MSc(Agr) Degrees, candidates who obtain at least 60% in the Higher Diploma examination may opt to change their registration to the MAgrSc or MSc(Agr) Degree by Mode II.

Applications should be submitted to the Academic Director, Higher Diploma/Masters Degree Programme in Forestry, Department of Crop Science, Horticulture and Forestry, Faculty of Agriculture, University College Dublin, Belfield, Dublin 4.

PROGRAMME

Year 1

FOR P011 Silviculture **10 Credits**

Species – identification, classification, characteristics, provenance.

Plant production - plant ecology, diseases, plant management (physical handling and susceptibility), transportation and storage.

Soil and site factors - soil types and classification, chemical and physical properties, hydrological characteristics, soil structure and fertility, topography, exposure and climatic effects, cultivation, natural vegetation and species selection, species mixtures.

Plantation Establishment and Management - planting methods, factors of mortality, nutrition, spacing, thinning, pruning, disease and pest control reforestation, mechanised and manual operations and costs, windthrow hazard classification, forestry and the environment.

FOR P012 Forest Harvesting and Forest Economics 8 Credits
Harvesting and Transport - harvesting methods, manual and mechanical options, site limitations, soil effects, roading, off-road and on-road extraction, haulage consideration

Forest Economics - compounding and discounting, NDR/ROI/IRR, risk and return, cost benefit analysis. Forest Planning; applications of decision making techniques to forest management.

FOR P013 Forest Policy and Forest Management 8 Credits
Current Forest Policy - Ireland, EU; factors impacting on land use, environmental guidelines and policies.

International market trends, customer needs, competitor awareness.

Strategic and Logistics Management - strategic management, planning tools and techniques, decision making and implementation.

Environmental Management - land use options and benefits, forest landscape design, environmental effects of operations, good environmental practices, statutory and legal requirements.

FOR P014 Wood Science and Tree Physiology 8 Credits
Introduction to wood structure, characteristics and features of wood, wood grading and quality.

Physiology of tree growth, basic genetics and classical tree improvement, provenance, applied tree improvement and use of vegetative propagation.

AERD P001 Communications 4 Credits
Introduction to role of Communications. Written communication methods - to include the lecture/class handout; technical reports/papers; reports for management and clients; business letters. Oral presentation methods.

FOR P006 Project* 10 Credits

FOR P015 Distance learning* 12 Credits
** Higher Diploma only*

Year 2 (MAgrSc/MSc(Agr))

FOR P009 Computer Applications 4 Credits
The aim of this module is to develop the skills necessary for the utilisation of a number of computer packages and to help students develop and understanding of the use and applicability of these packages in their work. It will consist mainly of "hands-on" experience. A generic overview of word processing applications, spreadsheets.

FOR P016 Forest Biometrics 4 Credits
Principles of sampling populations, parameter estimation and statistical interference. Random sampling with and without replacement. Estimation of the mean, variance, standard deviation, variance of the mean, standard error of the mean and 95% confidence intervals for the mean for continuous and discrete weighted variables. Estimation of the required sample size.

Concept of regression. Fundamental equation of regression analysis. Method of least squares. Hypothesis testing. Analysis of variance. Statistical inference. Basic volume-basal area theory. Volume estimation and analysis using regression.

Introduction to the concept of experimental design. Use of EXCEL for data analysis.

FOR P017 GIS in Forest Resource Management I 4 Credits
Principles of remote sensing and integrated geographic information systems (IGIS). Computer mapping of spatially distributed forest resources. Creation of vector, attribute and raster georeferenced IGIS forest databases using ArcView 3.1. Applications of IGIS technology in forest inventory, design, management and planning.

FOR P018 Thesis 30 Credits

MASTER OF SCIENCE (AGRICULTURE)/HIGHER DIPLOMA IN RURAL DEVELOPMENT (HUMANITARIAN ASSISTANCE)

A postgraduate programme leading to the Degree of MSc(Agr) Mode II or a Higher Diploma in Rural Development (Humanitarian Assistance) is offered by the Faculty through the Department of Agribusiness, Extension and Rural Development, with the support of other Faculties in UCD and of a network of seven European universities. The purpose of the programme is to provide a postgraduate qualification for people who have worked or who intend to work in the area of humanitarian assistance and development.

Candidates for the MSc(Agr) Degree and the Higher Diploma must satisfy the entry requirements for the MSc(Agr) Mode II Degree.

Applications should be submitted to the Academic Director, Humanitarian Assistance Programme, Faculty of Agriculture, University College Dublin, Belfield, Dublin 4.

PROGRAMME

HUAS P001 Intensive Programme **5 Credits**
The Intensive Programme is a 10 day intensive course bringing together all the students of the partner universities and key players involved in humanitarian assistance. The purpose is to give students an overview of the key issues relating to humanitarian assistance.

HUAS P002 International Humanitarian Law **5 Credits**
Humanitarian aid in the context of international law. The function, the subjects and the sources of international law. Basic rights and duties of States with regard to humanitarian aid. Responsibility under international law. International humanitarian organisations as humanitarian actors. The United Nations family and its organisations. European Union humanitarian aid. Non-governmental organisations. Rights and protection of victims. Disaster and emergency situations. Armed conflict and complex emergency situations. Humanitarian assistance, rights, duties and protection of assistance personnel. The rights and duties of humanitarian organisations and their personnel. Rights to humanitarian assistance. Enforcement of the protection norms of international law. The enforcement of international humanitarian law. Special mechanisms of enforcement.

HUAS P003 Medicine – Epidemiology **5 Credits**
Epidemiology and biostatistics. Presentation and summarising of data. Measures of disease frequency and association. Planning and conducting an investigation. Health care planning. Priority and objectives in the context of planning. Obstacles to planning. Different stages of the planning process. Economic evaluation of health care programmes. Health and development. Overview and general aspects. Operational aspects.

HUAS P005 Geopolitics 5 Credits
Global geopolitical approach. Concepts and main trends of geopolitical thinking. The "world system". Geopolitical approach to humanitarian risk. Conflicts: Geopolitical aspects and typologies. Conflicts and humanitarian risk. Geopolitical approach to humanitarian aid. Humanitarian aid: a new form of international relations. Humanitarian aid: a new stake in international relations.

