University College Dublin
National University of Ireland, Dublin

Bachelor of Agricultural Science Degree

Session 2003/04

NOTE

This booklet contains information relating to the Bachelor of Agricultural Science degree programmes in the Faculty of Agriculture.

Information on postgraduate, continuing and professional education programmes in the Faculty of Agriculture is contained in a separate booklet.

Contents

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

Degrees in the Faculty of Agriculture

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

In the Faculty of Agriculture:

Bachelor of Agricultural Science (BAgrSc)

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. 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) due to the number of places available.
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 courses listed in this booklet are offered at the discretion of the Faculty of Agriculture.

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

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

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

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 Courses 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 Faculty guidelines (see the Summary of BAgrSc Degree Programmes).

Admissions Procedure

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

Mature Years Applications
The Faculty of Agriculture normally offers a number of places to mature applicants. Details are available from the Admissions Office or from the Faculty of Agriculture Office.

Transfers from Institutes of Technology
The Faculty of Agriculture normally accepts a number of transferees from Institutes of Technology who have completed relevant certificate/diploma programmes. Details are available from the Admissions Office or from the Faculty of Agriculture Office.

Contact Details

Admissions Office
Michael Tierney Building,
University College Dublin, Belfield, Dublin 4
Telephone:353.1.7161425 or 7161602
Email: admissions@ucd.ie
Website: www.ucd.ie/~admiss

Faculty of Agriculture 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 select 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.

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 – Agribusiness and Rural Development; 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 2004. To be considered for transfer, applicants must have: (a) a points score which would have secured entry to the preferred BAgrSc programme option in 2003; 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 Courses 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 the start of the Hilary term or in the middle of the Hilary term or at the start of the Trinity term of third year and continuing through to the start of the Michaelmas term of fourth year (consult the *Syllabus of Core Courses 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 courses of the second year.

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

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

First or Second Class Honours may be awarded on the results of the First, Second and Third University Examinations. The award of First or Second Class Honours in the BAgrSc Degree is based on the combined results of the Third and Fourth University Examinations. The detailed regulations are included in the publication *Marks and Standards* (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 course must seek the permission of the Faculty of Agriculture. 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: 7167194; Email: faculty.agriculture@ucd.ie

Associate Dean for Student Affairs
Dr Trevor Storey, Room 111, Agriculture and Food Science Building
Tel: 7167779; Email: Trevor.Storey@ucd.ie

Student Adviser Ms Aoife Fitzgerald, Room 203, Science Lecture Building
Tel: 7162863; Email: Aoife.Fitzgerald@ucd.ie

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

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

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

Dates of Academic Session 2003/04
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: 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 Agricultural and Food 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: 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).

Course Code		*Course 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
			12
Students must select one of the following nine 12-credit courses*:			
•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

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

For information on selection of BAgrSc degree programme options – see *Faculty Regulations*.

1. Animal and Crop Production

First Year

Course Code		*Course 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

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

Third Year

Course Code		*Course 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
CPSC	3201	Professional Work Experience	30
SLSC	3001	Soil Science II	6
			60

Fourth Year

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

2. Animal Science

First Year

Course Code		*Course 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

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

Third Year

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

Fourth Year

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

3. Agribusiness and Rural Development

First Year

Course Code		*Course 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

Course Code		*Course Title*	*Credits*
AERD	2003	Communications	6
AERD	2004	Business Management	6
AERD	2005	Applied Economic Analysis	6
AESC	2001	Agricultural and Environmental Biology	8
AESC	2002	Agricultural Zoology	4
CPSC	2002	Statistics	6
CPSC	2003	Crop Husbandry II	6
FDSC	2007	Agricultural Chemistry I	4
FDSC	2009	Agricultural Chemistry III	2
INDM	2005	Agricultural Microbiology	6
SLSC	2002	Soil Science I	6
			60

Third Year

Course Code		*Course Title*	*Credits*
AERD	3001	Business Law	2
AERD	3003	Co-operatives	2
AERD	3006	Financial Planning and Control	4
AERD	3007	Operations and Personnel Management	4
AERD	3008	Quantitative Methods	4
AERD	3009	Rural Development	6
AERD	3012	Computer Analysis	6
AERD	3013	Farm Business Management I	6
AERD	3200	Professional Work Experience	14
AERD	3300	Electives	4
ANSC	3009	Animal Husbandry II	8
			60

Fourth Year

Course Code		*Course Title*	*Credits*
AERD	4004	Agricultural Marketing and Trade	4
AERD	4005	Agricultural Policy II	8
AERD	4006	Communications II	6
AERD	4007	Enterprise Development	4
AERD	4009	Food and Farm Input Marketing	4
AERD	4011	Research Methods/Project	6
AERD	4012	Taxation	2
AERD	4014	Farm Business Management II	6
AERD	4015	IT and E-Business	4
AERD	4050	Major Project	4
AERD	4400	Electives	8
ECON	4101	National Economics	4
			60

4. Agricultural and Environmental Science

First Year

Course Code		*Course 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

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

Third Year

Course Code		*Course Title*	*Credits*
AESC	3004	Plant Pathology	6
AESC	3007	Agrichemicals and Plants	4
AESC	3011	Applied Zoology II	8
AESC	3012	Diversity in the Rural Landscape	8
AESC	3013	Literature Review Project	2
AESC	3201	Professional Work Experience	12
ANSC	3009	Animal Husbandry II	8
ANSC	3012	Fundamentals of Biotechnology	2
FOR	4005	Experimental Design	4
SLSC	3001	Soil Science II	6
			60

Fourth Year

Course Code		*Course Title*	*Credits*
Students must select 4 of the following 5 four-credit courses:			
• AESC	4004	Wildlife Management *(4)*	
• AESC	4005	Epidemiology and Zoonoses *(4)*	
• AESC	4006	Pest Management *(4)*	
• AESC	4007	Plant Disease Management *(4)*	
• AESC	4008	Molecular Biology and the Environment *(4)*	16
AESC	4051	Project	12
AESC	4400	Electives	12
ERM	4003	Environmental Impact Assessment	4
ERM	4005	Environmental Management	8
ERM	4006	Soil and Water Management	8
			60

5. Food Science

First Year

Course Code		*Course 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

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

Third Year

Course Code		*Course Title*	*Credits*
ENGT	3004	Food Engineering Principles	6
FDSC	3001	Food Analysis	10
FDSC	3003	Food Chemistry	8
FDSC	3005	Nutrition I	4
FDSC	3006	Biochemistry I and II	8
FDSC	3007	Product Development	4
FDSC	3201	Professional Work Experience	6
FOR	3005	Computer Applications	4
FOR	4005	Experimental Design	4
INDM	3009	Food Microbiology II	6
			60

Fourth Year

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

6. Engineering Technology

First Year

Course Code		*Course 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

Course Code		*Course Title*	*Credits*
AERD	2004	Business Management	6
AESC	2001	Agricultural and Environmental Biology	8
CPSC	2002	Statistics	6
CPSC	2003	Crop Husbandry II	6
ENGT	2007	Surveying	2
ENGT	2009	Literature Research Project	2
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	2015	Food Science and Technology	6
INDM	2005	Agricultural Microbiology	6
SLSC	2002	Soil Science I	6
			60

Third Year

Course Code		*Course Title*	*Credits*
AERD	3006	Financial Planning and Control	4
ANSC	3009	Animal Husbandry II	8
ENGT	3001	Food Engineering Principles	8
ENGT	3002	Power and Machinery I	8
ENGT	3003	Structural and Soil Engineering	8
ENGT	3008	Computer Information Systems and Programming	8
ENGT	3050	Major Project I	8
ENGT	3300	Electives	4
FOR	3010	Remote Sensing and GIS	4
			60

