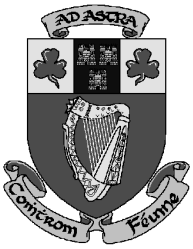
University College Dublin
An Coláiste Ollscoile Baile Átha Cliath

National University of Ireland, Dublin
Ollscoil na hÉireann, Baile Átha Cliath



Agri-Food & the Environment
(Bachelor of Agricultural Science Degree)

Session 2004/05

NOTE

This booklet contains information relating to the Bachelor of Agricultural Science degree programmes in the Faculty of Agri-Food and the Environment.

Information on postgraduate, continuing and professional education programmes in the Faculty of Agri-Food and the Environment is contained in a separate booklet.

Contents

Degrees in the Faculty of Agri-Food and the Environment

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 Agri-Food and the Environment:
Bachelor of Agricultural Science (BAgrSc)

Bachelor of Science in Rural Development (BSc(RD))

Master of Agricultural Science (MAgrSc)

Master of Science (Agriculture) (MSc(Agr))

Master of Landscape Architecture (MLArch) – Interfaculty

Doctor of Philosophy (PhD)

Degree of Bachelor of Agricultural Science (BAgrSc)

The approved programmes 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 (with the exception of transfer programmes – see note 3 below).

The BAgrSc Degree may be taken in:

1. Animal and Crop Production
2. Animal Science
3. Food and Agribusiness Management/Agribusiness and Rural Development
4. Agricultural and Environmental Science
5. Food Science
6. Engineering Technology
7. Horticultural Science
8. Landscape Horticulture
9. Forestry

Footnotes:

1. Direct entry to each of the BAgrSc degree programmes is via the denominated entry routes through the CAO System (DN040, DN041, DN042, DN043, DN044, DN045, DN046, DN047, DN048).
2. Entry to any of the nine degree programmes is possible via the omnibus entry route (CAO Code: DN010). However entry to specific degree programmes may be restricted (or may be unavailable) if the total number of available places have been filled by the denominated entry route.
3. Transfer/Progression routes from various programmes in the Institutes of Technology are also available for a number of degree programmes. These transfers usually take place following the successful completion of a diploma or certificate programmes in the Institutes of Technology and require an additional two or three year programme in the Faculty. For details see the *Summary of Transfer Programmes*.

Programme Structures and Credits

1. The BAgrSc degree programmes and constituent modules listed in this booklet are offered at the discretion of the Faculty of Agri-Food and the Environment.
2. The programmes for the first, second, third and fourth years are as set out in the Summary of BAgrSc Degree Programmes.
3. 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.

4. Each degree programme consists of 'required' or 'core' modules which are compulsory for all participating students and 'elective' modules (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 modules currently offered by the Faculty are listed in Elective Modules for the BAgrSc degree.
5. Courses are offered by the Faculty in a modular, semesterised framework and carry a credit rating according to the ECTS model operated by University College Dublin.

At present, one credit of course work at undergraduate level in the Faculty of Agri-Food and the Environment approximates to eight (8) hours of lectures (or their equivalent) together with the appropriate private study, totalling 20-25 hours per credit.

6. 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 Core Modules for the BAgrSc Degree Programmes.
7. 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 a Faculty guideline of 20-25 hours of student work for each credit (see the Summary of BAgrSc Degree Programmes).

Admissions Procedure

Details of admission procedures and entry requirements for programmes in the Faculty of Agri-Food and the Environment are contained in the booklet *Information for Applicants to Undergraduate Degree Courses* which is available from the Admissions Office.

Mature Years Applications

The Faculty of Agri-Food and the Environment normally offers a number of places to mature applicants. Details are available from the Admissions Office or from the Faculty of Agri-Food and the Environment Office.

Transfers from Institutes of Technology

The Faculty of Agri-Food and the Environment normally accepts a number of transferees from Institutes of Technology who have completed relevant certificate/diploma programmes. Details are available from the Admissions Office or from the Faculty of Agri-Food and the Environment Office.

Contact Details

Admissions Office
Michael Tierney Building, University College Dublin, Belfield, Dublin 4
Telephone: +353-1-716 1425/1602
Email:admissions@ucd.ie
Website: www.ucd.ie/admiss

Faculty of Agri-Food and the Environment Office
Agriculture and Food Science Building, University College Dublin, Belfield, Dublin 4
Telephone: +353-1-7167194
Email:faculty.agriculture@ucd.ie
Website: www.ucd.ie/agri

Faculty Regulations

Selection of BAgrSc Degree Programme Options for Students Admitted Via the Omnibus Entry Route (CAO Code DN010)

Students who have been admitted to the BAgrSc (DN010) degree programme must apply for their preferred degree programme 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. Entry may be denied if the total number of available places have been filled by students from the denominated entry route.

Transfer of BAgrSc Students To and From Direct Entry BAgrSc Degree Programmes

Students who have completed the First Year of any of the direct entry BAgrSc degree programmes (DN040 – Food Science; DN041 – Landscape Horticulture; DN042 – Forestry; DN043 – Food and Agribusiness Management; DN044 – Agricultural and Environmental Science; DN045 – Animal and Crop Production; DN046 – Animal Science; DN047 – Engineering Technology; DN048 – Horticultural Science) may apply for transfer to the Second Year of any other Faculty degree programme.

Applications should be made using the 'Internal Transfer Application Form', available from the Admissions Office. The closing date for such applications will be in early July 2005. To be considered for transfer, applicants must have: (a) a points score which would have secured entry to the preferred BAgrSc programme option in 2004; and (b) passed the First Year University Examination in Agricultural Science (AGBDF0001).

Transfer of such students is at the discretion of the Faculty and University on the basis of the availability of places in the preferred BAgrSc degree option. Where the number of eligible transferee applicants for a particular option exceeds the number of places available, places will be allocated on merit as determined by the aggregate marks obtained in the first attempt at the First University Examination in Agricultural Science (AGBDF0001).

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 Core Modules for the 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 end of the first semester or at some point during the second semester (consult the *Syllabus of Core Modules for the BAgrSc Degree Programmes*).

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 the 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 programme of the second year.

The Second University Examination must be passed within six terms from the time of entry to the programme 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 programme of the third year.

Students must pass the Third University Examination before entry to the programme 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 module before being re-admitted to the examination.

First or Second Class Honours (Grade I and Grade II) may be awarded on the results of the First, Second and Third University Examinations. The award of First or Second Class Honours (Grade I and Grade II) 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* (available on the UCD Website – address: www.ucd.ie/exams).

Leave of Absence

Students in good academic standing who wish to seek leave of absence for an academic year should put their request in writing to the Dean of the Faculty. Please consult with the relevant Head of Department in advance of writing to the Dean. Such requests will be brought to the Faculty and on to the Academic Council for approval.

Re-attendance

Students who wish to re-attend a module must seek the permission of the Faculty of Agri-Food and the Environment. Students must consult with the relevant Head of Department and put their request in writing to the Dean of the Faculty. Such requests will be brought to the Faculty and on to the Academic Council for approval.

Withdrawal

If you are considering leaving UCD, it is strongly recommended that you discuss the matter with the Student Adviser (Ms Aoife Fitzgerald). In order to withdraw officially from University you must notify the Registration Office, in writing and return your student card.

General Information

Contact Points:

Faculty Office
Room G12, Agriculture and Food Science Building,
Tel: 01-7167194; Email: faculty.agriculture@ucd.ie

Associate Dean for Student Affairs
Professor Edward Walsh, Room 109, Agriculture & Food Science Building
Tel: 01-7167775; Email: Edward.Walsh@ucd.ie

Student Adviser
Ms Aoife Fitzgerald, Room 121, Science Lecture Building
Tel: 01-7162863; Email: Aoife.Fitzgerald@ucd.ie

Exams
Examinations Office, Michael Tierney Building
Tel: 01-7161222; Email: examinations@ucd.ie

Fees

Fees Office, Michael Tierney Building
Tel: 01-7161432; Email: fees@ucd.ie; Website: www.ucd.ie/fees

Registration

Registration Office, Michael Tierney Building
Tel: 01-7161483 or 01-7161480; Email: registration@ucd.ie

Dates of Academic Session 2004/05

See last page of the booklet.

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.

International Exchange Programmes

The Faculty has formal exchange agreements with a number of US and European universities. In recent years the Faculty has offered a limited number of travel scholarships. For those interested in travelling abroad to participate in an exchange programme, please contact the Faculty International Relations Officer – Dr F Monahan (Tel: 01- 7167090; Email: Frank.Monahan@ucd.ie).

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, County Dublin and the Horticultural Unit on the university campus. Part of the third and fourth years of the Engineering Technology programme are taken at the Department of Biosystems Engineering, Earlsfort Terrace, Dublin 2.

Student Awards

Information on the scholarships and prizes available to students of the Faculty is contained in the Student Awards Booklet, available from the Fees and Grants Office (Tel: 01-7161431 or 7161432; Email: fees@ucd.ie; Website: www.ucd.ie/fees).

Summary of Programmes for the BAgrSc Degree

Agricultural Science First Year Programme

First Year

This programme is for those students who entered First Year Agricultural Science via the omnibus entry route (CAO Code: DN010).

Module Code	*Module Title*	*Credits*
AERD 1002	Introduction to Agricultural Economics and Business	6
BIOL 1002	Biology	10
CHEM 1002	Chemistry	12
EXPH 1002	Experimental Physics	10
MATH 1800	Mathematics	10
Students must select one of the following nine 12-credit modules*:		12
AERD 1003	Introduction to Food and Agribusiness *(12)*	
ANSC 1001	Introduction to Animal Science *(12)*	
CPSC 1002	Introduction to Animal and Crop Production *(12)*	
ENGT 1001	Introduction to Engineering Technology *(12)*	
ERM 1004	Introduction to Agricultural and Environmental Science *(12)*	
FDSC 1010	Introduction to Food Science *(12)*	
FOR 1001	Introduction to Forestry *(12)*	
HORT 1001	Introduction to Horticultural Science *(12)*	
HORT 1002	Introduction to Landscape Horticulture *(12)*	
		60

For information on selection of BAgrSc degree programme options – see Faculty Regulations (page 7).

* Students must register for one of the nine modules listed during the first semester. The Associate Dean for Student Affairs will advise the students in relation to this matter in due course.

1. Animal and Crop Production

First Year

Module Code	*Module Title*	*Credits*
AERD 1002	Introduction to Agricultural Economics and Business	6
BIOL 1002	Biology	10
CHEM 1002	Chemistry	12
CPSC 1002	Introduction to Animal and Crop Production	12
EXPH 1002	Experimental Physics	10
MATH 1800	Mathematics	10
		60

Second Year

Semester 1

Module Code	*Module Title*	*Credits*
AERD 2004	Business Management	6
AESC 2001	Agricultural and Environmental Biology	8
CPSC 2002	Statistics	6
FDSC 2007	Agricultural Chemistry I	4
INDM 2005	Agricultural Microbiology	6

Semester 2

Module Code	*Module Title*	*Credits*
ANSC 2001	Genetics I	2
ANSC 2006	Animal Nutrition I	4
ANSC 3012	Fundamentals of Biotechnology	2
CPSC 2001	Crop Husbandry I	4
ENGT 2011	Principles of Engineering I and II (i) *Principles of Engineering I (2)* (ii) *Principles of Engineering II (2)*	4
FDSC 2008	Agricultural Chemistry II	6
GEOL 2601	Geology	3
SLSC 2003	Soil Science	5
		60

Third Year

Semester 1

Module Code	*Module Title*	*Credits*
AESC 3010	Crop Protection	8
ANSC 3002	Animal Nutrition I	6
ANSC 3011	Animal Husbandry III	8
ANSC 3012	Fundamentals of Biotechnology	2
SLSC 3001	Soil Science II	6

Semester 2

Module Code	*Module Title*	*Credits*
CPSC 3201	Professional Work Experience	30
		60

Fourth Year

Semester 1

Module Code	*Module Title*	*Credits*
AERD 4003	Farm Business*	3
AERD 4016	Agricultural Policy Ia	3
ANSC 4004	Animal Husbandry IVa	12
CPSC 4005	Crop Husbandry IVa	8
CPSC 4100	Electives**	4

Semester 2

Module Code	*Module Title*	*Credits*
AERD 4002	Communications I	4
AERD 4003	Farm Business*	3
AERD 4017	Agricultural Policy Ib	3
ANSC 4005	Animal Husbandry IVb	4
CPSC 4006	Crop Husbandry IVb	6
CPSC 4100	Electives**	10
		60

* The module AERD 4003 'Farm Business' will be taught throughout Semester 1 and Semester 2

** Students must undertake elective modules amounting to 14 credits. Distribution of credits may vary across semester depending on individual selection of elective modules

2. Animal Science

First Year

Module Code	*Module Title*	*Credits*
AERD 1002	Introduction to Agricultural Economics and Business	6
ANSC 1001	Introduction to Animal Science	12
BIOL 1002	Biology	10
CHEM 1002	Chemistry	12
EXPH 1002	Experimental Physics	10
MATH 1800	Mathematics	10
		60

Second Year

Semester 1

Module Code	*Module Title*	*Credits*
AERD 2004	Business Management	6
AESC 2001	Agricultural and Environmental Biology	8
CPSC 2002	Statistics	6
FDSC 2007	Agricultural Chemistry I	4
INDM 2005	Agricultural Microbiology	6

Semester 2

Module Code	*Module Title*	*Credits*
AESC 2003	Animal Parasitology	2
ANSC 2002	Genetics I and II (i) *Genetics I (2)* (ii) *Genetics II (2)*	4
ANSC 2006	Animal Nutrition I	4
ANSC 3012	Fundamentals of Biotechnology	2
CPSC 2003	Crop Husbandry II	6
FDSC 2008	Agricultural Chemistry II	6
SLSC 2002	Soil Science I	6
		60

Third Year

Semester 1

Module Code	*Module Title*	*Credits*
ANSC 3002	Animal Nutrition I	6
ANSC 3004	Animal Breeding/Genetics	8
ANSC 3006	Anatomical Structure and Function	4
ANSC 3007	Experimental Design and Data Analysis	6
ANSC 3010	Computer Techniques	2
ANSC 3012	Fundamentals of Biotechnology	2
INDM 3010	Food Microbiology I	4

Semester 2

Module Code	*Module Title*	*Credits*
ANSC 3003	Animal Nutrition II	4
ANSC 3005	Animal Physiology	8
ANSC 3008	Animal Production Enterprises	4
ANSC 3201	Professional Work Experience	12
		60

Fourth Year

Semester 1

Module Code	*Module Title*	*Credits*
AERD 4003	Farm Business*	3
AERD 4016	Agricultural Policy Ia	3
ANSC 4002	Animal Husbandry V	4
ANSC 4004	Animal Husbandry IVa	12
ANSC 4400	Electives**	4
FDSC 4009	Fresh and Processed Meat Products I	4

Semester 2

Module Code	*Module Title*	*Credits*
AERD 4002	Communications I	4
AERD 4003	Farm Business*	3
AERD 4017	Agricultural Policy Ib	3
ANSC 4003	Animal Breeding II	6
ANSC 4005	Animal Husbandry IVb	4
ANSC 4400	Electives**	6
ERM 4004	Environmental Issues in Agriculture	4
		60

* The module FDSC 4003 'Farm Business' will be taught throughout Semester 1 and Semester 2.
** Students must undertake elective modules amounting to 10 credits. Distribution of credits may vary across semester depending on individual selection of elective modules.