HUAS P006 Management 5 Credits
Disasters, complex emergencies and international responses. Actors, interests and the humanitarian regime. The internal dynamics of humanitarian organisations: management of policy, personnel and finances. Organisational culture, communication and evaluation. From 'relief' to 'recovery': strategy.

HUAS P010 Research Project/Placement (Higher Dip. students) 5 Credits
Students will examine the work of an agency involved in humanitarian assistance. Where possible the project will involve a short placement with the agency. Alternatively, students may use secondary information, leading to a research report which will satisfy the project requirements.

HUAS P011 Minor Thesis (Master's students) 25 Credits
Students pursue a research area of particular interest to them. In most cases, the research will relate to practical issues concerning humanitarian assistance and development and in most cases will involve the collection of primary data. Students will work closely with a specified supervisor in planning, designing and carrying out this work.

HUAS P014 Social Anthropology 5 Credits
The concept of emergency. Cross-cultural justice and the distribution of assistance. Anthropological approaches to crises, conflicts and violent change. Reconceptualisation of violent change: the sociology of disasters. The global scope of disasters: morbidity profiles of a disaster scene. Socio-economic aspects of disasters. Ideological aspects to violent change. The anthropology/sociology of disasters and war. Responses and strategies for coping with crises. Choice and constraints: decisions about displacement. Strategies of coping. The challenge of adaptation and survival tactics. Patterns of belonging: the social organisation of identities in exile. The logic of interventions. The social context of interventions. Intercultural communication. Social relations and power games.

HUAS P015 Development Issues and Strategies 8 Credits
Defining development. Essentials for initiating development. Overview of development approaches and associated strategies. Top-down, bottom-up and participatory approaches. Policies, programmes and projects as components of the development mix. Area based development and planning.

HUAS P016 Communications 8 Credits
Theory of communications and communications in development. Group work (leadership/meetings/team building). Individual consultations. Writing skills (reports and proposals).

HUAS P017 Sociology of Development 4 Credits
Researching the emergency/development situation. RRA and PRA approaches. Working with people (social structure, social relationships, etc.). Role of women in agriculture and rural development.

HUAS P018 Relief to Development 4 Credits
Rebuilding society/rehabilitation phase. Relief in development and development in relief. Societal conditions for intervention and their indicators.

HUAS P019 Introduction to Specialisation 1 Credit
Review key principles and underlying concepts of Humanitarian Assistance and introduce principles and development.

MASTER OF LANDSCAPE ARCHITECTURE

The Department of Crop Science, Horticulture and Forestry of the Faculty, in conjunction with the Faculty of Engineering and Architecture, offers a two-year, full-time programme of study leading to the Degree of Master of Landscape Architecture (MLA) (Mode II).

Candidates must obtain the permission of the Board of Studies for the MLA Degree before entering the programme. The basic requirement is a primary degree (honours or equivalent) in Agriculture, Architecture or other appropriate discipline, with suitable work experience. Candidates will be recommended for admission to the programme following interview. A basic knowledge of art/design is desirable. Applicants may be required to undertake and successfully complete preliminary courses in specified subjects.

Applications should be submitted to the Academic Director, Master of Landscape Architecture Programme, Department of Crop Science, Horticulture and Forestry, Faculty of Agriculture, University College Dublin, Belfield, Dublin 4.

The programme comprises the following modules:

LARC P101 Landscape Science **14 Credits**

Soil Science (2 credits)

An outline of the morphological, physical and chemical properties of soils (both organic and mineral) with special reference to their potentials and limitations for amenity, recreational and engineering uses: soil genesis and the relationship between soils and geology, landscape features, hydrology and climate; discussion on soil survey and classification systems; land capability and engineering classification systems.

Landscape Ecology (4 credits)

Developing an understanding of landscape ecological patterns, with emphasis on the processes of colonisation and succession, and the relationships and interface between habitats. Geographic control of plant distribution; biomes and global ecosystems. The development of the post-glacial flora and fauna in Ireland. Phytosociology and the classification of communities in the landscape. The interdependency of vegetation and animals. Biodiversity, natural selection, speciation and extinction. Natural and anthropogenic ecosystems; ecotones; principles of ecosystem and habitat management.

The structure, development, management and landscape legacy of specific 'native' ecosystems (e.g. alluvial wetlands, salt marshes, sand dunes, moor/heathlands, hedgerows, woodlands).

Landscape Interpretation (4 credits)

Review of physical geology; geological and geomorphical evolution of the Irish landscape; relationships between geology, soils and flora; the evolution of the Irish flora; nature and development of the cultural landscape palimpsest; the role of water; special landscape assessment – landscape affinity, historic, 'cultural', 'outstanding', natural and semi-natural landscapes.

Environmental Horticulture and Botany (2 credits)
The taxonomy, biology and physiology of plants. Horticultural factors influencing the selection, establishment and growth of plants in the landscape. Developing an understanding of the main site and environmental factors limiting plant selection and growth. Undertaking a detailed survey/inventory and evaluation of existing vegetation.

Plant Materials and Turfgrass Management (2 credits)
Planting design, identification of woody and non-woody taxa commonly used in landscape schemes. Establishment and maintenance of turfgrass in amenity schemes.

LARC P102 Landscape Technology 14 Credits
Surveying (2 credits)
Chain surveying, levelling, ordnance survey maps, theodilite and angular measurements, areas, volumes and contouring.

Landscape Construction (6 credits)
Construction techniques: grading, earth works, cut and fill techniques; circulation and grading (pedestrian and cyclist); site drainage, pervious and impervious surfaces; storm water management; site utilities/site servicing, outdoor lighting; bioengineering techniques.
Materials: geotextiles; concrete; asphalt; masonry, wood, metal.
Structures: walls - retaining and free standing; paving - flexible and rigid; timber structures; pedestrian bridges; water bodies, pools and fountains.

Building Construction Workshop (2 credits)

CAD (4 credits)
This course is based around a series of demonstrations, explaining and carrying out commands which are coupled with a number of class assignments. Students complete a drawing assignment for assessment on completion of this course.