Fourth Year

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

7. Horticultural Science

First Year

Course Code		*Course 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

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

Third Year

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

Fourth Year

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

8. Landscape Horticulture

First Year

Course Code		*Course 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

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

Third Year

Course Code		*Course Title*	*Credits*
ERM	3004	Landscape Ecology	4
ERM	3005	Landscape Interpretation	4
HORT	3004	Plant Materials	6
HORT	3010	Urban Horticulture and Landscape and Turfgrass Management I	6
HORT	3011	Landscape Design Theory II and Professional Practice and Planning Law I	6
HORT	3012	Landscape Design Studio II	12
HORT	3013	Landscape Construction	6
HORT	3202	Professional Work Experience	12
SLSC	3003	Soil Science IV	4
			60

Fourth Year

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

9. Forestry

First Year

Course Code		*Course 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

Course Code		*Course Title*	*Credits*
AERD	2004	Business Management	6
AESC	2001	Agricultural and Environmental Biology	8
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	2004	Fundamentals of Forestry	8
FOR	2005	Silviculture I	6
INDM	2005	Agricultural Microbiology	6
SLSC	2002	Soil Science I	6
			60

Third Year

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

Fourth Year

Course Code		*Course Title*	*Credits*
FOR	4003	Forest Management Plan	12
FOR	4004	Forest Planning	6
FOR	4005	Experimental Design	4
FOR	4006	Forest Inventory and GIS	10
FOR	4051	Research Project	16
FOR	4100	Electives	12
			60

Summary of Transfer Programmes

1(a). Animal and Crop Production WIT Transfer

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

Second Year

Course Code		*Course 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

Course Code		*Course Title*	*Credits*
AERD	2004	Business Management	6
AESC	2001	Agricultural and Environmental Biology	8
AESC	2002	Agricultural Zoology	4
ANSC	2001	Genetics I	2
CPSC	2002	Statistics	6
CPSC	3300	Electives*	6
ENGT	2011	Principles of Engineering I and II (i) *Principles of Engineering I (2)* (ii) *Principles of Engineering II (2)*	4
FDSC	2007	Agricultural Chemistry I	4
FDSC	2008	Agricultural Chemistry II	6
GEOL	2601	Geology	3
INDM	2005	Agricultural Microbiology	6
SLSC	2003	Soil Science	5
			60

* *Elective courses to be selected from those listed in the 'Syllabus of Elective Courses' and/or from the restricted elective courses listed overleaf.*

Fourth Year

Course Code		*Course 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
CPSC	4400	Electives*	30
			60

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

AERD 4002 Communications I **4 Credits**

Syllabus as per the core course.

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.

ANSC 4117 Beef Cattle Husbandry **3 Credits**

Syllabus as for 'Beef Cattle Husbandry' Section of ANSC 4001.

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.

CPSC 4110 Cereal Production **2 Credits**

Syllabus as for 'Cereal Production' Section of CPSC 4001.

Factors determining optimum yield and quality in cereals; production factors – from soil preparation to crop harvest; holding systems, drying, storage; alternative uses of cereals; factors determining optimum net return from cereal systems; use of cereals, e.g. Maize, rye as forage crops.

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

Syllabus as for 'Root and Green Crops' Section of CPSC 4001.

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

* *Elective courses to be selected from those listed in the 'Syllabus of Elective Courses' and/or from the restricted elective courses listed overleaf.*

2(a). Animal Science WIT Transfer

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

Second Year

Course Code		*Course 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

Course Code		*Course Title*	*Credits*
AERD	2004	Business Management	6
AESC	2001	Agricultural and Environmental Biology	8
AESC	2003	Animal Parasitology	2
ANSC	2002	Genetics I and II (i) *Genetics I (2)* (ii) *Genetics II (2)*	4
ANSC	2004	Animal Husbandry I	2
ANSC	3300	Electives	6
CPSC	2002	Statistics	6
ENGT	2011	Principles of Engineering I and II (i) *Principles of Engineering I (2)* (ii) *Principles of Engineering II (2)*	4
FDSC	2007	Agricultural Chemistry I	4
FDSC	2008	Agricultural Chemistry II	6
INDM	2005	Agricultural Microbiology	6
SLSC	2002	Soil Science	6
			60

Fourth Year

Course Code		*Course Title*	*Credits*
AERD	4001	Agricultural Policy I	6
ANSC	3002	Animal Nutrition I	6
ANSC	3003	Animal Nutrition II	4
ANSC	3006	Anatomical Structure and Function	4
ANSC	3007	Experimental Design and Data Analysis	6
ANSC	3011	Animal Husbandry III	8
ANSC	3012	Fundamentals of Biotechnology	2
ANSC	4003	Animal Breeding II	6
ANSC	4401	Electives	14
INDM	3010	Food Microbiology I	4
			60

3(a). Agribusiness and Rural Development WIT Transfer

Third Year

Course Code		*Course Title*	*Credits*
AERD	2005	Applied Economic Analysis	6
AERD	3001	Business Law	2
AERD	3006	Financial Planning and Control	4
AERD	3007	Operations and Personnel Management	4
AERD	3008	Quantitative Methods	4
AERD	3009	Rural Development	6
AERD	3012	Computer Analysis	6
AERD	3013	Farm Business Management I	6
AERD	3200	Professional Work Experience	14
ANSC	3009	Animal Husbandry II	8
			60

Fourth Year

As for the degree programme in Agribusiness and Rural Development.

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

Second Year

Course Code		*Course Title*	*Credits*
AERD	1002	Introduction to Agricultural Economics and Business	6
AERD	1003	Introduction to Food and Agribusiness	12
AERD	2003	Communications	6
AESC	2001	Agricultural and Environmental Biology	8
CPSC	2002	Statistics	6
INDM	2005	Agricultural Microbiology	6
MATH	1800	Mathematics	10
SLSC	2002	Soil Science I	6
			60

Third Year

Course Code		*Course Title*	*Credits*
AERD	2004	Business Management	6
AERD	2005	Applied Economic Analysis	6
AERD	3001	Business Law	2
AERD	3003	Co-operatives	2
AERD	3006	Financial Planning and Control	4
AERD	3007	Operations and Personnel Management	4
AERD	3008	Quantitative Methods	4
AERD	3009	Rural Development	6
AERD	3012	Computer Analysis	6
AERD	3301	Electives	6
AERD	3200	Professional Work Experience	14
			60

Fourth Year

As for the Agribusiness and Rural Development degree programme.

4(a). Agricultural and Environmental Science WIT Transfer

Third Year

Course Code		*Course Title*	*Credits*
AESC	3004	Plant Pathology	6
AESC	3007	Agrichemicals and Plants	4
AESC	3011	Applied Zoology II	8
AESC	3012	Diversity in the Rural Landscape	8
AESC	3013	Literature Review Project	2
AESC	3201	Professional Work Experience	12
ANSC	3012	Fundamentals of Biotechnology	2
ERM	3006	Earth Science	8
FOR	4005	Experimental Design	4
SLSC	3001	Soil Science II	6
			60

Fourth Year

As for the degree programme in Agricultural and Environmental Science.

6(a). Engineering Technology ITT Transfer

Third Year

Course Code		*Course Title*	*Credits*
AFEN	3004	Process Engineering Principles	8
ANSC	3601	Crop Husbandry and Animal Husbandry	6
ENGT	2003	Principles of Engineering II	2
ENGT	3002	Power and Machinery I	8
ENGT	3003	Structural and Soil Engineering	8
ENGT	3008	Computer Information Systems and Programming	8
ENGT	3050	Major Project I	8
ENGT	3301	Electives	8
FOR	3010	Remote Sensing and GIS	4
			60

Fourth Year

As for the degree programme in Engineering Technology.

6(b). Engineering Technology WIT Transfer

Third Year

Course Code		*Course Title*	*Credits*
AERD	3006	Financial Planning and Control	4
AFEN	3004	Process Engineering Principles	8
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	3002	Power & Machinery I	8
ENGT	3003	Structural & Soil Engineering	8
ENGT	3008	Computer Information Systems & Programming	8
ENGT	3050	Major Project I	8
ENGT	3302	Electives	6
FOR	3010	Remote Sensing and GIS	4
			60

Fourth Year
As for the degree programme in Engineering Technology.