3a. Food and Agribusiness Management

First Year

Module Code	*Module Title*	*Credits*
AERD 1002	Introduction to Agricultural Economics and Business	6
AERD 1003	Introduction to Food and Agribusiness	12
BIOL 1002	Biology	10
CHEM 1002	Chemistry	12
EXPH 1002	Experimental Physics	10
MATH 1800	Mathematics	10
		60

Second Year

Semester 1

Module Code	*Module Title*	*Credits*
AERD 2004	Business Management	6
AERD 3001	Business Law	2
AESC 2001	Agricultural and Environmental Biology	8
CPSC 2002	Statistics	6
FDSC 2007	Agricultural Chemistry I	4
INDM 2005	Agricultural Microbiology	6

Semester 2

Module Code	*Module Title*	*Credits*
AERD 2005	Applied Economic Analysis	6
AERD 2006	Written Communications	4
AERD 3006	Financial Planning and Control	4
ANSC 2005	Animal Husbandry I	6
CPSC 2003	Crop Husbandry II	6
FDSC 2009	Agricultural Chemistry III	2
		60

3b. Agribusiness and Rural Development

Third Year

Semester 1

Module Code	*Module Title*	*Credits*
AERD 3001	Business Law	2
AERD 3009	Rural Development	6
AERD 3012	Computer Analysis	6
AERD 3013	Farm Business Management I	6
AERD 3300	Electives	4
ANSC 3009	Animal Husbandry II	8

Semester 2

Module Code	*Module Title*	*Credits*
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 3200	Professional Work Experience	14
		60

Fourth Year

Semester 1

Module Code	*Module Title*	*Credits*
AERD 4004	Agricultural Marketing and Trade	4
AERD 4011	Research Methods/Project	6
AERD 4012	Taxation	2
AERD 4014	Farm Business Management II*	3
AERD 4018	Agricultural Policy IIa	4
AERD 4400	Electives**	3
ECON 4101	National Economics	4

Semester 2

Module Code	*Module Title*	*Credits*
AERD 4006	Communications II	6
AERD 4007	Enterprise Development	4
AERD 4009	Food and Farm Input Marketing	4
AERD 4014	Farm Business Management II*	3
AERD 4015	IT and E-Business	4
AERD 4019	Agricultural Policy IIb	4
AERD 4050	Major Project	4
AERD 4400	Electives**	*5*
		60

* The module FDSC 4014 'Farm Business Management II' will be taught throughout Semester 1 and Semester 2.

** Students must undertake elective modules amounting to 8 credits. Distribution of credits may vary across semester depending on individual selection of elective modules.

4. Agricultural and Environmental Science

First Year

Module Code	*Module Title*	*Credits*
AERD 1002	Introduction to Agricultural Economics and Business	6
BIOL 1002	Biology	10
CHEM 1002	Chemistry	12
ERM 1004	Introduction to Agricultural and Environmental Science	12
EXPH 1002	Experimental Physics	10
MATH 1800	Mathematics	10
		60

Second Year

Semester 1

Module Code	*Module Title*	*Credits*
AESC 2007	Applied Plant Biology	6
CPSC 2002	Statistics	6
CPSC 2004	Agricultural Climatology and Meteorology	2
ENGT 2007	Surveying	2
ERM 2002	Earth Science and the Environment	4
FDSC 2007	Agricultural Chemistry I	4
INDM 2005	Agricultural Microbiology	6

Semester 2

Module Code	*Module Title*	*Credits*
AESC 2004	Plant Physiology	4
ANSC 2001	Genetics I	2
ANSC 2005	Animal Husbandry I	6
CPSC 2003	Crop Husbandry II	6
ERM 2003	Applied Zoology I	6
FDSC 2008	Agricultural Chemistry II	6
		60

Third Year

Semester 1

Module Code	*Module Title*	*Credits*
AESC 3007	Agrichemicals and Plants	4
AESC 3013	Literature Review Project	2
ANSC 3009	Animal Husbandry II	8
ANSC 3012	Fundamentals of Biotechnology	2
ERM 3007	Applied Zoology II	4
ERM 3009	Diversity in the Rural Landscape (a)	4
SLSC 3001	Soil Science II	6

Semester 2

Module Code	*Module Title*	*Credits*
AESC 3004	Plant Pathology	6
AESC 3201	Professional Work Experience	12
ERM 3008	Applied Zoology III	4
ERM 3010	Diversity in the Rural Landscape (b)	4
FOR 4005	Experimental Design	4
		60

Fourth Year

Semester 1

Module Code	*Module Title*	*Credits*
AESC 4004	Wildlife Management**	4
AESC 4006	Pest Management**	4
AESC 4007	Plant Disease Management**	4
AESC 4400	Electives*	6
ERM 4003	Environmental Impact Assessment	4
ERM 4005	Environmental Management	8

Semester 2

Module Code	*Module Title*	*Credits*
AESC 4005	Epidemiology and Zoonoses**	4
AESC 4008	Molecular Biology and the Environment**	4
AESC 4051	Project	12
AESC 4400	Electives*	6
ERM 4006	Soil and Water Management	8
		60

* Students must undertake elective modules amounting to 12 credits. Distribution of credits may vary across semester depending on individual selection of elective modules.

** Students must undertake and register for four of the five 4-credit modules.

5. Food Science

First Year

Module Code	*Module Title*	***Credits***
AERD 1002	Introduction to Agricultural Economics and Business	6
BIOL 1002	Biology	10
CHEM 1002	Chemistry	12
EXPH 1002	Experimental Physics	10
FDSC 1010	Introduction to Food Science	12
MATH 1800	Mathematics	10
		60

Second Year

Semester 1

Module Code	*Module Title*	Credits
AERD 2004	Business Management	6
CPSC 2002	Statistics	6
ERM 2001	Agricultural Ecology and Pollution Control	4
FDSC 2007	Agricultural Chemistry I	4
FDSC 2010	Sensory Analysis	4
INDM 2005	Agricultural Microbiology	6

Semester 2

Module Code	*Module Title*	Credits
ANSC 2005	Animal Husbandry I	6
CPSC 2003	Crop Husbandry II	6
FDSC 2004	Food Science I: Food Physics	4
FDSC 2005	Food Science II: Basic Analysis	8
FDSC 2008	Agricultural Chemistry II	6
		60

Third Year

Semester 1

Module Code	*Module Title*	*Credits*
ENGT 3004	Food Engineering Principles	6
FDSC 3008	Food Analysis I	6
FDSC 3010	Food Chemistry I	4
FDSC 3012	Literature Review	2
FOR 3005	Computer Applications	4
INDM 3009	Food Microbiology II	6

Semester 2

Module Code	*Module Title*	*Credits*
FDSC 3005	Nutrition I	4
FDSC 3007	Product Development	4
FDSC 3009	Food Analysis II	4
FDSC 3011	Food Chemistry II	6
FDSC 3013	Nutritional Physiology	6
FDSC 3202	Professional Work Experience	4
FOR 4005	Experimental Design	4
		60

Fourth Year

Semester 1

Module Code	*Module Title*	*Credits*
ENGT 4002	Food Manufacturing Systems	8
FDSC 4007	Nutrition II	4
FDSC 4010	Fresh and Processed Meat Products II	6
FDSC 4011	Dairy Products	6
FDSC 4014	Food Preservation	4
FDSC 4051	Project*	2

Semester 2

Module Code	*Module Title*	*Credits*
FDSC 4006	Marketing	4
FDSC 4008	Food Ingredients	6
FDSC 4012	Cereal Chemistry and Brewing Science	4
FDSC 4015	Food Process Technology	4
FDSC 4016	Food Safety	4
FDSC 4051	Project*	8
		60

* The module FDSC 4051 'Project' will be offered throughout Semester 1 and Semester 2.

6. Engineering Technology

First Year

Module Code	*Module Title*	*Credits*
AERD 1002	Introduction to Agricultural Economics and Business	6
BIOL 1002	Biology	10
CHEM 1002	Chemistry	12
ENGT 1001	Introduction to Engineering Technology	12
EXPH 1002	Experimental Physics	10
MATH 1800	Mathematics	10
		60

Second Year

Semester 1

Module Code	*Module Title*	*Credits*
AERD 2004	Business Management	6
CPSC 2002	Statistics	6
ENGT 2017	Literature Research Project	4
ERM 2001	Agricultural Ecology and Pollution Control	4
FDSC 2007	Agricultural Chemistry I	4
INDM 2005	Agricultural Microbiology	6

Semester 2

Module Code	*Module Title*	*Credits*
ANSC 2005	Animal Husbandry I	6
CPSC 2003	Crop Husbandry II	6
ENGT 2013	Principles of Engineering I, II and III (i) *Principles of Engineering I (2)* (ii) *Principles of Engineering II (2)* (iii) *Principles of Engineering III (2)*	6
ENGT 2014	Computer and Manufacturing Technology	6
ENGT 2016	Food Technology	6
		60

Third Year

Semester 1

Module Code	*Module Title*	*Credits*
ANSC 3009	Animal Husbandry II	8
ENGT 3001	Food Engineering Principles	8
ENGT 3009	Computer Information Systems	4
ENGT 3012	Waste Management	4
ENGT 3300	Electives*	2
FOR 3010	Remote Sensing and GIS	4

Semester 2

Module Code	*Module Title*	*Credits*
AERD 3006	Financial Planning and Control	4
ENGT 3002	Power and Machinery I	8
ENGT 3010	Computer Programming	4
ENGT 3011	Soil Engineering	4
ENGT 3050	Major Project I	8
ENGT 3300	Electives*	2
		60

Fourth Year

Semester 1

Module Code	*Module Title*	*Credits*
ENGT 4002	Food Manufacturing Systems	8
ENGT 4007	Power and Machinery II	8
ENGT 4008	Environmental Engineering Principles	8
ENGT 4050	Major Project II** (including professional work experience)	6

Semester 2

Module Code	*Module Title*	*Credits*
ENGT 4001	Buildings and Environment	8
ENGT 4003	Food Process Engineering	8
ENGT 4050	Major Project II*(including professional work experience)	8
ENGT 4100	Electives	6
		60

* Students must undertake elective modules amounting to 4 credits. Distribution of credits may vary across semester depending on individual selection of elective modules.

** Students must undertake the module ENGT 4050 'Major Project II' throughout Semester 1 and Semester 2.

7. Horticultural Science

First Year

Module Code	*Module Title*	*Credits*
AERD 1002	Introduction to Agricultural Economics and Business	6
BIOL 1002	Biology	10
CHEM 1002	Chemistry	12
EXPH 1002	Experimental Physics	10
HORT 1001	Introduction to Horticultural Science	12
MATH 1800	Mathematics	10
		60

Second Year

Semester 1

Module Code	*Module Title*	*Credits*
AERD 2004	Business Management	6
AESC 2007	Applied Plant Biology	6
CPSC 2002	Statistics	6
CPSC 2004	Agricultural Climatology and Meteorology	2
FDSC 2007	Agricultural Chemistry I	4
INDM 2005	Agricultural Microbiology	6

Semester 2

Module Code	*Module Title*	*Credits*
AESC 2004	Plant Physiology	4
ANSC 2001	Genetics I	2
ENGT 2012	Engineering and Surveying *(i) Principles of Engineering III (2 credits)* *(ii) Surveying (2 credits)*	4
FDSC 2008	Agricultural Chemistry II	6
HORT 2009	Fundamentals of Horticulture	8
SLSC 2002	Soil Science I	6
		60

Third Year

Semester 1

Module Code	*Module Title*	*Credits*
ERM 3011	Plant Protection (Horticultural Zoology)	6
HORT 3001	Landscape and Turfgrass Management I	4
HORT 3002	Landscape Design Theory	4
HORT 3005	Pomology I	4
HORT 3007	Vegetable Crops I	2
HORT 3017	Plant Materials (a)	4
SLSC 3002	Soil Science III	6

Semester 2

Module Code	*Module Title*	*Credits*
ERM 3012	Plant Protection (Plant Pathology)	6
HORT 3003	Nursery/Garden Centre Management I	4
HORT 3006	Protected Horticulture I	4
HORT 3018	Plant Materials (b)	2
HORT 3200	Professional Work Experience	14
		60

Fourth Year

Semester 1

Module Code	*Module Title*	*Credits*
CPSC 4004	Crop Breeding	2
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 4050	Research Project*	4
HORT 4400	Electives**	8

Semester 2

Module Code	*Module Title*	*Credits*
AERD 4006	Communications II	6
AERD 4007	Enterprise Development	4
ERM 4007	Molecular Crop Breeding	2
HORT 4007	Vegetable Crops II	2
HORT 4050	Research Project*	6
HORT 4400	Electives**	10
		60

* The module HORT 4050 'Research Project' will be offered throughout Semester 1 and Semester 2.
** Students must undertake elective modules amounting to 18 credits. Distribution of credits may vary across semester depending on individual selection of elective modules.

8. Landscape Horticulture

First Year

Module Code	*Module Title*	*Credits*
AERD 1002	Introduction to Agricultural Economics and Business	6
BIOL 1002	Biology	10
CHEM 1002	Chemistry	12
EXPH 1002	Experimental Physics	10
HORT 1002	Introduction to Landscape Horticulture	12
MATH 1800	Mathematics	10
		60

Second Year

Semester 1

Module Code	*Module Title*	*Credits*
AESC 2001	Agricultural and Environmental Biology	8
CPSC 2002	Statistics	6
HORT 2008	Landscape Design Theory I	8
HORT 2010	Landscape Studio 2a	4
HORT 2012	Computer Applications in Landscape Architecture	4

Semester 2

Module Code	*Module Title*	*Credits*
AERD 2006	Written Communications	4
AESC 2004	Plant Physiology	4
ENGT 2007	Surveying	2
HORT 2009	Fundamentals of Horticulture	8
HORT 2011	Landscape Studio 2b	6
SLSC 2002	Soil Science I	6
		60

Third Year

Semester 1

Module Code	*Module Title*	*Credits*
ERM 3004	Landscape Ecology	4
ERM 3005	Landscape Interpretation	4
HORT 3001	Landscape and Turfgrass Management I	4
HORT 3014	Landscape Design Studio 3a	6
HORT 3016	Landscape Design Theory II	4
HORT 3017	Plant Materials (a)	4
SLSC 3003	Soil Science IV	4

Semester 2

Module Code	*Module Title*	*Credits*
HORT 3013	Landscape Construction	6
HORT 3015	Landscape Design Studio 3b	6
HORT 3018	Plant Materials (b)	2
HORT 3019	Professional Practice and Planning Law I	2
HORT 3020	Urban Horticulture	2
HORT 3202	Professional Work Experience	12
		60

Fourth Year

Semester 1

Module Code	*Module Title*	*Credits*
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 4013	Landscape Design Studio 4a	4
HORT 4051	Landscape Research Project*	6
HORT 4101	Electives**	6

Semester 2

Module Code	*Module Title*	*Credits*
AERD 4006	Communications II	6
HORT 4010	Landscape Design Theory III and Professional Practice and Planning Law II	6
HORT 4014	Landscape Design Studio 4b	8
HORT 4051	Landscape Research Project*	4
HORT 4101	Electives**	2
		60

* The module HORT 4051 'Landscape Research Project' will be offered throughout Semester 1 and Semester 2.