LARC P103 Landscape Design Theory 10 Credits
History of Designed Landscapes (4 credits)
This course examines how from earliest times the development of parks and gardens has been influenced by the environment, both natural and cultural in which they were created. This study includes the history of art and history of architecture. Topics include: ancient civilisations, Islamic gardens, medieval gardens, Renaissance and Mannerist gardens, Baroque and Rococo gardens, English Landscape Parks. The picturesque and gardenesque. The Parks Movement in Europe and the United States. Parks and gardens of the Orient. Ireland's garden heritage. 20th century designed landscapes. Restoration of period gardens.

Landscape Architectural Theory (4 credits)
The landscape design process from project inception through to completion. Perception of landscape. Landscape processes. Developing knowledge and a critical understanding of the values and methodologies employed in landscape design. Appreciation of underlying values and philosophies of the design process. A consideration of landscape design in the context of wider theories of aesthetics, social psychology, political theory and environmental ethics.

Environmental Sociology for Landscape Architects (2 credits)
Perception of human requirements through behavioural studies, including territoriality and personal space identity.

LARC P104 Landscape Design Studio 22 Credits
The design studio is at the core of the MLA programme. It runs concurrently throughout the two year programme. By integrating the other subjects with the studio subjects, the relevance of the taught courses to the process of landscape design is demonstrated by direct application.

Basic and Applied Design (4 credits)
Recognising the stages of structured design process. Logical design process applied to simple landscape design exercises.

Graphic Development, Design and Communication (4 credits)
Graphic communication using selected media. Development of visual literacy. Understanding form, shape and qualities of materials in 2-D and 3-D.

Design Studio (14 credits)
Introduction to the design studio. Students undertake a series of exercises aimed at developing visual and spatial perceptiveness, design ability and presentation skills. Studio projects of various lengths are undertaken which aim to encourage and develop the ability to translate design theory and principles into practical landscape design solutions.

LARC P201 Landscape Planning 14 Credits

History of Development and Planning (2 credits)
The evolution of settlement patterns, the growth of urban pressures on the landscape and the evidence of planned approaches to manage change in an orderly manner. The growth and achievements of a planning movement during this century.

Design of the Urban and Rural Landscape (2 credits)
To understand, organise and manage the urban, spatial and physical environment and to appreciate its influence on the daily experience of its inhabitants. To develop an understanding of how change occurs in the physical environment and the constraints imposed by the existing physical fabric on the design process.

Environmental Impact Assessment (2 credits)
Environmental Impact Assessment and the landscape; the legislation and methodology for carrying out an EIS in compliance with S.I.349 of 1989 and S.I.25 of 1990 with special reference to landscape change in Ireland.

Rural Development and Planning (2 credits)
The dynamics of rural economies. The development and implementation of area based planning strategies. Funding mechanisms for rural planning and development. Rural settlement management. Landscape conservation.

Landscape Planning (4 credits)
Development of an understanding of landscape planning theories. Examination of tools and techniques available for landscape planning. Assessment of landscape character.

Environmental Management (2 credits)
Concepts of the environment; attitudes to management, dominance and control; global commons; planning vs. control; sustainable development.

LARC P202 Landscape Management 10 Credits
Habitat Creation and Wildlife Management (2 credits)
The application of ecological principles to landscape design. Survey and appraisal of semi-natural areas. The design and management of semi-natural landscapes. Awareness of management requirements for specific environmental objectives.

Soft Landscape Applications (2 credits)
Selection, establishment and management of plants for a range of landscape situations.

Landscape Management (2 credits)
Management plans, maintenance schedules, cost estimation. Computers and management. Case studies.

Arboriculture (2 credits)
Tree selection, tree planting, post planting management, tree surveys, tree surgery, trees and the law. Trees on development sites. Mechanisation and arboriculture. Urban woodland.

Managing Landscape Projects (2 credits)
Information handling and studio exercises aimed at the production of a set of working drawings, specification notes and preliminary costings for simple landscape projects.

LARC P203 Professional Practice and Planning Law 6 Credits
Environmental and Planning Law (2 credits)
Elements of the law and Irish planning legislation, general principles of law, professional responsibilities and liability, law of contract, warranties, bankruptcy, disputes, claims, nominated subcontractors, landscape contracts, bonds, arbitration, private land law, public land law, development plans and development control, special rights over land, basic principles of tort.

Professional Practice (4 credits)
The concept of professionalism and the landscape architect. An introduction to professional organisations relevant to the landscape architect. Office organisation and administration. Knowledge of professional relationships and responsibilities. An introduction to contracts, the preparation of specifications and bills of quantity, contract administration and site supervision. Invited landscape practitioners describe their work.

LARC P204 Landscape Design Studio **30 Credits**

Urban Design (6 credits)

Lecture programme related to studio.

Definitions of urban design in the public realm. The concept of design as applied to projects of long duration and large scale. Urban design in history. The concept of civilisation. Humanity and Nature: the new emphasis on open space and the perceived failure of the traditional city; 19th and 20th century urban theory. Context: Contemporary urban theory; the perceived failure of modernism. The concept of 'postmodernism'. Urban design in detail - modern and contemporary urban space. Exercises in criticism.

Regional Study (6 credits)

Investigations of the relationship between design and planning issues through a regional study. This is based on a group project providing experience of the larger scale of landscape design.

Major Design Thesis (18 credits)

A major studio project that is sufficiently large in scope to be worthy of developing over two semesters. This provides students with an opportunity of demonstrating the knowledge and skills acquired during the two year programme in the resolution of complex design issues. With staff guidance, students select their own site and write their own project brief. Students will be expected to demonstrate that they can undertake the whole process of design at a professionally acceptable level.

LARC P205 Research Dissertation **20 Credits**

A written dissertation on a landscape architectural topic to be undertaken on completion of the major design thesis.

MASTER OF SCIENCE (AGRICULTURE) IN PLANT PROTECTION

This one year, full-time programme leads to the Degree of MSc(Agr) by Mode II in Plant Protection and is designed to provide a comprehensive understanding of the principles underlying modern crop protection practices and strategies, and of the technology involved in their implementation. The programme is open to graduates holding an honours degree in Agricultural Science, Science, Environmental Science or other appropriate disciplines in accordance with the requirements for the MSc(Agr) Degree (Mode II).