7(a). Horticultural Science WIT Transfer

Third Year
As for the degree programme in Horticultural Science.

Fourth Year
As for the degree programme in Horticultural Science.

9(a). Forestry WIT Transfer

Third Year

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

Fourth Year

As for the degree programme in Forestry.

9(b). Forestry GMIT Transfer

Third Year

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

Fourth Year

As for the degree programme in Forestry.

Syllabus of Core Courses for the BAgrSc Degree

AERD 1002 Introduction to Agricultural Economics and Business 6 Credits

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.

AERD 1003 Introduction to Food and Agribusiness 12 Credits

Study Skills

Managing learning and study. Critical thinking. Communication. Inter-personal skills. 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

Eight hours of 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 library/literature project based on selected aspects of the lecture content.

AERD 2003 Communications 6 Credits

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

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

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

AERD 2004 Business Management **6 Credits**

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.

AERD 2005 Applied Economic Analysis **6 Credits**

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.

AERD 3001 Business Law **2 Credits**
Legal persons: sole trader, partnership, companies and co-operatives. Laws applicable; common law and legislation including EU legislation. Law of contract; definition of a contract in terms of offer, acceptance and consideration. Law of tort; duty of care and negligence. EU law; mechanisms and instruments by which EU law becomes a source of Irish law. Legal issues in retention of title and in insurances.

AERD 3003 Co-operatives **2 Credits**
Description and evaluation of structural, conduct and performance characteristics of alternative forms of agribusiness firms; historical development of agricultural co-operation in Ireland and world-wide; size and growth trends of agricultural co-operatives in terms of value added, membership, sectoral penetration, resources and profitability; legal aspects and rules; roles and responsibilities of shareholders, management and board members; co-operatives in non-traditional agricultural activities, in non-agricultural industries and in developing countries.

AERD 3006 Financial Planning and Control **4 Credits**
Methods of investment and project analysis, cost classification, cost/volume/profit relationships, cost and revenue control systems, financial planning and budgetary control.

AERD 3007 Operations and Personnel Management **4 Credits**
Production/operations, management and human resource development; introduction to production management and materials handling functions in food processing and other agribusiness firms; principles and techniques of human resource management; industrial relations structures and the collective bargaining process.

AERD 3008 Quantitative Methods **4 Credits**
A study of the quantitative methods commonly employed in the analysis of economic and business problems, including multiple regression, covariance analysis, time series analysis, linear programming and simulation; applications of the various methods using computer programmes.

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

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

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

Objectives of the CAP and their attainment, especially in relation to incomes. CAP Reform: Economic surplus analysis of price reduction and supply control. Other approaches including demand-side policies, deficiency payments and tiered pricing.

Direct payments: Rationale, coupling, funding and duration. Socio-structural Policy and Rural Development. The Uruguay Round Agreement and its implications. Future developments in agricultural policy, such as enlargement to the East, the trade liberalisation. Agricultural Policy in Developing Countries.

AERD 4002 Communications I **4 Credits**

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

Project work to include: lecture presentation and accompanying handout and radio scripting and recording.

AERD 4003 Farm Business **6 Credits**

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

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

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

Marketing

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

Trade

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

AERD 4005 Agricultural Policy II **8 Credits**

Syllabus as for AERD 4001 'Agricultural Policy I' plus additional theoretical material and literature assignments.

AERD 4006 Communications II **6 Credits**

The development of communication skills which are most commonly used in professional careers. These include individual, group and mass media methods of communication such as:

advising/counselling; lecturing and public speaking; facilitating group meetings and discussions; organising demonstrations; scripting and presenting for local radio; and writing skills (lecture handouts, technical reports, press articles, CV).

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

AERD 4007 Enterprise Development **4 Credits**

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

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

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

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

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

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

AERD 4012 Taxation **2 Credits**

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

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

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.

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

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.

AERD 4050 Major Project **4 Credits**

AERD 4400 Electives **8 Credits**

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

(i) Agricultural Botany (4 credits)

This section of the course 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.

AESC 2002 Agricultural Zoology **4 Credits**

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

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

AESC 2003 Animal Parasitology **2 Credits**

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

AESC 2004 Plant Physiology **4 Credits**

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

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

AESC 2005 Impact of Man on the Environment **4 Credits**

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

AESC 2006 Applied Zoology I **4 Credits**

Introduction to the biology and ecology of terrestrial and aquatic invertebrate groups of interest in agricultural and environmental science. Taxonomy of major groups with emphasis on recognition in the field.

AESC 2007 Applied Plant Biology **6 Credits**

(i) Agricultural Botany (4 credits)

As for the Agricultural Botany Section of AESC 2001. This section of the course 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.

AESC 3004 Plant Pathology **6 Credits**

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

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

AESC 3005 Plant Protection I **12 Credits**

Plant Pests

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

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

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

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

AESC 3006 Forest Protection **6 Credits**
Concept of plant disease. Symptoms and signs. Biotic agents (fungi, bacteria, viruses, mycoplasma-like organisms) causing disease. Epiphytology. Symptomatology, and etiology of important tree diseases.

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

AESC 3007 Agrichemicals and Plants **4 Credits**
History, rationalisation and integration of agrichemicals in crop production; pathways of foliar and root uptake; uptake and translocation of plant metabolites and exogenous chemicals; formulation of agrichemicals; metabolism of xenobiotic materials; toxicology, residues and statutory regulations; environmental and biological fate of agrichemical residues; basic chemical properties and modes of action of herbicides, fungicides and insecticides; biological tolerance and resistance; chemical regulation of the plant life cycle, foliar nutrition; miscellaneous agrichemical products.

AESC 3010 Crop Protection **8 Credits**
Economic and social impact of diseases on crop production: sources of loss and quality control. Symptoms and signs. Infectious diseases vs. non-infectious disorders. Koch's postulates. Epiphytology and disease forecasting. Symptomatology, etiology and control of important fungal, bacterial and virus diseases of field crops, including seedling and post-harvest diseases. Disease control: regulatory, chemical, biological and integrated control methods and pathogen resistance.

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

AESC 3011 Applied Zoology II **8 Credits**
Factors influencing the structure and dynamics of animal populations and communities. Animal/plant interactions. Role of animals in terrestrial ecosystems; influence on primary production, decomposition and nutrient cycling, and on soil structure.

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

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

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

Principles of epidemiology with special emphasis on zoonotic infections.

AESC 3012 Diversity in the Rural Landscape 8 Credits

Concepts and methods in natural heritage evaluation. Ecological methods. Origins and evolution of the Irish flora. The recognition and evaluation of natural habitats. Landscape heritage and geology. The impact of agriculture on rural diversity through history.

Cultural heritage of the farmed landscape. The cultural palimpsest of the rural landscape. Legislation and incentives pertaining to rural environmental heritage. Habitat management case studies and special topics.

An introduction to native and migrant vertebrate species in Ireland. The impact of land use and habitat fragmentation, and the role of national and EU measures in the conservation of species.

AESC 3013 Literature Review Project 2 Credits

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

AESC 3201 Professional Work Experience 12 Credits

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

AESC 4002 Plant Protection II 6 Credits

Plant Pests

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

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

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

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

AESC 4004 Wildlife Management **4 Credits**
Wildlife management is the application of management techniques for the conservation and use of our wildlife resource. The course will examine: resident and migrant species; population census and analysis; habitat evaluation, monitoring and analysis; management for conservation and hunting; impact of man on wildlife with emphasis on the conservation/damage interface; the role and importance of wildlife law.

Course projects will include an essay and a management plan.