** Students must undertake elective modules amounting to 8 credits. Distribution of credits may vary across semester depending on individual selection of elective modules.

9. Forestry

First Year

Module Code	*Module Title*	*Credits*
AERD 1002	Introduction to Agricultural Economics and Business	6
BIOL 1002	Biology	10
CHEM 1002	Chemistry	12
EXPH 1002	Experimental Physics	10
FOR 1001	Introduction to Forestry	12
MATH 1800	Mathematics	10
		60

Second Year

Semester 1

Module Code	*Module Title*	*Credits*
AERD 2004	Business Management	6
AESC 2001	Agricultural and Environmental Biology	8
FOR 2004	Fundamentals of Forestry	8
INDM 2005	Agricultural Microbiology	6

Semester 2

Module Code	*Module Title*	*Credits*
AESC 2004	Plant Physiology	4
ENGT 2012	Engineering and Surveying (i) *Principles of Engineering III (2 credits)* (ii) *Surveying (2 credits)*	4
FDSC 2006	Agricultural Chemistry IV	4
FOR 2001	Forest Mensuration and Biometrics	8
FOR 2005	Silviculture I	6
SLSC 2002	Soil Science I	6
		60

Third Year

Semester 1

Module Code	*Module Title*	*Credits*
AESC 3006	Forest Protection	6
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 3100	Electives*	2

Semester 2

Module Code	*Module Title*	*Credits*
FOR 3002	Forest Harvesting	4
FOR 3011	Forest Inventory and Biometrics	4
FOR 3012	Professional Forestry Practice	4
FOR 3100	Electives*	4
FOR 3201	Professional Work Experience	12
		60

Fourth Year

Semester 1

Module Code	*Module Title*	*Credits*
FOR 4003	Forest Management Plan**	4
FOR 4004	Forest Planning	6
FOR 4006	Forest Inventory and GIS	10
FOR 4100	Electives***	8

Semester 2

Module Code	*Module Title*	*Credits*
FOR 4003	Forest Management Plan**	8
FOR 4005	Experimental Design	4
FOR 4051	Research Project	16
FOR 4100	Electives***	4
		60

* Students must undertake elective modules amounting to 6 credits. Distribution of credits may vary across semester depending on individual selection of elective modules.

** The module FOR 4003 'Forest Management Plan' will be offered throughout Semester 1 and Semester 2.

*** Students must undertake elective modules amounting to 12 credits. Distribution of credits may vary across semester depending on individual selection of elective modules.

Summary of Transfer Programmes

1(a). Animal and Crop Production WIT Transfer

This programme is for students who have obtained the National Diploma in Science in Agricultural Science.

Third Year
As for the degree programme in Animal and Crop Production.

Fourth Year
As for the degree programme in Animal and Crop Production.

1(b). Animal and Crop Production Teagasc/IT Transfer

This programme is for students who have obtained the National Certificate in Agriculture.

Second Year

Module Code	*Module Title*	*Credits*
BIOL 1002	Biology	10
CHEM 1002	Chemistry	12
EXPH 1002	Experimental Physics	10
MATH 1800	Mathematics	10
CPSC 1002	Introduction to Animal and Crop Production	12
CPSC 2200	Electives*	6
		60

Third Year

Semester 1

Module Code	*Module Title*	*Credits*
AERD 2004	Business Management	6
AESC 2001	Agricultural and Environmental Biology	8
CPSC 2002	Statistics	6
FDSC 2007	Agricultural Chemistry I	4
INDM 2005	Agricultural Microbiology	6

Semester 2

Module Code	*Module Title*	*Credits*
ANSC 2001	Genetics I	2
ANSC 2006	Animal Nutrition I	4
ANSC 3012	Fundamentals of Biotechnology	2
CPSC 3301	Electives*	4
ENGT 2011	Principles of Engineering I and II (i) *Principles of Engineering I (2)* (ii) *Principles of Engineering II (2)*	4
FDSC 2008	Agricultural Chemistry II	6
GEOL 2601	Geology	3
SLSC 2003	Soil Science	5
		60

Fourth Year

To be confirmed in Academic Session 2005/06.

Restricted Electives (Available to the Animal and Crop Production Teagasc/IT Transfer Programme)

Communications I **4 Credits AERD 4002**

Syllabus as per the core module.

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, radio scripting and recording.

* Elective modules to be selected from those listed in the 'Elective Modules for the BAgrSc Degree' and/or from the following restricted elective modules.

Beef Cattle Husbandry **3 Credits** **ANSC 4117**

Syllabus as for 'Beef Cattle Husbandry' Section of ANSC 4005.

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.

Cereal Production **2 Credits** **CPSC 4110**

In this course, taken in Semester 1, topics related to cereal production (as in module CPSC 4005 'Crop Husbandry IVa') are covered.

Root and Green Crops **2 Credits** **CPSC 4111**

In this course, taken in Semester 2, topics related to root crop production (as in module CPSC 4006 'Crop Husbandry IVb') are covered.

2(a). Animal Science WIT Transfer

The following programme is for students who have obtained the National Diploma in Science in Agricultural Science.

Third Year

As for the degree programme in Animal Science.

Fourth Year

As for the degree programme in Animal Science.

2(b). Animal Science Teagasc/IT Transfer

The following programme is for students who have obtained the National Certificate in Agriculture.

Second Year

Module Code	*Module Title*	*Credits*
ANSC 1001	Introduction to Animal Science	12
ANSC 2200	Electives	6
BIOL 1002	Biology	10
CHEM 1002	Chemistry	12
EXPH 1002	Experimental Physics	10
MATH 1800	Mathematics	10
		60

Third Year

Semester 1

Module Code	*Module Title*	*Credits*
AERD 2004	Business Management	6
AESC 2001	Agricultural and Environmental Biology	8
CPSC 2002	Statistics	6
FDSC 2007	Agricultural Chemistry I	4
INDM 2005	Agricultural Microbiology	6

Semester 2

Module Code	*Module Title*	*Credits*
AESC 2003	Animal Parasitology	2
ANSC 2002	Genetics I and II (i) *Genetics I (2)* (ii) *Genetics II (2)*	4
ANSC 2006	Animal Nutrition I	4
ANSC 3012	Fundamentals of Biotechnology	2
ANSC 3300	Electives	6
FDSC 2008	Agricultural Chemistry II	6
SLSC 2002	Soil Science I	6
		60

Fourth Year

To be confirmed in Academic Session 2005/06.

3(a). Agribusiness and Rural Development WIT Transfer

The following programme is for students who have obtained the National Diploma in Science in Agricultural Science.

Third Year

Semester 1

Module Code	*Module Title*	*Credits*
AERD 3001	Business Law	2
AERD 3009	Rural Development	6
AERD 3012	Computer Analysis	6
AERD 3013	Farm Business Management I	6
ANSC 3009	Animal Husbandry II	8

Semester 2

Module Code	*Module Title*	*Credits*
AERD 2005	Applied Economic Analysis	6
AERD 3006	Financial Planning and Control	4
AERD 3007	Operations and Personnel Management	4
AERD 3008	Quantitative Methods	4
AERD 3200	Professional Work Experience	14
		60

Fourth Year

As for the degree programme in Agribusiness and Rural Development.

3(b). Food and Agribusiness Management Teagasc/IT Transfer

The following programme is for students who have obtained the National Certificate in Agriculture.

Second Year

Module Code	*Module Title*	*Credits*
AERD 1002	Introduction to Agricultural Economics and Business	6
AERD 1003	Introduction to Food and Agribusiness	12
AERD 2006	Written Communications	4
AERD 3001	Business Law	2
AERD 3003	Co-operatives	2
AERD 3006	Financial Planning and Control	4
AESC 2001	Agricultural and Environmental Biology	8
CPSC 2002	Statistics	6
INDM 2005	Agricultural Microbiology	6
MATH 1800	Mathematics	10
		60

3(c). Agribusiness and Rural Development Teagasc/IT Transfer

The following programme is for students who have obtained the National Certificate in Agriculture.

Third Year

Semester 1

Module Code	*Module Title*	*Credits*
AERD 2004	Business Management	6
AERD 3001	Business Law	2
AERD 3009	Rural Development	6
AERD 3012	Computer Analysis	6
AERD 3301	Electives	6

Semester 2

Module Code	*Module Title*	*Credits*
AERD 2005	Applied Economic Analysis	6
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 3200	Professional Work Experience	14
		60

Fourth Year

To be confirmed in Academic Session 2005/06.

4(a). Agricultural and Environmental Science WIT Transfer

The following programme is for students who have obtained the National Diploma in Science in Agricultural Science.

Third Year

Semester 1

Module Code	*Module Title*	*Credits*
AESC 3007	Agrichemicals and Plants	4
AESC 3013	Literature Review Project	2
ANSC 3012	Fundamentals of Biotechnology	2
ERM 3006	Earth Science	8
ERM 3007	Applied Zoology II	4
ERM 3009	Diversity in the Rural Landscape (a)	4
SLSC 3001	Soil Science II	6

Semester 2

Module Code	*Module Title*	*Credits*
AESC 3004	Plant Pathology	6
AESC 3201	Professional Work Experience	12
ERM 3008	Applied Zoology III	4
ERM 3010	Diversity in the Rural Landscape (b)	4
FOR 4005	Experimental Design	4
		60

Fourth Year

As for the degree programme in Agricultural and Environmental Science.

6(a). Engineering Technology ITT Transfer

The following programme is for students who have obtained the National Diploma in Engineering (Agricultural).

Third Year

As for the degree programme in Engineering Technology.

Fourth Year

As for the degree programme in Engineering Technology.

6(b). Engineering Technology WIT Transfer

The following programme is for students who have obtained the National Diploma in Science in Agricultural Science.

Third Year

As for the degree programme in Engineering Technology.

Fourth Year

As for the degree programme in Engineering Technology.

7(a). Horticultural Science WIT Transfer

The following programme is for students who have obtained the National Diploma in Science in Agricultural Science.

Third Year

As for the degree programme in Horticultural Science.

Fourth Year

As for the degree programme in Horticultural Science.

7(b). Horticultural Science ITB/WIT Transfer

The following programme is for students who have obtained the National Diploma in Horticulture.

Third Year

Module Code	*Module Title*	*Credits*
AERD 1002	Introduction to Agricultural Economics and Business	6
BIOL 1002	Biology	10
CHEM 1002	Chemistry	12
EXPH 1002	Experimental Physics	10
HORT 1003	Introduction to Horticulture	6
HORT 3301	Electives	6
MATH 1800	Mathematics	10
		60

Fourth Year

Semester 1

Module Code	*Module Title*	*Credits*
AESC 2001	Agricultural and Environmental Biology	8
CPSC 2004	Agricultural Climatology and Meteorology	2
FDSC 2007	Agricultural Chemistry I	4
HORT 4401	Electives*	10
INDM 2005	Agricultural Microbiology	6

Semester 2

Module Code	*Module Title*	*Credits*
AERD 4006	Communications II	6
HORT 4050	Research Project	10
HORT 4401	Electives*	14
		60

Restricted Electives (Available to the Horticultural Science ITB/WIT Transfer Programme)

Module Code	*Module Title*	*Credits*
HORT 3001	Landscape and Turfgrass Management I	4
HORT 3002	Landscape Design Theory	4
HORT 3003	Nursery/Garden Centre Management I	4
HORT 3005	Pomology I	4
HORT 3006	Protected Horticulture I	4
HORT 3007	Vegetable Crops I	2
HORT 3017	Plant Materials (a)	4
HORT 3018	Plant Materials (b)	2
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

* Students must undertake elective modules amounting to 24 credits. Distribution of credits may vary across semester depending on individual selection of elective modules. The elective modules can be selected from those listed in the 'Elective Modules for the BAgrSc Degree' and/or from the following restricted elective modules. The description for the following modules can be found in the syllabus of core modules for BAgrSc degree programmes.

8(a). Landscape Horticulture ITB/WIT Transfer

The following programme is for students who have obtained the National Diploma in Horticulture.

Third Year

As for the degree programme in Landscape Horticulture.

Fourth Year

As for the degree programme in Landscape Horticulture.

9(a). Forestry WIT Transfer

The following programme is for students who have obtained the National Diploma in Science in Forestry.

Third Year

Module Code	*Module Title*	*Credits*
Semester 1		
AERD 2004	Business Management	6
AESC 3006	Forest Protection	6
FOR 3006	Forest Management	4
FOR 3008	Silviculture II	8
FOR 3010	Remote Sensing and GIS	4
FOR 3100	Electives*	2
Semester 2		
AESC 2004	Plant Physiology	4
FDSC 2006	Agricultural Chemistry IV	4
FOR 3011	Forest Inventory and Biometrics	4
FOR 3100	Electives*	4
FOR 3202	Professional Work Experience	8
SLSC 2002	Soil Science I	6
		60

Fourth Year

As for the degree programme in Forestry.

* Students must undertake elective modules amounting to 6 credits. Distribution of credits may vary across semester depending on individual selection of elective modules.

9(b). Forestry GMIT Transfer

The following programme is for students who have obtained the National Diploma in Technology(Forest Management)

Third Year

Semester 1

Module Code	*Module Title*	*Credits*
AERD 2004	Business Management	6
AESC 3006	Forest Protection	6
FOR 3006	Forest Management	4
FOR 3008	Silviculture II	8
FOR 3010	Remote Sensing and GIS	4
FOR 3100	Electives*	2

Semester 2

Module Code	*Module Title*	*Credits*
AESC 2004	Plant Physiology	4
FDSC 2006	Agricultural Chemistry IV	4
FOR 3011	Forest Inventory and Biometrics	4
FOR 3100	Electives*	4
FOR 3202	Professional Work Experience	8
SLSC 2002	Soil Science I	6
		60

Fourth Year

As for the degree programme in Forestry.

* Students must undertake elective modules amounting to 6 credits. Distribution of credits may vary across semester depending on individual selection of elective modules.

Syllabus of Core Modules for the BAgrSc Degree

Introduction to Agricultural Economics and Business 6 Credits AERD 1002

Overview of the National Economy

The Key Institutions (Government, Semi-State and Private Sector) of the Economy; Evolution, Development and Trends in the Key Indicators and Variables in the National Economy; Policy-Making at National and European level.

The Agri-Food Sector in the Economy

Role of Agriculture in the National Economy; Structure of the Sector; Trends in Key Indicators; The Food Supply Chain; Role of Policy in the Agri-Food Sector.

Introduction to Producer and Consumer Behaviour

Fundamentals of Supply and Demand Analysis; Role of Markets in the Economy; Role of Government in the Economy; Trade and the Economy.

Introduction to the Rural Economy

Defining the Rural Economy; The Contribution of the Rural Economy; Key Trends and Indicators; Key Policy Issues.

Introduction to Food and Agribusiness 12 Credits AERD 1003

Study Skills

Group communication, writing skills, use of library. Critical thinking. Basic concepts of information technology. Practical computer skills with word processing, spreadsheet and presentation applications. Email and internet.

Preparation for Science Studies

To provide incoming students, particularly those with limited exposure to science subjects at second level, with an overview of the subject and a foundation for higher-level study of science. The scientific method and its component steps. States of matter: gas, liquid, solid. Elements and compounds. Atoms, isotopes and ions. Periodic table. Terminology of chemical reactions.