The programme comprises nine months of formal teaching followed by a three-month research project.

Applications should be submitted to the Academic Director, Plant Protection Programme, Department of Environmental Resource Management, Faculty of Agriculture, University College Dublin, Belfield, Dublin 4.

The main areas of study are as follows:

AESC P001 Review of Plant Disease, Pest and Weed Problems 14 Credits
Losses caused by pests, diseases and weeds; plant/pest interactions; nature and development of disease epidemics and pest outbreaks; factors affecting populations of pests and disease-causing organisms.

AESC P002 Properties and Use of Pesticides 14 Credits
Screening and development of plant protection agents; chemistry and biochemistry of pesticides; formulation and application of pesticides; environmental impact of pesticides; the law in relation to pesticides; coping with the toxicity and other hazards of pesticides; safe handling and storage of pesticides.

AESC P003 Strategies for Pest and Disease Control 12 Credits
History of pest and disease control; physical, cultural, biological and other non-chemical methods of plant protection; monitoring of population densities of pests and disease-causing organisms; population modelling; establishment of economic injury thresholds; pest and disease forecasting; plant health legislation; genetic engineering and biotechnology in relation to plant protection; development and implementation of integrated management systems.

AESC P004 Special Topics and Assignments 12 Credits
Students are required to prepare essays and seminars on a number of specially chosen topics.

AESC P005 Research Project 28 Credits

MASTER OF AGRICULTURAL SCIENCE/ MASTER OF SCIENCE (AGRICULTURE)/ HIGHER DIPLOMA IN RURAL DEVELOPMENT

Courses of study in Rural Development are offered by the Department of Agribusiness, Extension and Rural Development, leading to the degrees of MAgrSc or MSc(Agr) by Mode II or to a Higher Diploma in Rural Development.

The courses are designed to cater for the professional requirements of students from Ireland, Europe and developing countries who are involved in rural development or who wish to develop a career in that area.

Candidates for the MAgrSc, the MSc(Agr) degrees and the Higher Diploma must satisfy the entry requirements relating to the MAgrSc/MSc(Agr) Mode II degrees of the Faculty.

Applications should be submitted to the Academic Director, Rural Development Programme, Department of Agribusiness, Extension and Rural Development, Faculty of Agriculture, University College Dublin, Belfield, Dublin 4.

RDEV P001 Rural Development **12 Credits**

Economics of Development - measuring economic development. Theories of economic development. Strategies for economic development in developing countries. Trade policy and its impact on economic development and structural adjustment policies and developing countries. Sociology of Development – meanings and definitions of development. Theories of development. Modernisation and marginalisation. Indicators of development. Socio-economic changes in Ireland. Culture, social relationships, land tenure and the impact of technology on development. Approaches and strategies to Rural Development – the critical issues in rural development. Problems associated with rural areas. Overview of development approaches. EU and Irish Government policies and programmes. Irish government overseas programme. Non-governmental organisations.

RDEV P002 Enterprise Development **14 Credits**

Project Appraisal - the project cycle. Project preparation and analysis. The economic evaluation of projects. Cost benefit analysis case study. The economic measurement of environmental impact. Management and organisation - the nature of management, the role of the manager and functional management. Planning for business development; planning models and SWOT analysis. Leadership and direction, styles of leadership, control of the business and organisation and techniques for implementation of control.

Financial analysis and planning - the concept of business finance, understanding accounts, the income statement and the balance sheet. Preparation of cash flow budgets. Investment and funding sources and making applications for funding. Using EXCEL for financial planning.

Basic Marketing - analysis for marketing strategy development. Qualitative and quantitative issues relating to the consumer and the market. External and internal analysis leading to a SWOT summary. Segmentation and positioning, the marketing mix and the marketing plan.

Programme Planning - principles and assumptions of programme planning. Investigating needs. Principles of learning and learning experiences. Programme implementation. Management of programmes including the Logical Framework Approach. Programme and project evaluation.

RDEV P003 Research Methods 10 Credits
Problem analysis. Study design, preparing the research proposal. Carrying out a literature review. Developing the methodology. Defining the population and sampling. Methods of collecting information, questionnaires, elite interviews, case studies, resource audits, group meetings, RRA and PRA. Introduction to computing systems and SPSS. Collecting data. Data coding, entry and analysis. Review of basic statistics. Interpretation of computer outputs. Preparing a research report.

RDEV P004 Communications 12 Credits
Communications in development, defining communications, role of communications in agriculture and rural development. The human communication process. Communication methods in information and technology transfer. Factors relating to the communicator and the client. Reference groups and opinion leaders. Promoting and facilitating participation in rural development. Leadership development and training for rural development. Writing skills. Lecturing and public speaking. Preparation and use of audio visual aids. Group discussion techniques. The use of demonstrations and individual visits. Using radio and communication campaigns.

RDEV P005 Rural Tourism 10 Credits*
Overview of the resource base. Developing the resource base. Countryside management. Scope, nature and meaning of tourism. Historical development of tourism. Trends in the development of tourism and leisure. Component elements of the industry. Tourism policy and the macro-economy. Tourism as an engine for local and regional development.
**Students who take Rural Tourism drop an equivalent number of credits from the other four main courses.*

RDEV P201 Research Thesis (Master's students) 32 Credits
Students pursue an area of study which is of particular interest to them. In most cases, the study is an investigation of a practical problem arising in rural development and almost always involves the collection of primary data. Students work closely with an appointed facilitator when planning, designing and carrying out the research.

RDEV P006 Project (Higher Diploma students) 12 Credits
Students select an area of interest from the material presented during the course. This topic will be further developed mainly through the use of secondary information and will be presented in the form of a research project. The student will work closely with an appointed supervisor during the preparation of the project.