AESC 4005 Epidemiology and Zoonoses **4 Credits**
This course deals with the epidemiology and control of human and livestock diseases that involve a significant free-living, vector-borne or zoonotic stage and for which environmental considerations are especially important. The emphasis will be on diseases encountered in Ireland, but where necessary for illustration of principles, tropical diseases such as malaria will also be dealt with. The course will consist of the following components: ecology of major parasitic infections of livestock, ecology of parasitic zoonoses, ecology of major non-parasitic zoonoses, immunobiology, principles of epidemiology, epidemiological tools including diagnostics and mathematical models, control measures including general principles, chemotherapy, vaccination and environmental management.

AESC 4006 Pest Management **4 Credits**
This course examines the pest management concept as an alternative to more traditional approaches to pest control. Basic principles and tactics are examined, including establishment and implementation of economic injury thresholds and the integration of biological, cultural and chemical approaches. Case studies based on programmes which have been put into operation will be considered.

AESC 4007 Plant Disease Management **4 Credits**
Relevance of epidemiology to disease management; disease epidemics; disease build-up; pathogen dispersal; quantification of disease – phytopathometry and the analysis of epidemics; modelling and forecasting epidemics; genetics and epidemiology – strategies for the use of resistant cultivars; management of virus diseases: novel plant breeding, molecular biology and genetic engineering techniques for the production of virus resistant transgenic plants; developments in chemical control of plant disease; fungicide groupings and modes of action, application techniques, legislation, food residues; pathogen resistance to fungicides.

AESC 4008 Molecular Biology and the Environment **4 Credits**
A lecture/laboratory course designed to provide a basic understanding of the molecular techniques currently used in studies of environmental biology. The topics covered in this course will include the use of DNA diagnostics, immunodiagnostics, molecular variability

and molecular markers in environmental biology. The techniques will include DNA diagnostic, immunodiagnostic, DNA variation, DNA marker, protein marker and protein variation analyses.

AESC 4051 Project **12 Credits**

AESC 4400 Electives **12 Credits**

AFEN 3004 Process Engineering Principles **8 Credits**
Basic modes of heat transfer. Steady state conduction. Unsteady state conduction. Free and forced convection. Finned surfaces. Heat exchangers. Radiation. Heat transfer with phase change. Process laboratory practicals. Computer applications.

Mass balances in food process operations. Principles and applications of food separation processes including: distillation, leaching, filtration, ultrafiltration, reverse osmosis, electrodialysis, centrifugation. Psychrometrics in food and agricultural systems. Process laboratory practicals. Computer applications.

ANSC 1001 Introduction to Animal Science **12 Credits**
Study Skills
Managing learning and study. Critical thinking. Communication. Inter-personal skills. 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.

ANSC 2001 Genetics I **2 Credits**
This course will provide an overview of basic genetics, particularly as it applies to agriculture. The course 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.

ANSC 2002 Genetics I and II **4 Credits**
(i) Genetics I (2 credits)
As for the course 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.

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

ANSC 2200 Electives **6 Credits**

ANSC 3002 Animal Nutrition I **6 Credits**
Digestion and metabolism in farm animals; regulation of metabolism (including metabolic disorders); minerals; vitamins; water as nutrient; energy evaluation of feeds; protein evaluation of feeds; feeds and feeding (including sources, composition, nutritional value, effects of processing and feed additives); voluntary food intake by animals; factorial approach to nutrient requirements of livestock.

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

ANSC 3004 Animal Breeding/Genetics **8 Credits**
Animal Breeding (as for 'Animal Breeding' 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 course deals with the application of these principles to the genetic improvement of farm livestock, viz., dairy cattle, beef cattle, sheep, pigs and horses in the Irish context.

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.

ANSC 3005 Animal Physiology **8 Credits**
Physiological and endocrinological systems in the farm animal; endocrinology and physiology of reproduction, lactation and growth in farm mammals; environmental physiology; mammalian phermones; artificial insemination and modern developments in reproductive technology including embryo transfer, micromanipulation of embryos, in vitro maturation and fertilization of oocytes, in vitro culture of embryos, cloning, sexing and recombinant DNA technology as applied to farm animals. Controlled reproduction in farm animals. Reproductive behaviour. Controlled reproduction in alternative animal farming systems. Physiology of the newborn; growth and development of the animal body.

ANSC 3006 Anatomical Structure and Function **4 Credits**
Systematic anatomy of cattle, sheep and pigs with particular emphasis on the skeletal, muscular, digestive and urinogenetical systems; histology of the four primary tissues; microscopic anatomy of organs.

ANSC 3007 Experimental Design and Data Analysis **6 Credits**
Experimental Design
This section of the course deals with the design and interpretation of animal experiments.

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

estimation of components of variance and covariance; definition of 'fixed' vs. 'random' effects in the model and consideration of their influence on tests of hypotheses.

ANSC 3008 Animal Production Enterprises 4 Credits
This course 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.

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

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

ANSC 3011 Animal Husbandry III 8 Credits
Courses in Animal Husbandry are designed to acquaint students with the basic concepts of Animal Husbandry, and the incorporation of these concepts into systems of production and the effective management of these systems at farm level. The courses in Animal Husbandry are allocated between third year and fourth year.

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

Principles of selection. Factors influencing genetic response to selection viz., accuracy of selection, intensity of selection, genetic variability and generation length. The value of

individual testing, pedigree information, sib information and progeny testing. Principles of constructing selection indexes.

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

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

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

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

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

ANSC 3300 Electives 6 Credits

ANSC 3601 Crop Husbandry and Animal Husbandry 6 Credits
Climate and soils. Principles of tillage and grass production. Conservation and utilisation of farm foods. Principles of feeding, breeding and management of farm animals. Animals in disease. Animal behaviour; shelter needs of the animal. Interdependence of livestock and crops.

ANSC 4001 Animal Husbandry IV 16 Credits
Animal Health
Parasitology of common farm animals. Different stages of production of farm animals in intensive and non-intensive systems of farming; legislation covering disease control, including EU regulations.

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

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

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

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

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

ANSC 4002 Animal Husbandry V **4 Credits**
Animal Behaviour/Health/Welfare
This course complements the Animal Health Section of the course ANSC 4001 'Animal Husbandry IV'. The course deals with principles of disease control and prevention; control of diseases in Ireland; animal health problems associated with intensive animal production; legislation covering disease control including EU regulations. Behaviour of the newborn, acquired or innate behaviour, social, sexual, aggressive, ingestive and other forms of behaviour. Factors affecting behaviour and the role of behaviour in animal production. Definition of animal welfare. Areas of concern. Transport of animals. Role of behaviour/abnormal behaviour in assessing welfare.

ANSC 4003 Animal Breeding II **6 Credits**
This course covers the application of the following topics to farm livestock. Prediction of genetic progress in single trait selection with overlapping generations using Hill's transition matrix. Estimating breeding values using BLUP. Defining the breeding objectives. Economic

weights. Selecting for several traits using selection indexes. Investment appraisal of breeding programmes. Criteria for optimising breeding programmes. Discounted geneflow techniques.

ANSC 4400 Electives **10 Credits**
Elective choice is subject to approval by the Head of the Department of Animal Science and Production.

ANSC 4401 Electives **14 Credits**

BIOL 1002 Biology **10 Credits**
A formation course in the basic concepts of biological function and variation. Teaching involves four 1 hour lectures and one 2 1/2-hour practical per week for sixteen weeks based on the following topics:

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

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

Microbiology to include basic virology, bacteriology and mycology.

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

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

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

CHEM 1002 Chemistry **12 Credits**
General and Introductory:
Electronic structure and bonding. Molecular orbitals, polarity and hydrogen bonding. Intermolecular interactions. Chemical formulae and equations; oxidation-reduction.

Physical and Inorganic Chemistry:
Chemical kinetics and equilibria, catalysis. Acids and bases, buffer systems, indicators, hydrolysis, pH and pK_a. Electrochemistry, electrode potential, free energy, Nernst equation.

Enthalpies of formation, bond energies, equilibria (with special reference to biological systems). Periodic properties of elements; transition metals and co-ordination complexes, bioinorganic chemistry. Colloid and surface chemistry, membranes.