Introduction to the Food Chain

Lecture/seminar orientation covering (a) Economic and commercial perspectives of the food chain and (b) Sociological and environmental perspectives of the food chain. Students will also carry out a fieldwork/library/literature project based on selected aspects of the lecture content.

Business Management 6 Credits AERD 2004

Business Organisation

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

Business Finance
Basic concepts and principles of financial accounting. Financial statement structure, interpretation and analysis. Financial objectives and performance of Irish food and agribusiness firms. Comparative analysis of accounts of selected firms. Financial planning and asset management. Alternative funding strategies and characteristics of debt and equity sources of finance.

Marketing
Definition of marketing. Marketing in relation to Irish food, agriculture and related sectors. Marketing environment in which the Irish food, farming and forestry 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.

Applied Economic Analysis — 6 Credits — AERD 2005

The Agri-Food Chain
Analysis of the contribution of the Agri-Food Sector to the Economy. Structure, conduct and performance of the Food Supply Chain.

Producer and Consumer Behaviour
Application of Economic Analysis to Supply, Demand and Price Formation; Analysis of Markets; Behaviour of the Producer and the Firm; Consumer Behaviour; Analysis of Government Intervention in the Economy; Trade Policy Analysis.

Analysis of the Rural Economy
Conceptual and Measurement Issues in the Analysis of the Rural Economy; Markets for Rural Economy Goods and Services; Market Failure and the Rural Economy; Role of Policy in the Sector.

The Agri-Food Sector and the Environment
Interaction between the Agri-Food Sector and Environment; Rationale for Government Intervention; Role of Economics in Agri-Environmental Issues; Policy Issues for Agriculture and the Environment.

Written Communications — 6 Credits — AERD 2006

The meaning of communication and its role in food and agribusiness organisations.

The communication process and factors influencing its success.

Writing skills: principles of effective writing; and writing for different audiences and print media.

Business Law — 2 Credits — AERD 3001

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.

Co-operatives **2 Credits AERD 3003**

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.

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

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

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

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.

Quantitative Methods **4 Credits AERD 3008**

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.

Rural Development **6 Credits AERD 3009**

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.

Computer Analysis **6 Credits AERD 3012**

Role of computers in management information systems and decision support. Use of microcomputers in agribusiness with emphasis on spreadsheets, graphics and databases and "hands-on" experience with these systems. Spreadsheet applications in simulation modelling with examples in financial analysis and planning, investment appraisal, optimisation and risk analysis. Database architecture and the role of database management systems. Design, application and maintenance of databases. Issues of data security and protection.

Farm Business Management I **6 Credits AERD 3013**

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. Principles of production economics. Farm financial analysis; production contracts and quality assurance.

Professional Work Experience **14 Credits AERD 3200**

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

Electives **4 Credits AERD 3300**

Electives **6 Credits AERD 3301**

Communications I **4 Credits AERD 4002**

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.

Farm Business **6 Credits AERD 4003**

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.

Agricultural Marketing and Trade **4 Credits AERD 4004**

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.

Communications II **6 Credits AERD 4006**

The development of communication skills that 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.

Enterprise Development **4 Credits AERD 4007**

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.

Food and Farm Input Marketing **4 Credits AERD 4009**

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.

Research Methods/Project **6 Credits AERD 4011**

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.

Taxation **2 Credits AERD 4012**

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.

Farm Business Management II **6 Credits AERD 4014**

Principles of strategic management and planning. Systematic analysis of enterprise gross margin accounts to identify strengths and weakness in the farming system. Farm planning techniques: partial budgeting, whole farm budgeting gross margin planning, ad hoc budgeting, cash flow budgeting, linear programming. Principles of budgetary control. Investment appraisal techniques: pay back, rate of return, discounted cash flow. Economics of mechanisation and labour use. Influence of risk and uncertainty in decision-making. Direct payments and grants schemes. Farm computerisation and IT.

IT and E-Business **4 Credits AERD 4015**

Importance of Information and Communications Technology in agribusiness and rural development. Use and potential of commonly used ICTs. Role of ICT in promoting rural development. Internet, Intranet and Extranet services; impact of E-technology on business in market place, management and control systems. Information procurements; portals and web development; Investment for E-business including human resources; case studies in B2B, B2C and B2E situations in Food and Agribusiness. Legal requirements and protections in E-business trading; future developments in E-business.

Agricultural Policy Ia **3 Credits AERD 4016**

Agriculture in the national economy: measurement of the agricultural sector – output, nonfactor 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.

Agricultural Policy Ib **3 Credits AERD 4017**

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.

Agricultural Policy IIa **4 Credits AERD 4018**

Agriculture in the national economy: measurement of the agricultural sector – output, nonfactor 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.

Agricultural Policy IIb **4 Credits** **AERD 4019**

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.

Major Project **4 Credits** **AERD 4050**

Electives **8 Credits** **AERD 4400**

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

***(i) Agricultural Botany* (4 credits)**

This section of the module deals with the taxonomy, biology and physiology of plants of agricultural importance.

Introduction to the taxonomy 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.

Life cycle in relation to productivity and yield. Dormancy and germination, leaf expansion and root proliferation, floral development and flowering. Fertilisation, fruit and seed production, leaf and fruit senescence. Photosynthesis and primary productivity; the effects of stress on crop plants.

***(ii) Ecology* (2 credits)**

This section reviews basic ecological principles which apply to natural and managed ecosystems.

Review of ecological terminology; biosphere concepts; energy, hydrological and nutrient cycles. Plant/environment interactions and ecotypic variation; major biomes of the world; colonisation, succession and agri-ecosystem development; the effects of competition, interaction 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.

***(iii) Agriculture and Pollution* (2 credits)**

In this section, the impacts of human activity upon managed ecosystems are considered.

Source of pollution: energy and fertiliser 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.

Animal Parasitology — 2 Credits — AESC 2003

This module 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.

Plant Physiology — 4 Credits — AESC 2004

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.

Applied Plant Biology — 6 Credits — AESC 2007

(i) Agricultural Botany (4 credits)

As for the Agricultural Botany Section of AESC 2001. This section of the module deals with the taxonomy, biology and physiology of plants of agricultural importance.

Introduction to the taxonomy 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.

Life cycle in relation to productivity and yield. Dormancy and germination, leaf expansion and root proliferation, floral development and flowering. Fertilisation, fruit and seed production, leaf and fruit senescence. Photosynthesis and primary productivity; the effects of stress on crop plants.

(ii) Ecology (2 credits)

As for the Ecology Section of AESC 2001. This section reviews basic ecological principles which apply to natural and managed ecosystems.

Review of ecological terminology; biosphere concepts; energy, hydrological and nutrient cycles. Plant/environment interactions and ecotypic variation; major biomes of the world; colonisation, succession and agri-ecosystem development; the effects of competition,

interaction 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.

Plant Pathology **6 Credits** **AESC 3004**

This is an introductory module 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.

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.

Forest Protection **6 Credits** **AESC 3006**

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.

Agrichemicals and Plants **4 Credits** **AESC 3007**

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.

Crop Protection **8 Credits AESC 3010**

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.

Literature Review Project **2 Credits AESC 3013**

Students will be required to carry out a literature review project on a selected aspect of Agriculture and Environmental Science.

Professional Work Experience **12 Credits AESC 3201**

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.

Plant Protection II **6 Credits AESC 4002**

Horticultural Zoology

This section provides an overview of the biology and ecology of vertebrate and invertebrate animals of horticultural interest. The following topics will be addressed:

- Introduction to the classification, structure, physiology and biology of Annelida, Nematoda, Mollusca, Arthropoda and Chordata.
- Importance of biodiversity; methods for encouraging beneficial organisms and enhancing their role in horticultural landscapes.
- 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 field and protected fruit, vegetable and ornamental crops and turf grass. Identification of the main species, recognition of the damage caused, their biology and population dynamics, and methods for damage prevention and control.

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.

Wildlife Management **4 Credits AESC 4004**

Wildlife management is the application of management techniques for the conservation and use of our wildlife resource. The module 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.

Epidemiology and Zoonoses **4 Credits AESC 4005**

This module 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 module 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.

Pest Management **4 Credits AESC 4006**

This module 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.

Plant Disease Management **4 Credits AESC 4007**

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.

Molecular Biology and the Environment **4 Credits AESC 4008**

A lecture/laboratory module designed to provide a basic understanding of the molecular techniques currently used in studies of environmental biology. The topics covered in this module 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.

Project **12 Credits AESC 4051**

Electives **12 Credits AESC 4400**

Introduction to Animal Science **12 Credits ANSC 1001**

Study Skills

Group Communication, writing skills, use of library. Critical thinking. Basic concepts of information technology. Practical computer skills with word processing, spreadsheet and presentation applications. Email and internet.

Preparation for Science Studies

To provide incoming students, particularly those with limited exposure to science subjects at second level, with an overview of the subject and a foundation for higher-level study of science. The scientific method and its component steps. States of matter: gas, liquid, solid. Elements and compounds. Atoms, isotopes and ions. Periodic table. Terminology of chemical reactions.

Application of Science in Animal Production

Students will carry out a library/research project on a selected topic relating to animal science or an associated topic. This may involve students working in small groups. Assessment will be by way of continuous assessment and/or seminars.

Genetics I **2 Credits ANSC 2001**

This module will provide an overview of basic genetics, particularly as it applies to agriculture. The module will cover the following: Genetic consequences of cell division and gametogenesis. Basic Mendelian genetics. Probability and genetics. Extending Mendelian genetics. Recombination and genetic linkage. Chromosomal inheritance and sex determination. The structure and function of DNA. Gene expression. The molecular basis of mutation.

Genetics I and II **4 Credits ANSC 2002**

(i) Genetics I (2 credits)

As for the module ANSC 2001.

(ii) Genetics II (2 credits)

Evolution and Population Genetics: Basic evolutionary theory. The theory of allele frequencies. The genetic structure of populations and microevolution. The origin of genetic variation.

Introduction to Quantitative Genetics: Properties of the normal distribution. Sources of phenotypic variation. Heritability and artificial selection. Relationship and inbreeding.

Animal Husbandry I **6 Credits ANSC 2005**

This module is intended for students other than those specialising in *Animal Science/Animal Production.* It is designed to give an overview of animal science and animal production in Ireland, the EU and on a world basis, with the focus on the main animal production enterprises in Ireland. The topics covered for each enterprise will include the following: the structure and importance of the enterprises at farm, national and international level; the organisation and management of the production systems at farm level; seasonality of production, product quality and implications for processing and marketing; farm costs and returns and factors affecting profitability. In addition to the sections on the main farm enterprises the module will include brief outlines of the principles of animal

breeding, animal nutrition, animal physiology and disease control. There are no specific prerequisites for this module.

Animal Nutrition I **4 Credits ANSC 2006**

This module is designed for students in *Animal Science/Animal Production*. It is a basic/foundation level module designed to give students an understanding of nutrition for both ruminant and monogastric farm animals. Topics dealt with include the following: structure and functioning of the digestive system, the processes of digestion and absorption plus digestive disorders; metabolism of nutrients, especially in relation to energy, protein, minerals and vitamins plus an introduction to metabolic disorders; nutrient requirements and systems of energy and protein evaluation of feeds; dry matter intake; feed additives; feed processing; major classes of feedstuffs and introduction to the formulation of feeding programmes. Basic/foundation level biology and chemistry/biochemistry modules are prerequisites.

Electives **6 Credits ANSC 2200**

Animal Nutrition I **6 Credits ANSC 3002**

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.

Animal Nutrition II **4 Credits ANSC 3003**

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, utilisation 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.

Animal Breeding/Genetics **8 Credits ANSC 3004**

Animal Breeding (as for 'Animal Breeding' Section of ANSC 3011)

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 module 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.

Genetics

Advanced Transmission Genetics: Complex and polygenic inheritance. Sex-linked traits. Genetic linkage and mapping. Epigenetic inheritance – parental imprinting.

Molecular Genetics: Transcription and translation. The genetic code. The structure of genes. Gene expression.

Structural and Functional Genomics: Genome organisation. Genome sequencing. Genome expression studies using array technologies. Bioinformatics.

Developmental Genetics: Differential gene expression. Genetics of pattern formation. Homeotic genes.

The Genetic Origins of Livestock: Genetic diversity in cattle, sheep and pigs. The genetics of domestication.

Animal Physiology 8 Credits ANSC 3005

Physiological and endocrinological systems in the farm animal; endocrinology and physiology of reproduction, lactation and growth in farm mammals; environmental physiology; mammalian pheromones; artificial insemination and modern developments in reproductive technology including embryo transfer, micromanipulation of embryos, in vitro maturation and fertilisation 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.

Anatomical Structure and Function 4 Credits ANSC 3006

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.

Experimental Design and Data Analysis 6 Credits ANSC 3007

Experimental Design

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

Data Analysis

This section of the module 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. Student's 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.

Animal Production Enterprises **4 Credits ANSC 3008**

This module will be concerned with management practices and principles in animal production enterprises. Students will visit a number of modern animal production enterprises and related facilities and will carry out a project on a selected topic relating to animal science and production.

Animal Husbandry II **8 Credits ANSC 3009**

This module 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.

Computer Techniques **2 Credits ANSC 3010**

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).

Animal Husbandry III **8 Credits ANSC 3011**

Modules 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 modules 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 module 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.

Fundamentals of Biotechnology **2 Credits ANSC 3012**

This module will familiarise students with the basic concepts used in plant and animal biotechnology. The module 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).

Professional Work Experience **12 Credits ANSC 3201**

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.

Electives **6 Credits ANSC 3300**

Animal Husbandry V **4 Credits ANSC 4002**

Animal Behaviour/Health/Welfare

This module complements the Animal Health Section of the module ANSC 4004 'Animal Husbandry IVa'. 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.

Animal Breeding II **6 Credits ANSC 4003**

This module 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.

Animal Husbandry IVa **12 Credits ANSC 4004**

This module is designed for students in *Animal Science/Animal Production*. It consists of four equal sections dealing with Dairy, Sheep and Swine Husbandry, and Animal Health.

Animal Health

Definition of health and disease, dynamic state of disease, causes of disease, role of secondary factors in disease, resistance to disease, how disease spreads, factors influencing spread of disease, control of disease including common diseases of farm animals.

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; key issues relating the sustainable production of a quality product, sheep housing and handling facilities; selection and marketing of lamb for the various markets; costs and returns in sheep production.

Basic modules in Animal Breeding/Animal Physiology (ANSC 3011) and Animal Nutrition (ANSC 3002), or their equivalent, are prerequisites for this module.

Animal Husbandry IVb **4 Credits ANSC 4005**

This module is designed for students in *Animal Science/Animal Production*. It consists of two parts that deal with Beef production and Farm Buildings/Animal Wastes/Mechanisation.

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.

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, fertiliser planning and pollution control. Mechanisation of forage handling, feeding systems and effluent disposal.

Basic modules in Animal Breeding/Animal Physiology (ANSC 3011) and Animal Nutrition (ANSC 3002), or their equivalent, are prerequisites for this module.

Electives **10 Credits ANSC 4400**

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

Biology **10 Credits BIOL 1002**

A formation module 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.

Chemistry **12 Credits CHEM 1002**

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 of 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.