MASTER OF AGRICULTURAL SCIENCE/ MASTER OF SCIENCE (AGRICULTURE)/HIGHER DIPLOMA IN RURAL ENVIRONMENTAL CONSERVATION AND MANAGEMENT

This part-time programme in the Faculty of Agriculture leads to a Higher Diploma in Rural Environmental Conservation and Management or to the degrees of MAgrSc/MSc(Agr) by Mode II. Course schedules are designed to facilitate participants with work commitments. The programme, which combines academic course work with projects in relevant areas, will replace the existing Diploma programme in Rural Environmental Management.

Entry to the Higher Diploma is restricted to applicants who hold a primary degree or equivalent qualifications. The course content, where feasible, will be adjusted to take account of the background and interests of the individual students. The Higher Diploma will be awarded at pass and honours level.

Candidates who obtain at least 50% in the Higher Diploma examination will be eligible to proceed to the MAgrSc or MSc(Agr) Degree Mode II.

Applications should be submitted to the Academic Director, Rural Environmental Conservation and Management Programme, Department of Environmental Resource Management, Faculty of Agriculture, University College Dublin, Belfield, Dublin 4.

PROGRAMME

YEAR 1

ERM P008 Soils, Nutrients and Environmental Management 8 Credits
Physical/chemical/mineralogical/hydrological properties of soils. Soil assessment and management/soil maps. Forestry and its interactions with the soil environment. Soil plant relations. Properties, reactions and environmental implications of using animal manures. Farm yard effluent. Heavy metals/micropollutants in the soil. Sustainable agriculture and organic farming. Weather and agriculture. Surface and ground water pollution. Soil testing and fertilizer recommendations for grass and tillage. Nutrient management planning.

ERM P009 Farm Buildings and the Environment 8 Credits
Environmental awareness and education – role of state and semi-state bodies. Farm buildings – design and layout. Farmyard waste and management of animal manures. Farmyard surveys. Farmyards in the landscape. Animal welfare. Building construction. Nuisance abatement in the farmyard. Environmental monitoring and analysis. Farm water supplies.

ERM P011 Archaeological and Cultural Heritage 4 Credits

Discovering archaeological remains; tracking the earliest inhabitants; the builders of Megalithic Tombs; changing society – the end of the Stone age; the Bronze age; low visibility archaeology in Ireland; later Prehistoric Ireland; early Christian Ireland; medieval archaeology; the evolution of a landscape; types of monuments; locating and discovering monuments; recording of archaeological sites; management and maintenance of sites; regulations for the protection of sites; case study.

Cultural heritage, historic buildings and their conservation. History and management of the landscape.

ERM P012 Conservation and Management of Rural Ecosystems 10 Credits

Principles of ecology; interaction of farming practice and environmental heritage.

Farmed habitats; ecology evaluation and management of wetlands, peatlands, heathlands, natural and semi-natural grassland and field boundaries. Management of lakes, river and streams. Flora and fauna of farmed areas; species identification and ecology. Habitat conservation and management.

Protected areas; Natural Heritage areas; Special areas of Conservation and Special Protection areas.

Environmental Impact Assessment; scoping, flora and fauna, habitat and visual landscape.

Soil degradation. Biocides; direct and indirect effect of pesticides on the natural environment.

ERM P017 Rural Planning, Environmental Law and International Agreements 4 Credits

Introduction to planning law and the role of Planning Control Authorities; exempted development; preparation of planning submissions; appeal procedures.

Pollution and the law – overview of environmental legislation with reference to agricultural point source pollution of surface water and ground water. National and EU legislation on pollution from nutrients, pesticides and over-grazing.

Environmental litigation – handling disputes; law of contract; preparation and presentation of evidence as an expert witness.

Wildlife law; EU directives; International agreements and directives.

ERM P018 Management Plan* 12 Credits

Background reading, environmental and habitat assessment and preparation of plans for the future management of selected areas of conservation interested.

ERM P013 Project* 14 Credits

* Higher Diploma only

YEAR 2

ERM P019 Evaluation, Conservation and Management of Rural Habitats **8 Credits**

The ecology of natural and semi-natural habitats in the rural landscape: marine, coastal and estuarine habitats; peatlands, fens and other wetlands; freshwater; grasslands, woodland, hedgerow and scrub; rock habitats. Evaluation of habitats in terms of biodiversity and in relation to change. Practical conservation and management of habitats.

ERM P020 Computing Techniques **6 Credits**

The student will be introduced to a range of computer packages for word processing, data analysis and data presentation.
Computer techniques for environmental analysis: multivariate methods; Geological Information Systems (GIS).

ERM P021 Thesis **32 Credits**

MASTER OF AGRICULTURAL SCIENCE/ MASTER OF SCIENCE (AGRICULTURE)/ HIGHER DIPLOMA IN URBAN FORESTRY/ARBORICULTURE

The Department of Crop Science, Horticulture and Forestry offers programmes leading to a Higher Diploma in Urban Forestry/Arboriculture, or to the Degrees of MAgrSc and MSc(Agr) by Mode II. The Higher Diploma is an intensive part-time programme lasting one academic year. Study schedules are designed to facilitate participants with work commitments. The programme combines academic course work with particular projects, which are designed to develop and enhance skills in a wide range of relevant areas of interest.

The programme deals with the selection, planting and management of single or small groups of trees in a rural or urban environment. Factors influencing tree selection and establishment, planting procedures, arboricultural practices, current research issues and policy will be addressed. The programme comprises lectures, practicals, field visits and project thesis work.

Entry to the Higher Diploma/Masters Degree is restricted to applicants who hold a primary degree or equivalent qualifications in Horticulture, Forestry or related disciplines. The Higher Diploma/Masters Degree will be awarded at pass and honours level.

In the case of the MAgrSc/MSc(Agr) degree, candidates who obtain at least 50% in the Higher Diploma examination may opt to change their registration to the MAgrSc or MSc(Agr) degree by Mode II.

Applications should be submitted to Dr. Mary Forrest, Academic Director, Urban Forestry/ Arboriculture Programme, Department of Crop Science, Horticulture and Forestry, Faculty of Agriculture, University College Dublin, Belfield, Dublin 4.

PROGRAMME

HORT P001 Tree Establishment 12 Credits

Factors influencing tree establishment, Soils and soil ecosystems, Tree physiology, Woodland Environment and Ecology *(4 credits)*.