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

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

CPSC 1002 Introduction to Animal and Crop Production 12 Credits
Study Skills
Managing learning and study. Critical thinking. Communication. Inter-personal skills. 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.

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

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

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

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

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

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

Chi-Square – definition, application in testing goodness-of-fit, contingency tests. 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.

CPSC 2003 Crop Husbandry II **6 Credits**

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

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

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.

CPSC 2200 Electives **6 Credits**

CPSC 3201 Professional Work Experience **30 Credits**

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

CPSC 3300 Electives **6 Credits**

CPSC 4001 Crop Husbandry III **14 Credits**

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

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

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

Farm Mechanisation: The application of mechanical, electrical and hydraulic equipment in agricultural production: tractors; tillage techniques and systems; seeding and planting; artificial fertilizer application; spraying techniques; crop harvesting and storage; farmyard manure and liquid manure handling; grass conservation systems.

Cereal Production: Factors determining optimum yield and quality in cereals; production factors – from soil preparation to crop harvest; holding systems, drying, storage; alternative uses for cereals; factors determining optimum net return from cereal systems; use of cereals, e.g. maize, rye as forage crops.

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

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

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

CPSC 4003 Crop Breeding **4 Credits**

(i) Crop Breeding (2 credits)

As for the Crop Breeding section of CPSC 4001 'Crop Husbandry III'.

(ii) Genetic Engineering (2 credits)

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

CPSC 4100 Electives **14 Credits**

CPSC 4400 Electives **30 Credits**

ECON 4101 National Economics **4 Credits**

The Supply side and the Demand side of the economy.

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

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

ENGT 1001 Introduction to Engineering Technology 12 Credits

Study Skills

Managing learning and study. Critical thinking. Communication. Inter-personal skills. 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 mechanization systems. Students will write two short essays on any two topics presented during the course.

ENGT 2003 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.

ENGT 2007 Surveying 2 Credits

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

ENGT 2009 Literature Research Project 2 Credits

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

ENGT 2010 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.

ENGT 2011 Principles of Engineering I and II 4 Credits

(i) Principles of Engineering I (2 credits)

As for ENGT 2010 'Principles of Engineering I'.

(ii) Principles of Engineering II (2 credits)

As for ENGT 2003 'Principles of Engineering II'.

ENGT 2012 Engineering and Surveying 4 Credits

(i) Principles of Engineering III (2 credits)

As for 'Principles of Engineering III' Section of ENGT 2013.

(ii) Surveying (2 credits)

As for ENGT 2007.

Rheological and thermal properties of foods. Measurements of colour of foods. Mass transfer in foods. Experimental analysis of food composition and properties.

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

ENGT 3002 Power and Machinery I **8 Credits**
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.

ENGT 3003 Structural and Soil Engineering **8 Credits**
Soil classification. Phase relations. Failure theory. Retaining walls. Slope stability. Foundation pressures. Consolidation and compaction. Structural analysis. Estimation of loading on structures including wind load. Steel, reinforced concrete and wood as structural materials. Design for bending, shear, deflection, compression and buckling in basic structural elements including beams, slabs, walls, columns, trusses and simple frames.

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

ENGT 3008 Computer Information Systems and Programming **8 Credits**
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. Introduction to computer programming with Visual Basic including syntax, logic, loops, functions, subroutines, visual component, debugging, macro programming.

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

ENGT 3300 Electives **4 Credits**

ENGT 3301 Electives **8 Credits**

ENGT 3302 Electives **6 Credits**

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

ENGT 4002 Food Manufacturing Systems **8 Credits**
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.

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

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

ENGT 4007 Power and Machinery II **8 Credits**
Students may take any *two* of the following modules:

Mechanisation (4 credits)
Agricultural machinery, system selection and operation: including tractors, tillage, seeding and planting; artificial fertiliser application: spraying techniques; crop harvesting.

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

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

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

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

ENGT 4100 Electives **6 Credits**

ERM 1004 Introduction to Agricultural and Environmental Science **12 Credits**
Study Skills
Managing learning and study. Critical thinking. Communication. Inter-personal skills. 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. Course project: Students will be required to present a project report on one aspect of the interrelationship between farming and the environment.

ERM 3004 Landscape Ecology 4 Credits
This course provides an understanding of landscape ecological patterns, with emphasis on the processes of colonisation and succession, and the relationships and interface between habitats.

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

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

ERM 3005 Landscape Interpretation 4 Credits
The course will cover the following topic areas: Review of physical geology; geological and geomorphical evolution of the Irish landscape; relationships between geology, soils and flora; the evolution of the Irish flora; nature and development of the cultural landscape palimpsest; the role of water in landscape horticulture; special landscape assessment – landscape affinity, historic, 'cultural', 'outstanding', natural and semi-natural landscapes. The course will comprise lectures, field visits and practical exercises.

ERM 3006 Earth Science 8 Credits
Introduction: Soil as a medium for plant growth; soil composition and constitution; the soil profile as the unit of study; important Irish soil types.

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

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

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.

ERM 4003 Environmental Impact Assessment 4 Credits

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

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

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

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

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

Concepts of environmental audit.

Case-study based tutorials, seminars and EIA simulation.

ERM 4004 Environmental Issues in Agriculture 4 Credits

In this course, 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); fertilizer 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).

ERM 4005 Environmental Management 8 Credits

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).

ERM 4006 Soil and Water Management 8 Credits
This course 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; characterization 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. Fertilizer use in Ireland; fate of fertilizers in soil-plant continuum; sample calculations relating to soil testing and fertilizer applications. Chemical and biological characterization 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.

EXPH 1002 Experimental Physics 10 Credits
Lectures:
Kinematics and dynamics. Gravitation. Statics and hydrostatics. The earth's climate. Surface tension, viscosity and applications.

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

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

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

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

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

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

FDSC 1010 Introduction to Food Science 12 Credits

Study Skills

Managing learning and study. Critical thinking. Communication. Inter-personal skills. 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.

FDSC 2004 Food Science I: Food Physics 4 Credits

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

FDSC 2005 Food Science II: Basic Analysis 8 Credits

An introduction to the general principles of chemical analysis applied to foods. Topics covered include acids and bases, titrimetry, indicators, standard solutions, pH measurement, buffers and their preparation, strength and buffering capacity, halide titrations, oxidation-

reduction reactions, redox indicators, potentiometry, complexiometric titration, electrochemical analytical methods, proximate analysis, visible-UV spectrophotometry.

FDSC 2006 Agricultural Chemistry IV **4 Credits**
As for sections of FDSC 2008 'Agricultural Chemistry II'.

FDSC 2007 Agricultural Chemistry I **4 Credits**
Chemistry of Biological Compounds: Occurrence, chemical structures, properties and reactions of the important animal and plant mono– and oligosaccharides. Chemistry of starch, dextrins, glycogen and of plant cell wall structural components including cellulose, hemicellulose, pectic substances and lignin.

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

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

Structures, properties and functions of nucleotides and nucleic acids.

FDSC 2008 Agricultural Chemistry II **6 Credits**
Cell structures, cell membranes, mitochondrial membranes. Intracellular compartmentation of enzyme systems. Bioenergetics, redox potentials, electron carrier systems. Oxidative and photosynthetic phosphorylation. Enzymes, vitamins and co-enzymes.

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

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

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

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

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

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

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

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

FDSC 3001 Food Analysis **10 Credits**

Principles and application of modern laboratory techniques used in the analysis of agricultural and food products.

FDSC 3003 Food Chemistry **8 Credits**

Food Carbohydrates

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

Food Lipids

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

Food Proteins

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

Other Topics

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

FDSC 3005 Nutrition I **4 Credits**

Structure and function of the human gut. Nutrient digestion and absorption. Metabolism of protein, fat and carbohydrate. Protein requirements, 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.