Introduction to Animal and Crop Production **12 Credits CPSC 1002**

Study Skills

Group Communication, writing skills, use of library. Critical thinking. Basic concepts of information technology. Practical computer skills with word processing, spreadsheet and presentation applications. Email and internet.

Preparation for Science Studies

To provide incoming students, particularly those with limited exposure to science subjects at second level, with an overview of the subject and a foundation for higher-level study of science. The scientific method and its component steps. States of matter: gas, liquid, solid. Elements and compounds. Atoms, isotopes and ions. Periodic table. Terminology of chemical reactions.

Application of Science in Animal and Crop Production

Students will carry out a library/literature project on a selected aspect of the application of scientific knowledge in crop and animal agriculture.

Crop Husbandry I **4 Credits CPSC 2001**

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.

Statistics **6 Credits CPSC 2002**

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 hypotheses – definition of the statistical hypothesis, significance level. Type I and Type II error, confidence limits. Student's t-distribution – estimating the standard deviation, testing hypotheses 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.

Crop Husbandry II **6 Credits** **CPSC 2003**

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.

Agricultural Climatology and Meteorology **2 Credits** **CPSC 2004**

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 for moisture and heat; drought irrigation. Soil fertility implications. Surface water and aquifer vulnerability. Timing of land-related activities. Weather, animal and crop production. Crop-weather interactions: forestry, horticulture and protected crops. Wind shelter and housing. Influence on disease and pest outbreaks. Implications of climate change for production agriculture and environmental well being.

Electives **6 Credits** **CPSC 2200**

Professional Work Experience **30 Credits** **CPSC 3201**

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 PWE Programme supervisor.

Electives **4 Credits CPSC 3301**

Crop Breeding **2 Credits CPSC 4004**

This module introduces you to crop improvement strategies that are based on the application of genetic principles. You will discover the conventional (recombination) methods of plant breeding and how they have contributed to the improvement of crop performance, stability and quality (as in CPSC 4005 – Crop Husbandry IVa).

Crop Husbandry IVa **8 Credits CPSC 4005**

This module builds on earlier courses in basic science, applied science, economics and management and examines how this knowledge is integrated to formulate and refine crop production systems that are economical, profitable, safe and environmentally responsible.

Crop Husbandry IVb **6 Credits CPSC 4006**

This module supplements the earlier course – CPSC 4005 'Crop Husbandry IVa' – by considering additional crops and expanding on some of the cereal, root and forage crop topics covered in the first semester.

Electives **14 Credits CPSC 4100**

National Economics **4 Credits ECON 4101**

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.

Introduction to Engineering Technology **12 Credits ENGT 1001**

Study Skills

Group Communication, writing skills, use of library. Critical thinking. Basic concepts of information technology. Practical computer skills with word processing, spreadsheet and presentation applications. Email and internet.

Preparation for Science Studies

To provide incoming students, particularly those with limited exposure to science subjects at second level, with an overview of the subject and a foundation for higher-level study of science. The scientific method and its component steps. States of matter: gas, liquid, solid. Elements and compounds. Atoms, isotopes and ions. Periodic table. Terminology of chemical reactions.

Application of Science in Engineering Technology

Introduction to research in Engineering Technology including: process engineering, environmental engineering and mechanisation systems. Students will write two short essays on any two topics presented during the module.

Surveying **2 Credits** **ENGT 2007**

Chain surveying, surveys of small areas and buildings, levelling, ordnance survey maps, theodolite and angular measurements, areas, volumes and contouring.

Principles of Engineering I and II **4 Credits** **ENGT 2011**

(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.

Engineering and Surveying **4 Credits** **ENGT 2012**

(i) 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.

(ii) Surveying (2 credits)

As for ENGT 2007.

Principles of Engineering I, II and III **6 Credits** **ENGT 2013**

(i) Principles of Engineering I (2 credits)

As for 'Principles of Engineering I' Section of ENGT 2011.

(ii) Principles of Engineering II (2 credits)

As for 'Principles of Engineering II' Section of ENGT 2011.

(iii) Principles of Engineering III (2 credits)

As for 'Principles of Engineering III' Section of ENGT 2012.

Computer and Manufacturing Technology **6 Credits** **ENGT 2014**

Introduction to PCs, word processing, spreadsheet analysis, databases, presentation graphics, 2D and 3D computer aided drafting. Manufacturing technology: welding, turning, milling, tools, materials, stock control.

Food Technology **6 Credits** **ENGT 2016**

Physical, rheological and thermal properties of foods. Measurement of colour of foods. Mass transfer in foods. Experimental analysis of food composition and properties.

Literature Research Project **4 Credits** **ENGT 2017**

Students will be required to carry out a literature survey in a selected aspect of agricultural and food engineering.

Food Engineering Principles **8 Credits ENGT 3001**
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. Process laboratory practicals. Computer applications. Tutorials.

Power and Machinery I **8 Credits ENGT 3002**
Internal combustion engines. Energy sources, including biofuels. Energy audits. The agricultural tractor. Power transmission and traction. Soil-vehicle interaction. Tractor hydraulic systems. Electronics in agricultural tractors and equipment. Tractor-implement mechanics. Tillage and cultivation machinery. Stress analysis and fatigue. International Standards. Properties of biomaterials. Computer applications. Tutorials.

Food Engineering Principles **6 Credits ENGT 3004**
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.

Computer Information Systems **4 Credits ENGT 3009**
Introduction to computer information systems; computers; networks; telephone systems; data, information and knowledge, the Internet; databases and data warehousing, data to knowledge; office and manufacturing systems.

Computer Programming **4 Credits ENGT 3010**
Introduction to computer programming with Visual Basic including syntax, logic, loops, functions, subroutines, visual component, debugging, macro programming.

Soil Engineering **4 Credits ENGT 3011**
Soil classification. Phase relations. Failure theory. Retaining walls. Slope stability. Foundation pressures. Consolidation and compaction.

Waste Management **4 Credits ENGT 3012**
IPPC Legislation. Waste minimisation. Environmental management systems. Risk management. Socio-economic constraints. Agricultural waste characterisation. Collection, storage and treatment of agricultural wastes. Anaerobic digestion and composting. Land application techniques. Nutrient management planning. Rural Environment Protection Scheme.

Major Project I **8 Credits ENGT 3050**
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.

Electives **4 Credits ENGT 3300**

Buildings and Environment **8 Credits ENGT 4001**

Animal production buildings. Environmental control systems. Dispersion and abatement of atmospheric emissions. Crop storage buildings. Concrete, timber and structural steel in agricultural buildings. Environmental and planning legislation.

Food Manufacturing Systems **8 Credits ENGT 4002**

Food Quality and Safety Assurance (4 Credits)

Quality systems standards. Food legislation. Process plant layout. Principles of cleaning. Hygienic design. HACCP.

Food Refrigeration (4 Credits)

Refrigeration cycles, equipment, thermal properties, cooling and freezing processes, mathematical modelling, IT, chilled and frozen foods. Tutorials.

Food Process Engineering **8 Credits ENGT 4003**

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.

Environmental Engineering **8 Credits ENGT 4006**

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.

Power and Machinery II **8 Credits ENGT 4007**

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.

Environmental Engineering Principles **8 Credits ENGT 4008**

Principles of hydrology. Nitrogen, phosphorus and carbon cycles. Transport of pollutants from the landscape. Fundamentals of water and wastewater treatment. Microbiology for wastewater treatment. Noise and atmospheric pollution.

Major Project II
(including Professional Work Experience) 14 Credits ENGT 4050

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.

Electives 6 Credits ENGT 4100

Introduction to Agricultural and Environmental Science 12 Credits ERM 1004

Study Skills

Group Communication, writing skills, use of library. Critical thinking. Basic concepts of information technology. Practical computer skills with word processing, spreadsheet and presentation applications. Email and internet.

Preparation for Science Studies

To provide incoming students, particularly those with limited exposure to science subjects at second level, with an overview of the subject and a foundation for higher-level study of science. The scientific method and its component steps. States of matter: gas, liquid, solid. Elements and compounds. Atoms, isotopes and ions. Periodic table. Terminology of chemical reactions.

Farming and the Environment

The evolution of the farmed landscape. The need for environmental understanding in farming. The role of the environment in modern farming in Europe. The impact of environmental regulations on farming in Ireland. Module project: Students will be required to present a project report on one aspect of the interrelationship between farming and the environment.

Agricultural Ecology and Pollution Control 4 Credits ERM 2001

(i) Ecology (2 credits)

This section reviews basic ecological principles which apply to natural and managed ecosystems.

Review of ecological terminology; biosphere concepts; energy, hydrological and nutrient cycles. Plant/environment interactions and ecotypic variation; major biomes of the world; colonisation, succession and agri-ecosystem development; the effects of competition, interaction and symbioses in natural and managed ecosystems. Plant reproductive strategies; seed dispersal, seed dormancy and periodicity of germination, and the implications for weed biology.

(ii) Agriculture and pollution (2 credits)

In this section, the impacts of human activity upon managed ecosystems are considered.

Inputs and outflows of energy, water and nutrients in agro-ecosystems are described. Potential sources of environmental pollution (including fertilisers, pesticides, organic wastes, land use) are assessed in terms of their beneficial uses and potentially harmful impacts on water quality (e.g. eutrophication; fish kills; nitrate contamination); air quality (e.g. malodours; toxic gases; greenhouse gases); soil degradation (e.g. physical damage; fertility impairment) and food quality (e.g. nutritional quality; pesticide residues).

Students are introduced to principles of management (e.g. nutrient management planning; REPS; codes of good farming practice; alternative farming systems) and policy (e.g. Water Framework, Nitrate and other EU Directives; Water Pollution Acts) strategies for pollution control and prevention.

Earth Science and the Environment **4 Credits** **ERM 2002**

The module will cover the elements of physical geology and geomorphology, sedimentology, historical geology and stratigraphy, elementary mineralogy and petrography, and palaeontology. Special emphasis is placed on the way in which the fundamental qualities of particular landscapes relate to determining geological factors, on glacial geology and on the geology of water resources. There will be two full-day geological excursions.

Applied Zoology I **6 Credits** **ERM 2003**

This introductory module provides an overview of the biology and ecology of vertebrate and invertebrate animal groups of agricultural, environmental and conservation interest. The purpose of the module is to provide a basis of fundamental biological knowledge and an appreciation of the ecological role and value of invertebrate animals in agricultural landscapes including freshwater habitats. The following topics will be covered:

Introduction to the classification, biology and ecology of the Phylum Arthropoda: structure and function of arthropod anatomy; endocrinal and environmental control of developmental biology; sensory perception; communication and host recognition; basis of crop pest resistance; practical recognition of arthropod groups.

Introduction to selected non-arthropod invertebrate groups of agricultural importance (Oligochaeta, Nematoda, Gastropoda): classification, diversity, biology, ecology, importance, practical recognition.

Introduction to the biology and ecology of freshwater invertebrates: identification, ecological role and monitoring value of key freshwater macroinvertebrates.

Introduction to the biology and ecology of vertebrates: identification, ecology and agricultural and environmental relevance of selected species of birds and mammals.

Landscape Ecology **4 Credits** **ERM 3004**

This module 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 (e.g. alluvial wetlands, salt marshes, sand dunes, moor/heathlands, hedgerows, woodlands).

Landscape Interpretation **4 Credits** **ERM 3005**

The module 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 module will comprise lectures, field visits and practical exercises.

Earth Science **8 Credits** **ERM 3006**

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 fertilisers; manures and waste materials; legislation for sale of fertilisers and liming materials.

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.

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 for moisture and heat; drought irrigation. Soil fertility implications. Surface water and aquifer vulnerability. Timing of land-related activities.

Applied Zoology II **4 Credits** **ERM 3007**

This module requires a prior basic knowledge of the main animal groups. It is an undergraduate module for third year Agricultural and Environmental Science students. The following topics are covered:

Principles of pest control: Pesticides – types, properties, mode of action, application. Toxicity, health and environmental hazards. Pesticide resistance. Pest monitoring and forecasting. Non-chemical pest control strategies – cultural, physical and biological. Integrated pest management.

Principles of animal parasitology: Review of the main groups of animal parasites in livestock – identification, biology, ecology, symptoms and signs. Principles of

epidemiology immunodiagnostics. Control – development and use of anti-parasitic drugs; vaccines; cultural control; integrated approaches.

Applied Zoology III **4 Credits** **ERM 3008**

This module requires a prior basic knowledge of the main animal groups. It is an undergraduate module for third year Agricultural and Environmental Science students. The following topics are covered:

Principles of animal ecology: Factors influencing the structure and dynamics of animal populations and communities; herbivore-plant interactions; the role of animals in terrestrial ecosystems; origins of pest outbreaks.

Crop pests: Review of major pests of crop plants and stored products – identification, biology and ecology, nature of damage caused, methods for prevention and control.

Biology and ecology of vertebrates: identification, ecology and agricultural and environmental relevance of selected species of birds and mammals.

Diversity in the Rural Landscape (a) **4 Credits** **ERM 3009**

The student is introduced to concepts and methods in natural heritage evaluation, and in particular to ecological methods. Key topics covered include ecological succession and the role of abiotic factors in ecology, the history of the Irish flora, plant strategies, island biogeography and habitat fragmentation, classification and ordination, conservation and biodiversity. Global issues and the global ecological context is emphasised through lectures on global habitats: tropical rainforests, mires, deserts, Arctic-Alpine habitats and grasslands. This module also provides an introduction to Irish vertebrate species, and management issues relating to their control and conservation.

Diversity in the Rural Landscape (b) **4 Credits** **ERM 3010**

The student is introduced to concepts and methods in natural and cultural heritage evaluation. The characteristics of and the processes at work in each of the major habitats of significance in the Irish rural landscape are reviewed, and their global context is surveyed: woodland, grassland, hedgerows, arable land, freshwater, peatlands and marginal habitats. Recognition modules are devoted to each of the major plant groups (trees, herbaceous flowering pants, ferns, bryophytes, fungi and algae), and to vertebrates. The cultural heritage of the landscape is introduced in some detail: archaeology, agri-industrial archaeology, vernacular architecture and cultural landscape detail. The recently-published *Farming in Ireland: History, Heritage and Environment* has been specifically written as a textbook for this module.

Plant Protection (Horticultural Zoology) 6 Credits ERM 3011

This module provides an overview of the biology and ecology of vertebrate and invertebrate animals of horticultural interest. The following topics will be addressed.

Introduction to the classification, structure, physiology and biology of Annelida, Nematoda, Mollusca, Arthropoda and Chordata.

Importance of biodiversity; methods for encouraging beneficial organisms and enhancing their role in horticultural landscapes.

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 field and protected fruit, vegetable and ornamental crops and turfgrass. Identification of the main species, recognition of the damage caused, their biology and population dynamics, and methods for damage prevention and control.

Plant Protection (Plant Pathology) 6 Credits ERM 3012

This module provides a basic but comprehensive treatment of the pathogens of plants of horticultural importance and builds on earlier courses in biology and microbiology.

There is emphasis on the classification, identification, biology and ecology of the major biotic agents of damage and on the nature and incidence of outbreaks both locally and internationally. The nature and economic value of damage caused, the development of symptoms and the procedures in diagnosis of causal agents receive major attention in relation to fungal, viral and bacterial diseases of plants.

The effects of environmental conditions on symptomatology and on pathogen activity are studied as well as environmental aspects of the damage and proposed control strategies.