Factors influencing tree selection, Dendrology, Woods and forest design, Urban trees in streets and parks *(4 credits)*.

Tree production and tree planting, Silvicultural systems – whips, nursery stock production – standard trees, Tree planting practice in woodland, streets, parkland *(4 credits)*.

HORT P002 Tree Management **12 Credits**

Arboriculture practice. Management of young, mature and senescent trees. Tree nutrition *(2 credits)*.

Tree health. Pests of woodland and urban trees. Diseases of woodland and urban trees *(6 credits)*.

Tree surveys. Tree surgery. Arboricultural machinery *(4 credits)*.

HORT P003 Arboricultural Research, Policy and Law **10 Credits**

GIS. Computer tree management systems, eg Arbortec *(2 Credits)*

Research in arboriculture and urban forestry. *(2 Credits)*

Law: The Legal System. Tree preservation orders. Planning applications. *(2 Credits)*

Urban forestry: Benefits in terms of amenity and recreational ecology. Public participation in urban forestry. *(2 Credits)*.

Tree planting policy: Tree planting grant schemes. State forestry policy**.** *(2 Credits)*

AERD P001 Communications **4 Credits**

Introduction to role of communications. Written communication methods – to include the lecture/class handout; technical reports/papers; reports for management and clients; business letters. Oral presentation methods.

HORT P004 Special Topics and Assignments **12 Credits**

Field visits to urban woodland sites; forests; parks; open spaces; tree collections; meetings with NGOs.

HORT P005 Project (Higher Diploma) **10 Credits**

Students select an area of interest from the material presented during the programme. This topic will be further developed mainly through the use of secondary information and will be presented in the form of a research project. The student will work closely with an appointed supervisor during the preparation of the project.

HORT P006 Research Thesis (Masters) **30 Credits**

Students pursue an area of study, which is of particular interest to them. In most cases, the study is an investigation of a practical problem arising in arboriculture or urban forestry and almost always involves the collection of primary data. Students work closely with an appointed facilitator when planning, designing and carrying out the research.

CERTIFICATE IN FOOD SAFETY (POSTGRADUATE)

The postgraduate Certificate in Food Safety takes place on a part-time basis over one academic year. The programme aims to keep the trainer up to date on food safety issues, surveillance and monitoring techniques as well as legislation. Lectures and parallel laboratory sessions will cover the topics of the programme. Each student is required to carry out case studies and to make a short presentation on a food safety topic relevant to their work situation.

Applicants for the postgraduate Certificate in Food Safety will have a degree in Agricultural Science, Science or equivalent qualification; other university graduates may be accepted. The Certificate will be awarded at pass and honours level.

Applications should be submitted to the Academic Director, Certificate in Food Safety Programme, Food Science Department, Faculty of Agriculture, University College Dublin, Belfield, Dublin 4.

PROGRAMME

FDSC P700 Pathogens Causing Foodborne Illnesses and Food Scares 4 Hours
Intoxication and infection. *Salmonella*, *E.coli* (including *E.coli 0157:H7*), *Campylobacter*, *Listeria*, *Clostridium*, *Cryptosporidium* and other pathogens. Sources of contamination, spread of infection and transmission of diseases. Recent outbreaks and trends.

FDSC P701 Good Laboratory Practice (GLP) 3 Hours
Training, sampling procedures, material and reagents. Weighing of samples. Documentation entry, records, housekeeping.

FDSC P702 Rapid Methods 4 Hours
Counting methods eg Spiral plating. Estimation of microbial numbers – ATP, Impedance. Immunodiagnostic methods including ELIZA, Rapid identification, eg API, Enterotubes, Vitek, DNA methods including PCR.

FDSC P703 Good Hygiene Practice 4 Hours
Building structural design and layout – Floors, walls, ceilings, lighting, air systems. Facilities for personnel. Equipment design. Design of food processing and kitchen areas.

FDSC P704 Quality systems 4 Hours
HACCP, ISO 9000 series

FDSC P705 Legislation 4 Hours
Irish and EU.

FDSC P706 Food Safety Issues of the Day 1 Hour
Invited guest speaker.

FDSC P707 Case Studies **24 Hours**

Students will be required to examine recent outbreaks and trends of food borne illnesses. They will then be given a case study for which they will produce a report detailing sampling and testing procedures, recall processes, notification procedures, corrective action, etc.

FDSC P708 Presentations **24 Hours**

Each student will be required to make a presentation on a food safety topic of relevance to their work.

Note: The hours indicated above are lecture hours only. Each lecture hour will be accompanied by a 2 hour laboratory practical.

SYLLABUS OF POSTGRADUATE ELECTIVE COURSES

FOR P101 Applied Remote Sensing and GIS 8 Credits

The objective is to introduce the application of advanced remote sensing and GIS techniques in spatial resource management including forestry, agriculture, environment and rural development.

This is an advanced remote sensing and GIS course for those specializing in spatial resource management. The remote sensing and GIS computer skills have applicability in the inventory, design, planning and monitoring systems in forestry, agriculture, rural development and the environment. The course will be hands-on and will introduce advanced remote sensing and GIS techniques. Report on the application of remote sensing and GIS in forestry, agriculture, rural development and/or the environment.

Intended audience: BAgrSc graduates, MAgrSc or MSc(Agr) level students.
Software: Microsoft Word and Excel. ESRI Arcview 3.1. MapInfo.

FOR P102 Applied Biological Modelling 8 Credits

The objective is to introduce the theory and application of modelling techniques in forestry, agriculture, environment, rural development, agribusiness and in food and animal science.

Review of the fundamental equation and assumptions of regression analysis. Parameter estimation of linear models. Hypothesis testing and biological interpretation of model parameters. The extra sums of squares principle and partial F tests. Model building strategies. Precision of the model estimates. Matrix formulation of the analysis of variance (ANOVA).

Integral and differential forms of nonlinear models. Parameter estimation, analysis and interpretation of nonlinear models to growth and yield data including the simple exponential, monomolecular, Logistic, von Bertallanffy, Chapman-Richards, Richards and Weibull models. Biological interpretation of nonlinear parameters which define sustained yield management parameters. Report on biological modelling.