FDSC 3006 Biochemistry I and II **8 Credits**

(i) Biochemistry I (4 credits)

The chemical properties, distribution and importance of primary and secondary plant products. Detailed metabolism involved in the biosynthesis and degradation of these compounds. Changes in chemical composition activity during development.

(ii) Biochemistry II (4 credits)

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

FDSC 3007 Product Development **4 Credits**
This course 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.

FDSC 3201 Professional Work Experience **6 Credits**
This will be acquired between the end of the Trinity term of the third year and the start of the Michaelmas term of the fourth year.

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

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

FDSC 4007 Nutrition II **4 Credits**
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.

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

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

products. Myofibrillar protein functionality. Effect of salt and phosphates on functionality. Low fat meat products. Least Cost Formulation. Sausage casings. Meat by-products. Fat rendering systems.

FDSC 4010 Fresh and Processed Meat Products II 6 Credits

Definition of meat. Muscle tissue structure. The muscle cell. Composition of muscle. Banding patterns. Myofibrillar proteins. Thick and thin filament formation. Regulatory and cytoskeletal proteins. Sarcoplasmic and stromal proteins. Connective tissue. Collagen structure. Age-related toughening of meat. Formation of gelatin. Cell sarcotubular system. Muscle contraction. Conversion of muscle to meat. Postmortem glycolysis. Normal, PSE and DFD conditions. Cold shortening. Thaw rigor. Electrical stimulation. Meat quality. Myoglobin and meat colour. Factors affecting meat colour, including oxidation-reduction reactions, oxygen partial pressure 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.

FDSC 4011 Dairy Products 6 Credits

A. Milk

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

B. Dairy Products

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

FDSC 4012 Cereal Chemistry and Brewing Science 4 Credits

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

FDSC 4013 Sensory Analysis **4 Credits**

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

FDSC 4051 Project **10 Credits**

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

FOR 1001 Introduction to Forestry **12 Credits**

Study Skills

Managing learning and study. Critical thinking. Communication. Inter-personal skills. 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

Dendrology. Wayside and woodland trees in spring, summer, autumn, winter. Characteristics of leaf, twig, bud, bark and stem. Varieties, cultivars, hybrids and provenances. Keys to the common broadleaved and coniferous trees.

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

Mensuration

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

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

Biometrics

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

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

Forest mensuration and biometrics applications of Microsoft Word and Excel.

Software: Microsoft Word and Excel. Windows 98.

FOR 2004 Fundamentals of Forestry **8 Credits**

Natural forests. Plantations. The structure and growth of trees. Stand development. The forest environment. Ecological conditions of forest development. Evolution, conservation and management of 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.

FOR 2005 Silviculture I **6 Credits**

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

FOR 3002 Forest Harvesting **4 Credits**

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

FOR 3005 Computer Applications **4 Credits**

Spreadsheets, databases, word processing, graphics.

FOR 3006 Forest Management **4 Credits**

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

FOR 3008 Silviculture II **8 Credits**

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

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

FOR 3009 Wood Science **4 Credits**

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

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

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

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

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

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

Inventory

Concept of yield class, marginal thinning age, age of maximum mean annual increment and biological maturity. Use of yield models for forest management. Thinning types, marginal thinning intensity and normal thinning period and yield. Thinning control.

Volume estimation for inventory purposes using fixed area plots, yield models, stand volume alignment charts, crop form height, point samples and abbreviated tariffing.

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.

FOR 3100 Electives **6 Credits**

FOR 3201 Professional Work Experience **12 Credits**

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

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

FOR 3202 Professional Work Experience **8 Credits**

FOR 4003 Forest Management Plan **12 Credits**

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 relation 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.

FOR 4004 Forest Planning **6 Credits**

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

FOR 4005 Experimental Design **4 Credits**

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 randomized, the randomized 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 course. 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.

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

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

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

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

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

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

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

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

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

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

FOR 4051 Research Project **16 Credits**

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

Regulations for Research Project:

1 The student will submit his/her proposal to the Professor of Forestry.

2 A Project Committee appointed by Faculty and consisting of the Professor of Forestry (who will be Convenor) and Heads of other Departments will consider the submissions.

3 Where the approved topic is taken in a department other than the Department of Crop Science, Horticulture and Forestry, the Project Committee will arrange the necessary facilities and for the joint supervision and examination of the project.

4 The student will write a dissertation on the approved topic.

5 The project will normally consist of:
   (a) A literature review.
   (b) A laboratory or field study.
   (c) Supporting course work if available and appropriate.
   (d) Written report or dissertation.

6 The dissertation must be lodged with the Professor of Forestry.

7 The examination will be conducted by the Professor of Forestry and the Forestry Extern.

FOR 4100 Electives **12 Credits**

GEOL 2601 Geology **3 Credits**

Geological principles and processes of relevance to agriculture, land use and landscape development are considered.

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

HORT 1001 Introduction to Horticultural Science 12 Credits

Study Skills

Managing learning and study. Critical thinking. Communication. Inter-personal skills. 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.

HORT 1002 Introduction to Landscape Horticulture 12 Credits

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.

HORT 2006 Fundamentals of Horticulture 10 Credits

Introduction to the Principles and Concepts of Horticultural Science

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

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

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

HORT 2007 Landscape Design Studio I **8 Credits**
Graphics
An introduction to graphic presentation, demonstration of graphic media, lettering techniques, graphic conventions and landscape architectural symbols.

Computer Aided Design
The use of computers including an introduction to AutoCAD and LandCAD.

Design Studio
An introduction to the design studio, basic design projects including a clay modelling exercise.

HORT 2008 Landscape Design Theory I **8 Credits**
History of Designed Landscapes
This course examines how, from earliest times, parks and gardens have been influenced by the environment, both natural and cultural in which they were created. This study includes the history of art and history of architecture and their relationship with landscape design. Topics include: ancient civilisations, Islamic gardens, medieval gardens, Renaissance and Mannerist gardens, Baroque and Rococo gardens, English landscape parks. The picturesque and gardenesque. The Parks Movement in Europe and the United States. Parks and gardens of the Orient. Ireland's Garden Heritage. Twentieth century designed landscapes. Restoration of period landscapes.

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.

HORT 3001 Landscape and Turfgrass Management I **4 Credits**
Landscape Management:
Management plans, maintenance schedules, cost estimation, computers and management. Case studies.

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

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

HORT 3004 Plant Materials **6 Credits**
Planting design, plant identification, cultivation and maintenance of a range of park and garden features to include shrubberies, ground cover schemes, climbers, rose, herbaceous borders, spring and summer bedding.

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

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

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

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

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

Landscape and Turfgrass Management I
As for HORT 3001.

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

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

Landscape Design Theory II (4 credits)
The landscape design process from project inception through to completion. Perception of landscape. Landscape processes. Landscape design principles for specific situations and specialised areas of design. A study of the materials of the designed landscape, considering the selection, specification and detailing of elements of the hard landscape.

Professional Practice and Planning Law I (2 credits)
The concept of professionalism and the landscape consultant. An introduction to professional organisations relevant to the landscape consultant (ILI, LI, IOH). Office organisation and administration. An introduction to contracts. Project costing. The preparation of specifications and bills of quantity. Contract administration and site supervision.

HORT 3012 Landscape Design Studio II **12 Credits**
Students undertake a range of design projects under the guidance of staff in Landscape Horticulture. These include studio projects of various lengths which aim to encourage and develop the ability to translate design theory and principles into practical landscape design exercises.

HORT 3013 Landscape Construction **6 Credits**

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

Materials
Geotextiles; concrete; asphalt; masonry; wood; metals.

Structures
Walls – retaining and free standing; paving – flexible and rigid; timber structures; pedestrian bridge; water bodies; pools and fountains.