The range of plants encompasses vegetable, fruit and protected crops of commercial and amenity species and includes perennial and annual plants.

Students study all aspects of current control strategies, including regulatory, cultural and biological methods, with emphasis on current and potential role of antagonistic species and biodiversity, and the use of protectant and eradicant chemicals.

Environmental Impact Assessment **4 Credits** **ERM 4003**

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.

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

In this module, selected issues which were introduced in AESC 2001 are developed.

Topics discussed include: countryside management (the Irish landscape; wildlife habitats and their management, wildlife conservation); fertiliser and waste management (pollution control, risk assessment, landspreading of farm and non-agricultural wastes and effluents, statutory regulations, e.g. 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).

Environmental Management **8 Credits** **ERM 4005**

Environmental Economics

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.

Environmental Evaluation and Assessment

Environmental values in the rural landscape. Global biodiversity; biodiversity in Ireland; the valuation of natural and cultural diversity; biodiversity and its management and conservation in the rural landscape. Issues in conservation biology; conservation strategies. Diversity as resource: alternative enterprise identification; payments for environmentally-friendly farming and land use management; rural tourism. Techniques for managing the rural environment: traditional management of the rural landscape; 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.

Computer Techniques for Environmental Management

Introduction to the history, theory and use of remote sensing techniques. Topics including use of maps, aerial photographs, satellite imagery (MSS, LANDSAT series, SPOT and

RADAR). Case studies of Irish projects involving remote sensing and GIS. Introduction to image processing software (ERDAs Imagine).

Soil and Water Management **8 Credits** **ERM 4006**

This module builds on material given in second and third year to apply principles of soil science to management of soil and water resources.

Overview of earth system components; pedology and hydrology as part of atmosphere – hydrosphere – biosphere – lithosphere systems. Earth's fluid envelopes; atmosphere and oceans as transporters of mass and energy.

Major cycling systems – energy, moisture, carbon, sulphur. Transfer systems and residence times of surface, soil and ground waters. Soil as a key hydrologic routing system. River basins as units of research and management; characteristics of river flow and well data.

Soil resources – variability and quality. Soil properties important to soil management. Soil as a filtering/buffering system; aquifer protection. Runoff risk assessment.

Arterial and land drainage. Irrigation systems. Land information and appraisal of land resources. Soil quality assessment.

Conceptual model of the soil plant system: requirements for optimum growth: nutrient storage and supply for growth; characterisation of aeration status; gas exchange; soil solution composition; solid solution equilibria. Nutrient acquisition by crops – transport processes, uptake, off-take, nutrient interactions.

Review of soil testing procedures and limitations of soil testing. Fertiliser use in Ireland; fate of fertilisers in soil-plant continuum; sample calculations relating to soil testing and fertiliser applications. Chemical and biological characterisation of water quality.

Animal manures and other wastes – BOD and nutrient loads. Nutrient management planning; sample calculations of nutrient applications. Safe landspreading of organic wastes-rates, timing and methods of application for maximal efficiency and soil and environmental protection; assessment of soil, site and weather criteria. Statutory and voluntary regulations.

Molecular Crop Breeding **2 Credits** **ERM 4007**

Genotyping of plant species, genera and varieties; gene cloning; gene modification; plant transformations; reporter genes; RFLPs, RAPDs, PCR; coupled reverse transcription and PCR; diagnostic uses of DNA and RNA probes.

Experimental Physics **10 Credits** **EXPH 1002**

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.

Introduction to Food Science — 12 Credits FDSC 1010

Study Skills

Group Communication, writing skills, use of library. Critical thinking. Basic concepts of information technology. Practical computer skills with word processing, spreadsheet and presentation applications. Email and internet.

Preparation for Science Studies

To provide incoming students, particularly those with limited exposure to science subjects at second level, with an overview of the subject and a foundation for higher-level study of science. The scientific method and its component steps. States of matter: gas, liquid, solid. Elements and compounds. Atoms, isotopes and ions. Periodic table. Terminology of chemical reactions.

Application of Science in Food Science

Students will carry out a library/literature research project on a selected topic relating to food science. This may involve students working in small groups. Assessment will be by continuous assessment, seminars and/or a short report.

Food Science I: Food Physics — 4 Credits FDSC 2004

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.

Food Science II: Basic Analysis — 8 Credits FDSC 2005

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.

Agricultural Chemistry IV — 4 Credits FDSC 2006

As for sections of FDSC 2008 'Agricultural Chemistry II'.

Agricultural Chemistry I **4 Credits** **FDSC 2007**

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.

Agricultural Chemistry II **6 Credits** **FDSC 2008**

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.

Agricultural Chemistry III **2 Credits** **FDSC 2009**

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, utilisation 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.

Sensory Analysis **4 Credits** **FDSC 2010**

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 module will involve practical tasting sessions and the analysis of data using appropriate statistical techniques.

Nutrition I **4 Credits** **FDSC 3005**

Structure and function of the human gut. Nutrient digestion and absorption. Metabolism of protein, fat and carbohydrate. Protein requirements, consequences of deficiency. Lipid transport and cholesterol metabolism. Energy metabolism, energy values of foods and energy requirements. Thermogenic mechanisms. Comparative aspects of gut structure and function in mammals: implications for digestive efficiency. Introduction to nutritional methodology.

Product Development **4 Credits** **FDSC 3007**

This module consists of a series of practical workshops introducing the general concepts of product and process development combined with a major group product development project. Students will be assessed on the basis of the end product developed by the group and a report/oral presentation of the development strategy used.

Food Analysis I **6 Credits** **FDSC 3008**

This module will cover the applications of (a) molecular spectroscopies (absorption, fluorescence and infra-red) and (b) atomic spectroscopies (including AA and ICP), x- ray fluorescence and x-ray diffraction techniques to the analysis of foods. The use of applied diagnostics related to food safety, focusing on immuno and genetic based approaches, will be covered in a separate section.

Food Analysis II **4 Credits** **FDSC 3009**

The main part of this module will cover the applications in modern food analysis of separation techniques such as thin- layer chromatography, high performance liquid chromatography, gas chromatography and electrophoresis. A separate section will deal with the use of radioactive isotopes in analysis.

Food Chemistry I **4 Credits** **FDSC 3010**

This third year module focuses on foods proteins with emphasis on relationships between their structure and functional properties in their modified and unmodified states. The module emphasises how processing, storage, cooking, enzymatic treatment and use of additives alters the molecular interactions and functionality of proteins. Functional properties examined include: solubility, viscosity, gelation, emulsification and foaming. Selected protein systems are used to demonstrate the structure–function relationships e.g. milk proteins and wheat proteins. The role of water in foods and water activity are also examined.

Food Chemistry II **6 Credits** **FDSC 3011**

This third year module focuses on the carbohydrate and lipid constituents of foods with emphasis on their structure and functional properties in their modified and unmodified states. The course emphasises how enzymatic/chemical treatments, processing and storage alter the molecular interactions occurring in these food components. Selected systems are used to demonstrate the structure–function relationships, e.g. simple sugars, starches, pectins, marine/plant gums, vegetable, and animal fats. The chemistry of lipid deterioration, its effects and control are also discussed. Food components, which have a major influence on the sensory properties of foods including pigments and flavours also form part of the course.

Literature Review **2 Credits** **FDSC 3012**

An individual literature review will be carried out on a food related topic. Students will be required to assess the literature, prepare an essay on the topic and deliver an oral presentation on the subject.

Nutritional Physiology **6 Credits** **FDSC 3013**

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.

Professional Work Experience **4 Credits** **FDSC 3202**

Professional work experience to be carried out over the summer period.

Marketing **4 Credits** **FDSC 4006**

An introduction to the basic principles of marketing including advertising and promotion.

Nutrition II **4 Credits** **FDSC 4007**

Appetite and regulation of energy balance. Diet and health: Primary nutritional disorders (e.g. obesity, malnutrition). Diet-related disorders (e.g. heart disease, cancer, food allergies). Minerals and vitamins, consequences of deficiency and excess. Dietary fibre, vegetarianism. Recommendations for healthy eating. Changes in dietary habits and the national diet.

Food Ingredients **6 Credits** **FDSC 4008**

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.

Fresh and Processed Meat Products I **4 Credits** **FDSC 4009**

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.

Fresh and Processed Meat Products II **6 Credits** **FDSC 4010**

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 and 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.

Dairy Products **6 Credits** **FDSC 4011**

A. Milk

Introduction to milk composition and the factors that 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.

Cereal Chemistry and Brewing Science **4 Credits** **FDSC 4012**

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 module

with a small number of examples drawn from the following production processes: whiskey, flour, bread, biscuits, cakes and pasta.

Food Preservation **4 Credits** **FDSC 4014**

The heating and cooling of foods; sterilisation; microwave and dielectric heating; freezing; introduction to dehydration.

Food Process Technology **4 Credits** **FDSC 4015**

Evaporation. Dehydration of solid and liquid foods; extraction; emulsification; homogenisation; filtration; centrifugation; mixing.

Food Safety **4 Credits** **FDSC 4016**

Introduction to Food Safety and Consumer health; Introduction to Microbial Risk Assessment; MRA Methodology; Bacterial Hazards, Emerging Infections and Control of Zoonotic Transmission; Antimicrobial resistance; Chemical contamination of the food chain; Non-bacterial Hazards; Genetic Modification; Agri and Bio terrorism; Applied Siagnostic strategies; Rapid alerting models and Control of Global Disease Outbreaks.

Project **10 Credits** **FDSC 4051**

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

Introduction to Forestry **12 Credits** **FOR 1001**

Study Skills

Group Communication, writing skills, use of library. Critical thinking. Basic concepts of information technology. Practical computer skills with word processing, spreadsheet and presentation applications. Email and internet.

Preparation for Science Studies

To provide incoming students, particularly those with limited exposure to science subjects at second level, with an overview of the subject and a foundation for higher-level study of science. The scientific method and its component steps. States of matter: gas, liquid, solid. Elements and compounds. Atoms, isotopes and ions. Periodic table. Terminology of chemical reactions.

Application of Science in Forestry

Students will explore science in Forestry through presentations, field visits, videos, lab demonstrations, lectures and hand-outs. Assessment will be by way of short reports, essays and continuous assessment.

Forest Mensuration and Biometrics **8 Credits** **FOR 2001**

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 98.

Fundamentals of Forestry **8 Credits** **FOR 2004**

Natural forests. Plantations. The structure and growth of trees. Stand development. The forest environment. Ecological conditions of forest development. Evolution, conservation and management of natural woodlands. Forest land in Ireland. Silvicultural characteristics and natural range of tree species. Species selection. Forest seed supply. Provenances. Tree breeding programmes. Certification of forest reproductive material. The silvicultural management of a range of tree species including oak, beech, sycamore, ash, spruce, pine, fir and minor species.

Silviculture I **6 Credits** **FOR 2005**

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

Forest Harvesting **4 Credits** **FOR 3002**

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.

Computer Applications **4 Credits** **FOR 3005**

Spreadsheets, databases, word processing, graphics.

Forest Management **4 Credits** **FOR 3006**

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.

Silviculture II **8 Credits** **FOR 3008**

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.

Wood Science **4 Credits** **FOR 3009**

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.

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

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: ESRI ArcView 3.2a. Microsoft Office 2000: Word, Excel. Novell Applications Launcher (NAL) under Windows 2000.

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

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.

Biometrics

Volume-basal area theory. 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 and Word and ArcView 3.2a.

Software: ESRI ArcView 3.2a. Microsoft Office 2000: Word and Excel. Novell Applications Launcher (NAL) under Windows 2000.

Professional Forestry Practice **4 Credits** **FOR 3012**

This module is designed to familiarise Forestry undergraduate students with professional practices and skills. This hands-on module, in which students carry out a wide range of exercises and assignments, focuses on the presentation of technical, scientific and operational information, in an appropriate format, using the correct scientific and professional terminology and level of detail.

Electives **6 Credits** **FOR 3100**

Professional Work Experience **12 Credits** **FOR 3201**

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.

Professional Work Experience **8 Credits** **FOR 3202**

Forest Management Plan **12 Credits** **FOR 4003**

Each student must undertake a case study of an actual forest area and, in compliance with stated economic, social and environmental objectives, produce a written management plan for a prescribed period based on sustainable forest management (SFM) principles. The plan will incorporate a description of the site, including both timber and non-timber aspects, based on the results of Forest Inventory and GIS (FOR 4006).

Using SFM criteria and multi-criteria decision-support software, each student will carry out an analysis of the data, resulting in detailed prescriptions relating to yield regulation, harvest scheduling, silvicultural practices, forest protection, and environmental, cultural and social indicators. A financial analysis of the plan should also be included. The management plan report must be lodged with the Professor of Forestry.

Forest Planning **6 Credits** **FOR 4004**

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.

Experimental Design **4 Credits** **FOR 4005**

The objective is to develop applied quantitative computer skills for the transparent design, analysis and interpretation of data arising from elementary univariate experimental designs.

Basic concepts of experimentation, treatments, spatial layout of experimental units, response variables and hypothesis testing. Review of the two-sample t tests, the fundamental equation of analysis of variance (ANOVA) and the underlying assumptions.

Analysis, interpretation and reporting of data from univariate experimental designs including: the completely randomised, the randomised block, the Latin square and factorial designs with and without replication. Hypothesis testing of main and interaction effects. Concepts of repeated measures designs and autocorrelation.

Concept of simultaneous inference using Scheffé, Tukey and Student-Newman-Keuls multiple range tests.

Transparent analysis, interpretation and reporting of data arising from elementary experimental designs. This is an advanced hands-on computer skills experimental design module. Papers will be produced for a series of exercises.

Software: ESRI ArcView 3.2a. Microsoft Office 2000: Word, Excel. Novell Applications Launcher (NAL) under Windows 2000.

Forest Inventory and GIS **10 Credits FOR 4006**

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 3.2a. Microsoft Office 2000: Word and Excel. Novell Applications Launcher (NAL) under Windows 2000.

Research Project **16 Credits FOR 4051**

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.

Electives **12 Credits FOR 4100**

Geology **3 Credits GEOL 2601**

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.

Introduction to Horticultural Science **12 Credits HORT 1001**

Study Skills

Group Communication, writing skills, use of library. Critical thinking. Basic concepts of information technology. Practical computer skills with word processing, spreadsheet and presentation applications. Email and internet.

Preparation for Science Studies

To provide incoming students, particularly those with limited exposure to science subjects at second level, with an overview of the subject and a foundation for higher-level study of science. The scientific method and its component steps. States of matter: gas, liquid, solid. Elements and compounds. Atoms, isotopes and ions. Periodic table. Terminology of chemical reactions.

Introduction to Horticultural Science

Students will explore science in horticulture by way of industry site visits, lectures and web-based searches. Assessment will be by way of continuous assessment and/or seminar.

Introduction to Landscape Horticulture 12 Credits HORT 1002

Preparation for Science Studies

To provide incoming students, particularly those with limited exposure to science subjects at second level, with an overview of the subject and a foundation for higher-level study of science. The scientific method and its component steps. States of matter: gas, liquid, solid. Elements and compounds. Atoms, isotopes and ions. Periodic table. Terminology of chemical reactions.