Intended audience: BAgrSc graduates, MAgrSc and MSc(Agr) level students.
Software: Microsoft Word and Excel. SAS and Mathematica. Windows 95.

FOR P103 Applied Multivariate Analysis 8 Credits

The objective is to introduce the theory and application of multivariate analysis techniques in resource management including forestry, agriculture, environment and rural development.

Outline of the logic underlying multivariate analysis of p-dimensional data. Review of the matrix algebra including computation of the determinant and inverse of symmetric pxp matrices. Computation of mean vector, sums of squares and cross products, variance-covariance and correlation matrices using matrix algebra. Eigenvalue and eigenvector estimation and interpretation. Spectral decomposition. Wishart distribution. Testing the significance of non-zero eigenvalues. Reduction of dimensionality. Principle component analysis.

Classification criteria. Minimum distance, Mahalnobis distance and maximum likelihood classifiers. Cluster analysis. Bayes' and the adaped Bayes' rule. Application of multivariate classification in forestry, remote sensing, agriculture and environment. Report on application of multivariate analysis.

Intended audience: PhD and Post Doctorate level.
Software: Microsoft Word and Excel. SAS and Mathematica. Windows 95.

FOR P104 Applied Multivariate Analysis of Variance 8 Credits

The objective is to introduce the theory and application of multivariate analysis of variance (MANOVA) techniques in forestry, agriculture, environment, rural development and animal and food science.

Outline of the fundamental equation of multivariate analysis of variance (MANOVA). Hotelling's T^2 test for independent and dependent p-dimensional populations. Analysis and interpretation of one-way, two-way, factorial and split-plot-in-time MANOVA experimental designs. Outline of the union-intersection principle. Hypothesis testing using Wilks' lambda, Roy's greatest-root and other multivariate test statistics.

Estimation and interpretation of Bonferonni and Roy-Bose simultaneous confidence intervals. Application of MANOVA to forestry, remote sensing, agriculture and environment. Report on the application of MANOVA.

Intended audience: PhD and Post Doctorate level.
Software: Microsoft Word and Excel. SAS and Mathematics. Windows 95.

UNDERGRADUATE
DIPLOMA/CERTIFICATE PROGRAMMES

DIPLOMA IN ENVIRONMENTAL IMPACT ASSESSMENT

This is an inter-faculty venture, co-ordinated within the Department of Environmental Resource Management in the Faculty of Agriculture in association with the University Industry Programme, and with contributions from the Faculties of Arts, Engineering and Architecture, Law, Medicine, Philosophy and Sociology, Science and Veterinary Medicine. It is organised as part of the UCD Continuing Education Programme and leads to a Diploma (i.e. undergraduate entry) in Environmental Impact Assessment Management.

The course is intended for all persons with a professional or personal interest in Environmental Impact Assessment, especially potential developers, planners and those engaged in environmental consultancy.

The aim of the course is to develop EIA as a management exercise. It comprises a multidisciplinary programme examining the theory and practice of EIA as well as interpreting the practical requirements of EU Directive 85/337 and its translation into Irish law (SI 349. 1989 etc.).

Applications should be submitted to the Academic Director, Diploma in Environmental Impact Assessment Management, Department of Environmental Resource Management, Faculty of Agriculture, University College Dublin, Belfield, Dublin 4.

PROGRAMME

The Theoretical and Developmental Context
Life before EIAs; the North American experience; the conceptual range of impacts; scoping; screening; monitoring and audit as concepts.

The Legal Framework
The EU directive; Irish EIA law.

Approaching EIAs
Adopting the right attitude; public risk perception; staying out of trouble; the level and speed of information flow.

Putting the Team Together
Recognising the need for specialist help; what the specialist can achieve; what techniques might be used; how to assess specialist work; design and evaluation of surveys.

Hard Impacts
Air and water pollution; surface stability; noise and vibration; agricultural and chemical effluents etc.

Diffuse Impacts
Human health; radiological; applied biology; conservation problems etc.

Socio-Economic Impacts
Social; economic; cultural; archaeological etc.

Methodologies
Screening and scoping; quantifying impacts; technology assessment; risk analysis.

Case Study Analyses
Consideration of a number of prior and forthcoming studies.

Simulation Sessions
Leading to the production of a draft Environmental Impact Statement.

'Topical Module'
Detailed consideration of the potential impacts associated with one of the scheduled industries.

Concluding Overview
Discussion and consideration of the potential impacts associated with one of the scheduled industries.

Project Presentation

DIPLOMA IN RURAL DEVELOPMENT

This is a two-year, part-time, distance learning diploma for adults. The diploma resulted from the work of RUTAC (Rural Training Committee, Department of Agriculture) and is a collaborative effort between four Universities: University College Dublin, National University of Ireland, Maynooth, National University of Ireland, Galway and University College Cork. The course is targeted at people who are involved in rural development in a professional or voluntary leadership capacity. It provides the participants with the knowledge and skills necessary to initiate and manage local rural development.

Applications should be submitted to the Academic Director, Diploma Programme in Rural Development, Rural Development Unit, Faculty of Agriculture, University College Dublin, Belfield, Dublin 4.

RDEV 1001 Module 1: Introduction to Rural Development 30 Marks

The basic concepts of rural development, history of rural development in Ireland, current issues in development, different perspectives on development, different approaches to planning, rural development policy.

RDEV 1002 Module 2: Socio-Economic Aspects of Rural Development 60 Marks

The nature of the rural economy, agricultural change and restructuring, the role of agriculture in the rural economy. Rural households, resources, activities and income. Services, infrastructure and investments in rural areas. Case studies and their socio-economic impact.

RDEV 1003 Module 3: Socio-Economic Community/ Area Resource Audits 60 Marks

Introduction to local socio-economic resource audits, importance of local involvement in the audit process, measurements of resource-based needs and poverty. Planning a resource audit. Accessing existing and new sources of information and presenting statistical data. Writing a community/area profile.

RDEV 1004 Module 4: Community and Rural Development through Groups 70 Marks

Participatory development, the process and framework for participation. The group development process, factors which influence success in group work. Leadership skills and the role of leadership in groups. Voluntary and professional workers in local development. Networking and creating sustainable networks. The partnership approach and partnership issues.