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

HORT 3202 Professional Work Experience 12 Credits
This will be acquired between the start of the Trinity Term of the third year and the start of the Michaelmas term of the fourth year. Students are required to obtain two placements, preferably one in landscape management and one in landscape design. Students must submit a work diary, journal and a series of sketches

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

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

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

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

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

HORT 4005 Pomology II **4 Credits**

Post-harvest Physiology

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

HORT 4006 Protected Horticulture II **4 Credits**

Mushroom Production/Technology

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

HORT 4007 Vegetable Crops II **2 Credits**

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

HORT 4009 Landscape Planning **4 Credits**

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

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

(i) Landscape Design Theory III (4 credits)

Examination of the contemporary issues in landscape design involving a study of a range of specific landscapes including housing, industrial and business parks, roads, landscapes associated with leisure activities, utilities and waterways.

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

General principles of law, professional responsibilities and liability, law of contract, warranties, bankruptcy, disputes, claims, nominated subcontractors, landscape contracts, bonds, arbitration, private land law, public land law, development plans and development control, special rights over land, basic principles of tort.

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

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

HORT 4050 Research Project **10 Credits**

HORT 4101 Electives **8 Credits**

HORT 4400 Electives **18 Credits**

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

INDM 3009 Food Microbiology II **6 Credits**
Incidence and types of micro-organisms in foods; the principles underlying spoilage; pathogens transmitted through food; methods of food preservation; role of micro-organisms in the production of food and food supplements; biotechnology; quality assurance microbiological standards; factory hygiene and waste disposal.

INDM 3010 Food Microbiology I **4 Credits**
This course includes most elements of INDM 3009.

LANG 2007 European Language **4 Credits**

MATH 1800 Mathematics **10 Credits**
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.

SLSC 2002 Soil Science I **6 Credits**

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

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

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

SLSC 2003 Soil Science **5 Credits**

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

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

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

SLSC 3001 Soil Science II **6 Credits**

Soil Genesis, Classification and Land Use

Soil as a three-dimensional natural body; soil description in the field; horizon identification and designation; soil profile composition; internal soil forming processes; the soil environment – discussion of five main factors of soil formation; soil classification and distribution of major Irish soils; soil maps and reports; land suitability classification for agricultural and non-agricultural uses.

Soil Biology and Biochemistry

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

Soil Fertility and Soil-Plant Relations

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

SLSC 3002 Soil Science III **6 Credits**

Soil Genesis, Classification and Land Use

Soil description in the field; horizon identification and designation; soil profile composition; internal soil forming processes; external factors of soils' environment; soil classification and distribution of major Irish soils; soil suitability classification and interpretation for agricultural and non-agricultural uses.

Soil Fertility and Soil-Plant Relationships

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

Soil and Land Drainage

Causes and effects of impeded drainage; principles of drainage improvement systems.

SLSC 3003 Soil Science IV **4 Credits**

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

Syllabus of Elective Courses for the BAgrSc Degree

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

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

(a) Prerequisite requirement for certain electives;

(b) Timetabling constraints;

(c) Minimum or maximum limits on the number of students taking a particular elective course. Students will not be permitted to take a course of similar content to a core course or an elective course which they have previously taken.

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

AERD 3001 Business Law **2 Credits**
As for the core course:
Legal persons: sole trader, partnership, companies and co-operatives. Laws applicable; common law and legislation including EU legislation. Law of contract; definition of a contract in terms of offer, acceptance and consideration. Law of tort; duty of care and negligence. EU law; mechanisms and instruments by which EU law becomes a source of Irish law. Legal issues in retention of title and in insurances.

AERD 3003 Co-operatives **2 Credits**
As for the core course:
Description and evaluation of structural, conduct and performance characteristics of alternative forms of agribusiness firms; historical development of agricultural co-operation in Ireland and world-wide; size and growth trends of agricultural co-operatives in terms of value added, membership, sectoral penetration, resources and profitability; legal aspects and rules; roles and responsibilities of shareholders, management and board members; co-operatives in non-traditional agricultural activities, in non-agricultural industries and in developing countries.

AERD 3006 Financial Planning and Control **4 Credits**
As for the core course:
Methods of investment and project analysis, cost classification, cost/volume/profit relationships, cost and revenue control systems, financial planning and budgetary control.

AERD 3007 Operations and Personnel Management **4 Credits**
As for the core course:
Production/operations, management and human resource development; introduction to production management and materials handling functions in food processing and other agribusiness firms; principles and techniques of human resource management; industrial relations structures and the collective bargaining process.

AERD 3008 Quantitative Methods **4 Credits**
As for the core course:
A study of the quantitative methods commonly employed in the analysis of economic and business problems, including multiple regression, covariance analysis, time series analysis, linear programming and simulation; applications of the various methods using computer programmes.

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

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

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

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

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

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

AERD 4150 Elective Project I **2 Credits**

AERD 4151 Elective Project II **4 Credits**

AESC 4004 Wildlife Management **4 Credits**
As for the core course:
Wildlife management is the application of management techniques for the conservation and use of our wildlife resource. The course will examine: resident and migrant species; population census and analysis; habitat evaluation, monitoring and analysis; management for conservation and hunting; impact of man on wildlife with emphasis on the conservation/damage interface; the role and importance of wildlife law.

Course projects will include an essay and a management plan.

AESC 4005 Epidemiology and Zoonoses **4 Credits**
As for the core course:
This course deals with the epidemiology and control of human and livestock diseases that involve a significant free-living, vector-borne or zoonotic stage and for which environmental considerations are especially important. The emphasis will be on diseases encountered in Ireland, but where necessary for illustration of principles, tropical diseases such as malaria will also be dealt with. The course will consist of the following components: ecology of major parasitic infections of livestock, ecology of parasitic zoonoses, ecology of major non-parasitic zoonoses, immunobiology, principles of epidemiology, epidemiological tools including diagnostics and mathematical models, control measures including general principles, chemotherapy, vaccination and environmental management.

AESC 4006 Pest Management **4 Credits**
As for the core course:
This course examines the pest management concept as an alternative to more traditional approaches to pest control. Basic principles and tactics are examined, including establishment and implementation of economic injury thresholds and the integration of biological, cultural and chemical approaches. Case studies based on programmes which have been put into operation will be considered.

AESC 4007 Plant Disease Management **4 Credits**

As for core course:

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.

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

As for the core course:

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

AESC 4101 Apiculture **2 Credits**

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

AESC 4103 Forest Pathology **2 Credits**

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

AESC 4104 Livestock Health Products **2 Credits**

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

AESC 4110 Reclamation of Marginal and Damaged Land 4 Credits
General concepts of 'reclamation', 'marginality', 'damage', 'dereliction'; the nature and scale of the problem. Irish incentives and controls regarding habitats, reclaimed, derelict and contaminated land.

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

AGRD 4101 GIS for Agricultural and Environmental Sciences 4 Credits
Fundamental concepts of remote sensing and Geographic Information Systems (GIS). Digital interpretation of OS raster maps and orthophotos. Development of hands-on GIS computer skills of point, line and polygon theme and attribute table creation within ArcView 3.1. GIS skills of joining dbf databases to theme attribute tables. Building GIS queries. Integration of vector, raster and attribute GIS databases. Specification of GIS database structure. Digital area and perimeter estimation.

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

Software: ArcView 3.1. Microsoft Excel. Windows 98.

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

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

ANSC 4102 Advanced Dairy Production **4 Credits**
This course develops selected topics from the Dairy Husbandry section of 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 course includes a project usually based on a case study of a dairy farm.

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

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

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

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

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

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

ANSC 4113 Elective Project I **2 Credits**

ANSC 4114 Elective Project II **4 Credits**

ANSC 4115 Applied Biotechnology **4 Credits**
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.

ANSC 4116 Poultry Production **2 Credits**
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.

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

CPSC 4102 Developments in Grassland **2 Credits**
Detailed examination of certain topics outlined in the 'Grassland' section of CPSC 4001 Crop Husbandry III.