An Appreciation of Landscape

The meaning of place; developing an understanding of the significance and scope of landscape projects; an introduction to basic design theory and expression; problem solving through design. Via workshops, library reviews, recording of site visits and critiques, students will analyse a series of designed landscapes, identifying the range of components that characterise a scheme. This work will consist of graphic and written exercises and will be continually assessed.

Introduction to Horticulture 6 Credits HORT 1003

Study Skills

Group Communication, writing skills, use of library. Critical thinking. Basic concepts of information technology. Practical computer skills with word processing, spreadsheet and presentation applications. Email and internet.

Preparation for Science Studies

To provide incoming students, particularly those with limited exposure to science subjects at second level, with an overview of the subject and a foundation for higher-level study of science. The scientific method and its component steps. States of matter: gas, liquid, solid. Elements and compounds. Atoms, isotopes and ions. Periodic table. Terminology of chemical reactions.

Landscape Design Theory I 8 Credits HORT 2008

History of Designed Landscapes

This module 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.

Landscape Design Theory

An introduction to landscape theory and the process of landscape design.

Introduction to Sociology

An introduction to Sociological Theories. The process of social change in Ireland; Culture and Stratification in society.

Fundamentals of Horticulture **8 Credits HORT 2009**

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, sterilisation, 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.

Landscape Studio 2a **4 Credits HORT 2010**

The module is structured through a series of short projects. The majority of these will focus on spatial issues, while others will address other design matters. Students will be introduced to a range of methods of representation. During the academic year the projects build in complexity regarding the issues addressed.

Landscape Studio 2b **6 Credits HORT 2011**

This module builds on HORT 2010 'Landscape Studio 2a with students directed through a series of short design projects devised to expose them to some of the primary issues addressed in landscape architecture.

Computer Applications in Landscape Architecture **4 Credits HORT 2012**

This module introduces students to a range of computer applications used in the landscape architectural profession including the use of AutoCad which is the industry standard in Computer Aided Design software. The module is based on a series of lectures and class assignments, each of which introduces new commands to students.

Landscape and Turfgrass Management I **4 Credits HORT 3001**

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.

Landscape Design Theory **4 Credits HORT 3002**

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.

Nursery/Garden Centre Management I **4 Credits HORT 3003**

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.

Pomology I **4 Credits HORT 3005**

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* module *is taught in alternate years)*.

Protected Horticulture I **4 Credits HORT 3006**

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* module *is taught in alternate years)*.

Vegetable Crops I **2 Credits HORT 3007**

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.

Landscape Construction **6 Credits HORT 3013**

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.

Landscape Design Studio 3a **6 Credits HORT 3014**

The module is structured through a series of short projects. During the academic year these projects build in complexity regarding the issues addressed. This course links closely with HORT 3016 'Landscape Design Theory II' and gives students a chance to apply

those theoretical components. One project will involve a 'real' client and shall include a public exhibition of the students' work.

Landscape Design Studio 3b **6 Credits HORT 3015**
This third year studio based design module is based on a series of design projects. Typically one project will involve a 'real' client and shall include a public exhibition of the students' design proposals.

Landscape Design Theory II **4 Credits HORT 3016**
This module builds on the introductory course HORT 2008 'Landscape Design Theory I'. It has two components: *Landscape Design Process:* looking at theories and approaches needed to effectively design the landscape, and *Materials of Landscape Design:* looking at aesthetic and practical issues concerning the selection of material and construction of landscape details.

Plant Materials (a) **4 Credits HORT 3017**
An introduction to the general range of trees and shrubs, used in urban and rural landscape schemes, learn how to identify them, how and where they can be used in planting design and how they are cultivated and maintained. This module follows from an examination of the functional and ornamental uses of vegetation in the landscape taken in Second Year as part of Fundamentals of Horticulture and is linked in particular with the courses Landscape Management and Landscape Design Studio.

Plant Materials (b) **2 Credits HORT 3018**
An introduction to the general range of conifers, perennials and bulbous plants, used in urban and rural landscape schemes, learn how to identify them, how and where they can be used in planting design and how they are cultivated and maintained. This module continues on HORT 3018 'Plant Materials (a)'.

Professional Practice and Planning Law I **2 Credits HORT 3019**
Planning Law covers the main elements of planning law and development control for Landscape professionals.

Urban Horticulture **2 Credits HORT 3020**
Series of lecture and project work examining the beneficial and detrimental effects of plants in the urban landscape, wildflower meadows, chemical and non-chemical weed control. This module is linked with landscape management.

Professional Work Experience **14 Credits HORT 3200**
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.

Professional Work Experience **12 Credits HORT 3202**
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

Electives **6 Credits HORT 3301**

Landscape and Turfgrass Management II **4 Credits HORT 4003**

Turfgrass Management

This module 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.

Fertiliser and lime application, running repairs and renovation, maintenance of specific areas.

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

Nursery/Garden Centre Management II **4 Credits HORT 4004**

Garden Centre Management

The module 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.

Pomology II **4 Credits HORT 4005**

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* module *is taught in alternate years)*.

Protected Horticulture II **4 Credits HORT 4006**

Mushroom Production/Technology

This module 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* module *is taught in alternate years)*.

Vegetable Crops II **2 Credits HORT 4007**

This module involves a study of the principles and practices of vegetable production and crop management for the fresh market and for primary processing. The module will emphasise cultural techniques, growing programmes, harvesting methodologies and quality systems for selected tuber, root, cole, bulb and legume crops.

Landscape Planning **4 Credits HORT 4009**

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.

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

(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.

Landscape Design Studio 4a **4 Credits HORT 4013**

The course is structured through a series of short projects. During the academic year these projects build in complexity regarding the issues addressed. Students undertake an historic precedent study of designed spaces and gain familiarity with the various resources available to support landscape design

Landscape Design Studio 4b **8 Credits HORT 4014**

The course builds on HORT 4013 'Landscape Design Studio 4a'. A series of short design projects give students the opportunity to apply some of the theories and knowledge acquired in concurrent lecture series. These include design methodology, and landscape construction. One project will involve a 'real' client and shall include a public exhibition of the students work.

Research Project **10 Credits HORT 4050**

Landscape Research Project **10 Credits HORT 4051**

Students select a research project in the area of Landscape Horticulture or a related subject.

Electives **8 Credits HORT 4101**

Electives **18 Credits HORT 4400**

Electives **24 Credits HORT 4401**

Agricultural Microbiology **6 Credits INDM 2005**

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.

Food Microbiology II **6 Credits INDM 3009**

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.

Food Microbiology I **4 Credits INDM 3010**

This module includes most elements of INDM 3009.

Mathematics **10 Credits MATH 1800**

Finite Mathematics

Linear programming, sets, binomial coefficients, finite sample spaces and probability, random variables, expectation. Vectors, matrices, inverses, systems of linear equations and their applications. Markov chains.

Calculus

Trigonometry and trigonometric functions. Exponential and logarithm. Derivative as a rate of change. Differentiation. Maxima and minima. Graphing. Inverse functions. Exponential growth and decay. Elements of integration.

Soil Science I **6 Credits SLSC 2002**

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 fertilisers; manures and waste materials; legislation for sale of fertilisers and liming materials.

Soil Science **5 Credits** **SLSC 2003**

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 fertilisers; manures and waste materials; legislation for sale of fertilisers and liming materials.

Soil Science II **6 Credits** **SLSC 3001**

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 micro organisms on soil nutrients.

Soil Fertility and Soil-Plant Relations

Factors affecting soil nutrient levels; nutrient transformations and reactions of N, P, K fertilisers in soils; movement of nutrients to plant roots; assessment of soil fertility, trace elements.

Soil Science III **6 Credits** **SLSC 3002**

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 fertiliser 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.

Soil Science IV **4 Credits** **SLSC 3003**

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; fertilisers in landscape horticulture; soil-root-fertiliser interactions. Soil management and interpretation for town and country planning.

Elective Modules for the BAgrSc Degree

The elective modules offered by the various Departments of the Faculty are listed below. Students may select from these modules to fulfil the elective requirement of their chosen degree programmes (see the *Summary of Programmes for the BAgrSc Degree/Summary of Transfer Programmes)*.

While all modules listed will normally be available for student selection, on occasion individual elective modules may be withdrawn at the discretion of the Faculty. Students should also note that choice of elective modules 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 module.
(d) Students will not be permitted to take a module of similar content to a core module or an elective module that they have previously taken.

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

List of Elective Modules

Module Code	*Module Title*	*Credits*	*Semester*
AERD 3001	Business Law	2	1
AERD 3003	Co-operatives	2	2
AERD 3006	Financial Planning and Control	4	2
AERD 3007	Operations and Personnel Management	4	2
AERD 3008	Quantitative Methods	4	2
AERD 4012	Taxation	2	1
AERD 4101	Project Development and Management	4	1
AERD 4104	Farm Input Marketing	2	2
AERD 4106	Food Marketing	2	2
AERD 4110	Farm Management	2	1
AERD 4111	Health and Safety on Farms	2	2
AERD 4150	Elective Project I	2	1 or 2*
AERD 4151	Elective Project II	4	1 or 2*
AESC 4004	Wildlife Management	4	1
AESC 4005	Epidemiology and Zoonoses	4	2
AESC 4006	Pest Management	4	1

* Students may take this elective module in either Semester 1 or Semester 2

AESC 4007	Plant Disease Management	4	1
AESC 4008	Molecular Biology and the Environment	4	2
AESC 4101	Apiculture	2	1
AESC 4104	Livestock Health Products	2	2
AESC 4110	Reclamation of Marginal and Damaged Land	4	1
ANSC 3012	Fundamentals of Biotechnology	2	1
ANSC 4101	Advanced Beef Production	4	2
ANSC 4102	Advanced Dairy Production	4	2
ANSC 4103	Advanced Sheep Husbandry	4	2
ANSC 4104	Advanced Swine Production	4	2
ANSC 4105	Applied Animal Physiology	4	1
ANSC 4106	Equine Husbandry	4	2
ANSC 4107	Feed Formulation and Quality Control	2	1
ANSC 4109	Animal Behaviour and Welfare	2	2
ANSC 4113	Elective Project I	2	1 or 2*
ANSC 4114	Elective Project II	4	1 or 2*
ANSC 4115	Applied Biotechnology	4	2
ANSC 4116	Poultry Production	2	2
ANSC 4151	Elective Project III	6	1 or 2*
ANSC 4152	Elective Project IV	8	1 or 2*
CPSC 4101	Developments in Cereal Production	4	2
CPSC 4102	Developments in Grassland	2	2
CPSC 4103	Organic Agriculture and Horticulture	2	1
CPSC 4112	Alternative Crop Development	4	2
CPSC 4150	Elective Project I	2	1 or 2*
CPSC 4151	Elective Project II	4	1 or 2*
CPSC 4152	Elective Project III	6	1 or 2*
CPSC 4153	Elective Project IV	8	1 or 2*
ENGT 4107	Buildings for Animal Production and Crop Storage	4	2
ENGT 4108	Forest Engineering	4	1
ENGT 4109	Food Quality and Safety Assurance	4	1
ENGT 4150	Elective Project I	2	1 or 2*
ENGT 4151	Elective Project II	4	1 or 2*
ENGT 4152	Elective Project III	6	1 or 2*
ENGT 4153	Elective Project IV	8	1 or 2*
ERM 4004	Environmental Issues in Agriculture	4	2
ERM 4101	Forest Wildlife Management	2	2
ERM 4104	Peatland Management	4	2
ERM 4106	Forestry and the Environment	2	2
FDSC 2007	Agricultural Chemistry I	4	1
FDSC 4006	Marketing	4	2
FDSC 4007	Nutrition II	4	1
FDSC 4009	Fresh and Processed Meat Products II	6	1
FDSC 4014	Food Preservation	4	1

* Students may take the elective module in either Semester 1 or Semester 2

FDSC 4016	Food Safety	4	2
FDSC 4101	Applied Diagnostics	4	1
FOR 3010	Remote Sensing & GIS	4	1
FOR 3012	Professional Forestry Practice	4	2
FOR 4005	Experimental Design	4	2
FOR 4105	Forest Landscape Design	2	TBC**
FOR 4106	Forest Management Techniques	2	TBC**
FOR 4108	Forest Policy	2	TBC**
FOR 4109	Forest Roads	2	TBC**
FOR 4110	Forest Tree Improvement	2	TBC**
FOR 4112	Multiple Use Management	2	TBC**
FOR 4115	Physiological Ecology of Forest Production	2	TBC**
FOR 4119	Special Forest Crops	2	TBC**
FOR 4121	The Biology, Silviculture and Management of Sitka Spruce	2	TBC**
FOR 4122	Wood Utilisation	2	TBC**
FOR 4123	Advanced Nursery Practice I	2	TBC**
FOR 4124	Advanced Nursery Practice II	2	TBC**
FOR 4125	Agro-Forestry	2	TBC**
FOR 4126	The Biology, Silviculture and Management of Broadleaves	2	TBC**
FOR 4127	Familiarisation with Forestry	2	TBC**
FOR 4128	Forest Harvest Scheduling Systems	2	TBC**
FOR 4129	Forestry in Europe	2	TBC**
FOR 4130	Sustainable Forest Management	2	TBC**
FOR 4132	Elective Essay I	2	1 or 2*
FOR 4133	Elective Essay II	4	1 or 2*
FOR 4134	Forestry and the Law	2	TBC**
FOR 4150	Elective Project I	2	TBC**
FOR 4151	Elective Project II	4	TBC**
HORT 4102	Computer Aided Design	2	TBC**
HORT 4103	Desk Top Publishing	2	2
HORT 4104	Exotic Trees and Shrubs	2	2
HORT 4105	Floriculture	4	TBC**
HORT 4106	Interior Plantscaping	2	1
HORT 4108	Leisure and Recreation Facilities	2	2
HORT 4110	Photographic Image Editing	2	2
HORT 4111	Photography	2	2
HORT 4112	Plant Biotechnology	4	TBC**
HORT 4113	Urban Design	2	2
HORT 4114	Advanced Pomology	4	TBC**
HORT 4115	Garden Restoration	2	2
HORT 4116	Nursery Management	4	TBC**

** Semester to be confirmed by the Head of Department of Crop Science, Horticulture and Forestry
* Students may take the elective module in either Semester 1 or Semester 2

HORT 4117	Garden Centre Management	4	TBC**
HORT 4118	Social Horticulture	4	TBC**
LANG 4101	Beginners French	4	1 and 2***
LANG 4102	Advanced French	4	1 and 2***
LANG 4103	Beginners German	4	1 and 2***
LANG 4104	Advanced German	4	1 and 2***
LANG 4105	Spanish	4	1 and 2***

Syllabus of Elective Modules

Business Law **2 Credits AERD 3001**

As for the core module:

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.

Co-operatives **2 Credits AERD 3003**

As for the core module:

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.

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

As for the core module:

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

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

As for the core module:

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.

** Semester to be confirmed by the Head of Department of Crop Science, Horticulture and Forestry
*** The elective module will be offered through Semester 1 and Semester 2

Quantitative Methods **4 Credits** **AERD 3008**

As for the core module:

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.

Taxation **2 Credits** **AERD 4012**

As for the core module:

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.

Project Development and Management **4 Credits** **AERD 4101**

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 module is supported throughout by examples of development projects.

Farm Input Marketing **2 Credits** **AERD 4104**

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.

Food Marketing **2 Credits** **AERD 4106**

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.

Farm Management **2 Credits** **AERD 4110**

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.