RDEV 1005 Module 5: Choosing and Setting up a Rural Development Related Organisation/Structure 60 Marks

Organising and the organisation, the different forms of organisations. Aspects of organisational structures, management and communication within the organisation. Area-based development organisations, establishment and management.

RDEV 1006 Module 6: Marketing for Rural Enterprise 50 Marks
Marketing for small rural enterprise, marketing and the marketing concept, the role of marketing in business. Market information, business planning and development stages. Product concept, marketing strategy and brand development.

RDEV 1007 Module 7: Business Planning and Stimulating Rural Enterprise 100 Marks
How businesses get started, the start-up process, sources of new venture ideas. Evaluating the potential of new enterprise ideas, operational and financial feasibility. Planning structure and presentation; production, operational and marketing planning. The competitive market environment, market analysis, marketing strategy. Financial planning and basic concepts of financial accounting and business finance. Sources of funding for new rural enterprises and supporting the developing business.

RDEV 1008 Module 8: Interpersonal Communications, Leadership and Group-Work Skills 100 Marks
The need for communication in development, communication models and approaches. Information and decision making. Leadership styles and characteristics. Role of counselling and effective counselling skills. Groups, group work and groups decision-making.

RDEV 1009 Module 9: Designing and Managing an Area Development Plan 100 Marks
Policies, programmes and projects. Content, components, principles and models of an area/local development plan. Needs identification and priority setting, specification of programme projects. Management of area/local development programmes and projects. Programme and project monitoring and evaluation.

RDEV 1010 Module 10: Inter-organisational Partnerships and the Role of Support Agencies 60 Marks
Key principles of the partnership approach, structures of rural development partnerships in Ireland. Guidelines for establishing and operating an effective partnership and experience of local/rural development partnerships. Training and other support agencies and services. Response to the need of rural communities at international, national, regional and local level.

RDEV 1011 Module 11: Social Exclusion and Gender Equality Issues in Rural Development 60 Marks
The concept of equality. Defining and understanding social exclusion, EU social policy and measures. Gender in development and policy approaches to disadvantaged women in development programmes. The contribution of women to rural development in Ireland, problems and issues identified in recent research.

RDEV 1050 Field Work Project and Final Report 250 Marks

CERTIFICATE IN FOOD SAFETY AND HANDLING

The Certificate in Food Safety and Handling takes place on a part-time basis over one academic year. The programme is intended for operatives (catering establishments, food industry, hospital kitchens, canteens, delicatessen counters, etc.) who have responsibility for the handling of food but who have no previous experience of Food Microbiology. This programme aims to give the food handler a knowledge and understanding of basic food microbiology, hygiene and good manufacturing practices. Lectures and parallel laboratory sessions will cover the topics of the programme.

Applicants for the Certificate in Food Safety and Handling will have a Leaving Certificate. Previous knowledge of Food Microbiology is not required. The Certificate will be awarded at pass and honours level.

Applications should be submitted to the Academic Director, Certificate in Food Safety and Handling, Food Science Department, Faculty of Agriculture, University College Dublin, Belfield, Dublin 4.

PROGRAMME

FDSC 1001 Introduction to Food Microbiology **3 Hours**
The occurrence of micro-organisms on foods. Growth of micro-organisms in foods. Water microbiology.

FDSC 1002 Food Spoilage **4 Hours**
Micro-organisms involved. Causative factors.

FDSC 1003 Food Poisoning **4 Hours**
Common pathogens. Prevention. Overview and trends. Case studies.

FDSC 1004 Food Preservation **3 Hours**
Methods used to prevent or reduce the incidence of food spoilage and food poisoning.

FDSC 1005 Storage of Food **3 Hours**
Storage conditions. Packaging and distribution.

FDSC 1006 Safe Handling of Food **4 Hours**
Clothing and personal hygiene. Sources of contamination. Cross contamination. Effects of inadequate cooling, reheating, thawing, undercooking.

FDSC 1007 Cleaning Practices **3 Hours**
Disinfection. Sanitation. C.I.P. Safe disposal of waste.

Note: The hours indicated above are lecture hours only. Each lecture hour will be accompanied by a 2 hour laboratory practical

DATES OF ACADEMIC SESSION 2000/2001

First Semester/Michaelmas Term
(1st Year Agricultural Science)

Lecture Term	18 September – 08 December, 2000	(12 weeks)

Second Semester/Hilary and Trinity Terms
(1st Year Agricultural Science)

Hilary Lecture Term	08 January – 03 March, 2001	(8 weeks)
Break/Fieldwork	05 March – 23 March, 2001	(3 weeks)
Trinity Lecture Term	26 March – 20 April, 2001	(4 weeks)
Revision	23 April – 28 April, 2001	(1 week)
Examinations Commence	01 May, 2001	

First Semester/Michaelmas Term
(2nd, 3rd and 4th Year Agricultural Science)

Lecture Term	18 September – 08 December, 2000	(12 weeks)
Revision	09 December – 13 December, 2000	(5 days)
Examinations	13 December – 22 December, 2000	(9 working days)

Second Semester/Hilary and Trinity Terms
(2nd and 4th Year Agricultural Science)

Hilary Lecture Term	08 January – 03 March, 2001	(8 weeks)
Break/Fieldwork	05 March – 23 March, 2001	(3 weeks)
Trinity Lecture Term	26 March – 20 April, 2001	(4 weeks)
Revision	21 April – 30 April, 2001	(10 days)
Examinations Commence	01 May, 2001	

Second Semester/Hilary and Trinity Terms
(3rd Year Agricultural Science)

Hilary Lecture Term	08 January – 03 March, 2001	(8 weeks)
Revision	03 March – 10 March, 2001	(1 week)
Examinations	12 March – 24 March, 2001	(12 working days)
Professional Work Experience:		
• ACP Programme:	08 January – 31 August, 2001	
• All Programmes Excl. ACP, Food Sci. and Eng. Tech.	26 March – 31 August, 2001	

Easter Sunday: 15 April, 2001