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

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

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

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

CPSC 4150 Elective Project I 2 Credits

CPSC 4151 Elective Project II 4 Credits

CPSC 4152 Elective Project III 6 Credits

CPSC 4153 Elective Project IV 8 Credits

ENGT 4107 Buildings for Animal Production and Crop Storage 4 Credits
Farmyard design and layout. Animal production buildings including environmental control systems. Milking parlours. Management of animal manures. Crop storage buildings. Structural elements in agricultural buildings. Services. Environmental and planning legislation and protection pertaining to agriculture.

Note: This course has a basic input with regard to 'Crop Storage Buildings' at present.

ENGT 4108 Forest Engineering 4 Credits
As for 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.

ENGT 4109 Food Quality and Safety Assurance 4 Credits
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.

ENGT 4150 Elective Project I 2 Credits

ENGT 4151 Elective Project II 4 Credits

ERM 4004 Environmental Issues in Agriculture 4 Credits
As for the core course:
In this course, 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); fertilizer 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).

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

ERM 4103 Peatland Forestry **2 Credits**
Peatland forests are an important component of our plantation forest resource. The course describes the major peatland types, including cutaway peatlands and the techniques used for their afforestation. All aspects of forestry practice, as they relate to peatlands, will be discussed. The environmental aspects of peatland forestry will also be considered including both the impact of harvesting operations and the contribution of peatland forestry to the global carbon cycle. This course includes one full-day field trip.

ERM 4104 Peatland Management **4 Credits**
Origin of peat soils, development and distribution of peatlands, classification; stratigraphy, pollen analysis, subpeatian archaeology.

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

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

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

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

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

ERM 4106 Forestry and the Environment **2 Credits**
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 course 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 course includes a half-day field trip.

FDSC 2007 Agricultural Chemistry I **4 Credits**

As for the core course:

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

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

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

Structures, properties and functions of nucleotides and nucleic acids.

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

As for the core course.

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.

FOR 4005 Experimental Design **4 Credits**

As for the Core Course:

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 randomized, the randomized 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 course. 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.

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

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

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

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

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

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

FOR 4112 Multiple Use Management **2 Credits**
Forest recreation and conservation valuation, contingency valuation, travel cost method, stated preference method, multiple objectives, goal programming, non-timber incentives, biodiversity.

FOR 4115 Physiological Ecology of Forest Production 2 Credits
Environment and plant growth and development. Carbon utilisation and dry matter production. Forest ecophysiology – succession, competition etc. Case studies in seed biology. Tree improvement; nurseries.

FOR 4118 Silvicultural Systems 2 Credits
High forest systems, selection systems and coppice systems. Clear cutting systems. The uniform system, group systems, wedge systems and irregular shelterwood systems. The selection system of silviculture. Two storied high forest. The coppice system and coppice with standards.

FOR 4119 Special Forestry Crops 2 Credits
Christmas tree production; biomass production; growing hurley ash; the silviculture of mixtures; veneer oak.

FOR 4120 Stress Grading of Timber 2 Credits
The grading of sawn softwood timber for the construction industry has become the norm in Ireland. This course will provide basic information on the current methods used to grade timber. It will broadly reflect the Forbairt course which industrial growers are obliged to follow before being allowed to grade timber for the Irish market.

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

FOR 4121 The Biology, Silviculture and Management of Sitka Spruce 2 Credits
Taxonomy; natural distribution. Provenance studies; physiology. Nutrition. Ecology. Silviculture. Pathology. Vegetative propagation. Wood properties.

FOR 4122 Wood Utilisation 2 Credits
This course will deal with wood structure and properties. The impact of wood structure and properties in utilisation will also be explored. The microstructure of the major tree species planted in Ireland will be examined and related to the utilisation of these species.

FOR 4123 Advanced Nursery Practice I 2 Credits
The course will focus on bare root nurseries.

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

FOR 4124 Advanced Nursery Practice II **2 Credits**
This course will focus on seed biology and container nursery culture.

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

FOR 4125 Agro-Forestry **2 Credits**
Classification and concepts, silvoarable, silvopastoral, windbreaks, tropical agro-forestry, economics of agro-forestry systems.

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

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

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

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

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

FOR 4131 Modelling in Forestry **4 Credits**
Fundamental equation of regression analysis. Assumptions of regression analysis. Basic descriptives and plotting. Simple linear regression. Simple linear model in volume and volume assortment estimation. Multiple regression in matrix notation. Significance tests.

Extra sum of squares principle. Partial F tests. Model building strategies. Applications of multiple regression models to forest parameters.

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

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

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

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

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

HORT 4104 Exotic Trees and Shrubs **2 Credits**
This is an advanced course and expands on the range of plants suitable for use in the landscape industry, particularly in private work.

Genera to be considered include Magnolia, Erica, Camellia, Rhododendron, Pinus, Acer, Sorbus and lesser known species. The history of plant introduction.

Field trips and project are also included.

This course is taught in alternate years.

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

Practical sessions will involve demonstrations and industry visits.

HORT 4106 Interior Plantscaping **2 Credits**
This course deals with all aspects of interior plantscaping including the organisation of interior spaces; design criteria of planting and interior decor; construction requirements for

planting; preparation of specifications and job costing; environmental factors affecting climatisation and growth; care and maintenance of planting; plant selection and identification.

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

HORT 4108 Leisure and Recreation Facilities **2 Credits**
Definition of leisure and recreation; leisure and the individual, leisure and society; planning and management of recreational resources for outdoor activities, sports centre management; interpretation of designed landscapes.

This course is taught in alternate years.

HORT 4110 Photographic Image Editing **2 Credits**
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 course also instructs the student how to operate the many and varied art tools for retouching a digital photo image. This is an excellent computer application for producing many different variations of the original image.

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

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

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

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

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

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

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

HORT 4117 Garden Centre Management* **4 Credits**
The course details the practices and methods used in retailing and marketing of green, dry and speciality goods. Topics covered include – garden centre design and its impact on customer flow; garden centre layout; product age and merchandising. The display of plants in the plantaria, A to Z; plant function/themes; pricing, pricing strategy, price position; plant labelling, computer labelling, label ledge systems; signage, Kendrew signs, information points, demonstration gardens, computerised point of sale equipment, bar codes, selling strategy and selling aids; the role of advertising and training. Garden centre security and security systems. The course will be supplemented by visits to selected production tree and shrub nurseries and garden centres.

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

HORT 4118 Social Horticulture **4 Credits**
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.

LANG 4101 Beginners French **4 Credits**

LANG 4102 Advanced French **4 Credits**

LANG 4103 Beginners German **4 Credits**

LANG 4104 Advanced German **4 Credits**

LANG 4105 Spanish **4 Credits**

Dates of Academic Session 2003/04

First Semester/Michaelmas Term First Year Agricultural Science		
First Year Registration and Orientation	10 September	
Michaelmas Lecture Term	15 September – 06 December	12 weeks
Revision	08 December – 14 December	1 week
Examinations (if required)	15 December – 22 December	7 working days

First Semester/Michaelmas Term Second, Third and Fourth Year Agricultural Science		
Michaelmas Lecture Term	15 September – 05 December	12 weeks
Revision	06 December – 10 December	5 days
Examinations	11 December – 20 December	9 working days

Second Semester/Hilary and Trinity Terms First, Second and Fourth Year Agricultural Science		
Hilary Lecture Term	05 January – 28 February	8 weeks
Break/Fieldwork	01 March – 20 March	3 weeks
Trinity Lecture Term	22 March – 17 April	4 weeks
Revision	19 April – 25 April	1 week
Examinations commence	26 April	

Second Semester/Hilary and Trinity Terms Third Year Agricultural Science		
Hilary Lecture Term	05 January – 27 February	8 weeks
Revision	28 February – 07 March	1 week
Examinations	08 March – 20 March	11 working days
Professional Work Experience • ACP Programme: • Other Programmes:	 05 January – 31 August 22 March – 31 August	

Easter Sunday: 11 April 2004
Autumn Examinations Commence: 10 August 2003