Health and Safety on Farms **2 Credits** **AERD 4111**

Health and safety legislation related to agriculture in Ireland. The Health and Safety Authority, its roles and functions. Health and safety statistics, identifying areas of major risk. Identifying safe work practices for major risk areas. The safety statement and safety audits.

Elective Project I **2 Credits** **AERD 4150**

Elective Project II **4 Credits** **AERD 4151**

Wildlife Management **4 Credits** **AESC 4004**

As for the core module:

Wildlife management is the application of management techniques for the conservation and use of our wildlife resource. The module 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.

Module projects will include an essay and a management plan.

Epidemiology and Zoonoses **4 Credits** **AESC 4005**

As for the core module:

This module 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 module 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.

Pest Management **4 Credits** **AESC 4006**

As for the core module:

This module 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.

Plant Disease Management **4 Credits** **AESC 4007**

As for core module:

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.

Molecular Biology and the Environment **4 Credits** **AESC 4008**

As for the core module:

A lecture/laboratory module designed to provide a basic understanding of the molecular techniques currently used in studies of environmental biology. The topics covered in this module 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.

Apiculture **2 Credits** **AESC 4101**

Scientific basis of bee-keeping; taxonomy, morphology, genetics and behaviour of bees; diseases, management and commercial aspects; demonstration and handling of bee colonies.

Livestock Health Products **2 Credits** **AESC 4104**

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.

Reclamation of Marginal and Damaged Land **4 Credits** **AESC 4110**

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, re-vegetation schedules; (d) Pernicious contamination problems: hydrocarbon contamination, chronic ionic toxicity, radioactive residues.

Fundamentals of Biotechnology **2 Credits** **ANSC 3012**

As for the core module:

This module will familiarise students with the basic concepts used in plant and animal biotechnology. The module 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).

Advanced Beef Production **4 Credits** **ANSC 4101**

This module 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.

Advanced Dairy Production **4 Credits ANSC 4102**
This module develops selected topics from the Dairy Husbandry section of ANSC 4001 Animal Husbandry IV, which is a prerequisite. Topics selected usually include grassland management, concentrate feeding, dairy breeding, economics/management and diseases/disorders. The module includes a project usually based on a case study of a dairy farm.

Advanced Sheep Husbandry **4 Credits ANSC 4103**
This elective covers in greater depth the areas covered in the core module 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.

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

Applied Animal Physiology **4 Credits ANSC 4105**
This module deals with aspects of applied reproductive technology in farm animals, examining means of improving reproductive efficiency. A literature review and seminar will account for 75% of the marks.

Equine Husbandry **4 Credits ANSC 4106**
This module is designed to give the student a basic understanding of horse production in Ireland. The topics covered in the module 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.

Feed Formulation and Quality Control **2 Credits ANSC 4107**
This module 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.

Animal Behaviour & Welfare **2 Credits ANSC 4109**
Behaviour of the newborn, acquired or innate behaviour, social, sexual, aggressive, ingestive and other forms of behaviours. 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.

Elective Project I **2 Credits ANSC 4113**

Elective Project II **4 Credits ANSC 4114**

Applied Biotechnology **4 Credits ANSC 4115**
The emphasis will be on up to date developments and techniques in biotechnology including transgenic plants and animals, GM foods, disease resistance, gene therapy and genomics. A literature review, presentation and laboratory practicals will account for 50% of the marks.

Poultry Production **2 Credits ANSC 4116**
The poultry industry at farm, national and EU level; systems of poultry production, poultry production management, including disease prevention and control, nutrition, breeds, reproduction and housing; costs and returns in poultry production.

Elective Project III **6 Credits ANSC 4151**

Elective Project IV **8 Credits ANSC 4152**

Agricultural Climatology and Meteorology **2 Credits CPSC 2004**
As for the core course.
Meteorological elements and their measurement; Climate of Ireland; The moisture balance-evaporation, soil storage, run-off, drainage; The energy balance – radiation, conduction, convention, evaporation. Climate and soil management; plant requirements for moisture and heat; drought irrigation. Soil fertility implications. Surface water and aquifer vulnerability. Timing of land-related activities. Weather, animal and crop production. Crop-weather interactions: forestry, horticulture and protected crops. Wind shelter and housing. Influence on disease and pest outbreaks. Implications of climate change for production agriculture and environmental well being.

Developments in Cereal Production **4 Credits CPSC 4101**
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.

Developments in Grassland **2 Credits CPSC 4102**
In this module, students engage in a detailed examination of topics related to forage production as covered in CPSC 4005 'Crop Husbandry IVa' and CPSC 4006 'Crop Husbandry IVb'.

Organic Agriculture and Horticulture **2 Credits** **CPSC 4103**
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.

Alternative Crop Development **4 Credits** **CPSC 4112**
The manufacturing industry is beginning to recognise the potential benefits of using crop-derived products as renewable raw materials. They have the benefits of being more sustainable and are biodegradable. This module provides the student with the opportunity to study in detail the production of non-food industrial crops at farm level and also to study their role at industry level.

Elective Project I **2 Credits** **CPSC 4150**

Elective Project II **4 Credits** **CPSC 4151**

Elective Project III **6 Credits** **CPSC 4152**

Elective Project IV **8 Credits** **CPSC 4153**

Buildings for Animal Production and Crop Storage **4 Credits** **ENGT 4107**
Legislation. Farm design and layout. Animal production buildings for pigs, cattle, sheep and horses. Crop storage buildings. Environmental control systems. Structural materials in agricultural buildings.

Forest Engineering **4 Credits** **ENGT 4108**
As for the Forest Engineering section of ENGT 4007:
Forest machinery design, selection and operation. Timber transport. Environmental impact. Central tyre inflation (CTI) and telemetric control systems.

Food Quality and Safety Assurance **4 Credits** **ENGT 4109**
As for the Food Quality and Safety Assurance section of ENGT 4002:
Quality systems standards. Food legislation. Process plant layout. Principles of cleaning. Hygienic design. HACCP.

Elective Project I **2 Credits** **ENGT 4150**

Elective Project II **4 Credits** **ENGT 4151**

Elective Project III **6 Credits** **ENGT 4152**

Elective Project IV **8 Credits** **ENGT 4153**

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

As for the core module:

In this module, selected issues which were introduced in AESC 2001 are developed.

Topics discussed include: countryside management (the Irish landscape; wildlife habitats and their management, wildlife conservation); fertiliser and waste management (pollution control, risk assessment, landspreading of farm and non-agricultural wastes and effluents, statutory regulations, e.g. 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).

Forest Wildlife Management **2 Credits** **ERM 4101**

This module will evaluate the forest habitats for wildlife management and conservation. The module 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.

Peatland Management **4 Credits** **ERM 4104**

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 utilisation, 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 utilisation; socio-economic aspects, aesthetics, conservation interests.

Forestry and the Environment **2 Credits** **ERM 4106**

The changing view of the goods and services which the forest is expected, by society, to provide have led to the development of the ecosystem based concept of sustainable management. The meaning of sustainability is explored in the module and the approaches taken to the implementation of the concept examined. The interaction of the forest with the environment involves both the impact of the forest on the environment and the impact of the environment on the forest. Topics discussed include atmospheric deposition, climate change, greenhouse gas cycles, soil acidification, critical loads and water quality for fisheries. The module includes a half-day field trip.

Agricultural Chemistry I **4 Credits** **FDSC 2007**

As for the core module:

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.

Marketing **4 Credits** **FDSC 4006**

As for the core module.

An introduction to the basic principles of marketing including advertising and promotion.

Nutrition II **4 Credits** **FDSC 4007**

As for the core module.

Appetite and regulation of energy balance. Diet and health: Primary nutritional disorders (e.g. obesity, malnutrition). Diet-related disorders (e.g. heart disease, cancer, food allergies). Minerals and vitamins, consequences of deficiency and excess. Dietary fibre, vegetarianism. Recommendations for healthy eating. Changes in dietary habits and the national diet.

Fresh and Processed Meat Products I **4 Credits** **FDSC 4009**

As for the core module.

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.

Food Preservation **4 Credits** **FDSC 4014**

As for the core module.

The heating and cooling of foods; sterilisation; microwave and dielectric heating; freezing; introduction to dehydration.

Food Safety **4 Credits** **FDSC 4016**

As for the core module.

Introduction to Food Safety and Consumer health; Introduction to Microbial Risk Assessment; MRA Methodology; Bacterial Hazards, Emerging Infections and Control of Zoonotic Transmission; Antimicrobial resistance; Chemical contamination of the food chain; Non-bacterial Hazards; Genetic Modification; Agri and Bio terrorism; Applied Siagnostic strategies; Rapid alerting models and Control of Global Disease Outbreaks.

Applied Diagnostics **4 Credits** **FDSC 4101**

Introduction to applied diagnostics; immuno-based approaches – immunochromatography; genetic-based approaches – introduction to DNA structure; hybridisation and amplification strategies, molecular sub-typing; biosensor-based approaches – new biosensors; applied systematics.

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

As for the core module.

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: ESRI ArcView 3.2a. Microsoft Office 2000: Word, Excel. Novell Applications Launcher (NAL) under Windows 2000.

Experimental Design **4 Credits** **FOR 4005**

As for the Core Module:

The objective is to develop applied quantitative computer skills for the transparent design, analysis and interpretation of data arising from elementary univariate experimental designs.

Basic concepts of experimentation, treatments, spatial layout of experimental units, response variables and hypothesis testing. Review of the two-sample t-tests, the fundamental equation of analysis of variance (ANOVA) and the underlying assumptions.

Analysis, interpretation and reporting of data from univariate experimental designs including: the completely randomised, the randomised block, the Latin square and factorial designs with and without replication. Hypothesis testing of main and interaction effects. Concepts of repeated measures designs and autocorrelation.

Concept of simultaneous inference using Scheffé, Tukey and Student-Newman-Keuls multiple range tests.

Transparent analysis, interpretation and reporting of data arising from elementary experimental designs. This is an advanced hands-on computer skills experimental design module. Papers will be produced for a series of exercises.

Software: ESRI ArcView 3.2a. Microsoft Office 2000: Word, Excel. Novell Applications Launcher (NAL) under Windows 2000.

Forest Landscape Design **2 Credits** **FOR 4105**

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.

Forest Management Techniques **2 Credits** **FOR 4106**

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.

Forest Policy **2 Credits** **FOR 4108**

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.

Forest Roads **2 Credits** **FOR 4109**

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.

Forest Tree Improvement **2 Credits** **FOR 4110**

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.

Multiple Use Management **2 Credits** **FOR 4112**

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

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

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.

Special Forestry Crops **2 Credits** **FOR 4119**

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

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

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

Wood Utilisation **2 Credits** **FOR 4122**

This module 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.

Advanced Nursery Practice I **2 Credits** **FOR 4123**

The module 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.

Advanced Nursery Practice II **2 Credits** **FOR 4124**

This module 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.

Agro-Forestry **2 Credits** **FOR 4125**

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

Biology Silviculture and Management of Broadleaves **2 Credits** **FOR 4126**

Species distribution, natural variation, provenance. Biology and ecology. Tree Improvement. Nutrition and silviculture. Wood properties. Diseases and pests.

Familiarisation with Forestry **2 Credits** **FOR 4127**

This module is designed to provide advanced undergraduates with a familiarisation of forestry terminology and practices. The module 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.

Forest Harvest Scheduling Systems **2 Credits** **FOR 4128**

The module 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.

Forestry in Europe **2 Credits** **FOR 4129**

The module 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.

Sustainable Forest Management **2 Credits** **FOR 4130**

The legal framework; the economic and policy framework; criteria and indicators; measures; certification.

Elective Essay I **2 Credits** **FOR 4132**

Individual students write a minor (2-credit) essay on an approved topic in Forestry, under the guidance of one of the Forestry staff members.

Elective Essay II **4 Credits** **FOR 4133**
Individual students write a major (4-credit) essay on an approved topic in Forestry, under the guidance of one of the Forestry staff members.

Forestry and the Law **2 Credits** **FOR 4134**
This elective module for third and fourth year Forestry students covers the historical background to forestry legislation in Ireland and the contemporary forestry related laws in the Republic. Related issues such as planning and the environment, EU directives, codes and guidelines arising from legislation are also covered.

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

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

Computer Aided Design **2 Credits** **HORT 4102**
This elective is directed to students who have an interest in Computer Aided Design. The module 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 module.

Desk Top Publishing **2 Credits** **HORT 4103**
This module 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.

Exotic Trees and Shrubs **2 Credits** **HORT 4104**
This is an advanced module 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 module *is taught in alternate years.*

Floriculture **4 Credits** **HORT 4105**
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.

Interior Plantscaping **2 Credits HORT 4106**

This module 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.

Leisure and Recreation Facilities **2 Credits HORT 4108**

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 module *is taught in alternate years.*

Photographic Image Editing **2 Credits HORT 4110**

The student's 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 module 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.

Photography **2 Credits HORT 4111**

Intensive module on photographic techniques and equipment taught by staff of the Audio-Visual Centre.

Plant Biotechnology **4 Credits HORT 4112**

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.

Urban Design **2 Credits HORT 4113**

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.

Advanced Pomology **4 Credits HORT 4114**

This module 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.

Garden Restoration **2 Credits HORT 4115**
A project based module, 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.

Nursery Management* **4 Credits HORT 4116**
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.

Garden Centre Management* **4 Credits HORT 4117**
The module 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 module will be supplemented by visits to selected production tree and shrub nurseries and garden centres.

Social Horticulture **4 Credits HORT 4118**
Introduction and definition. Evolution of the concept of Social Horticulture. People-Plant interactions; the significance of plants in human activities. Horticultural therapy for physical rehabilitation and maintenance of mobility. Horticultural therapy for physical rehabilitation of offenders and preventative programmes. Horticulture in Special Needs education. Horticulture and the community. Horticultural tourism.

Beginners French **4 Credits LANG 4101**

Advanced French **4 Credits LANG 4102**

Beginners German **4 Credits LANG 4103**

Advanced German **4 Credits LANG 4104**

Spanish **4 Credits LANG 4105**

* Taught in alternate years and applies to Landscape Horticulture students only.

Dates of Academic Session 2004/05

First Semester/Michaelmas Term First, Second, Third and Fourth Year Agricultural Science		
First Year Registration and Orientation	13 September 2004	
Michaelmas Lecture Term	16 September-08 December 2004	12 weeks
Revision	09 December-15 December 2004	1 week
Examinations	16 December-23 December 2004	7 working days

Second Semester/Hilary and Trinity Terms First, Second and Fourth Year Agricultural Science		
Hilary Lecture Term	10 January-12 March 2005	9 weeks
Break/Fieldwork	14 March-02 April 2005	3 weeks
Trinity Lecture Term	04 April-23 April 2005	3 weeks
Revision	25 April-01 May 2005	1 week
Examinations commence	03 May 2005	

Second Semester/Hilary and Trinity Terms Third Year Agricultural Science		
Hilary Lecture Term	10 January-05 March 2005	8 weeks
Revision	06 March-12 March 2005	1 week
Examinations	14 March-26 March 2005	2 weeks
Professional Work Experience *ACP Programme:* *Other Programmes:*	 10 January-31 August 2005 04 April-31 August 2005	

Easter Sunday: 27 March 2005

Autumn Examinations Commence: 08 August 2005