

Faculty of Agricultural and Food Sciences

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SECTION 1: Programs Offered

Degree/Diploma Programs Offered

Degree/Diploma	Years to Completion	Total Credit Hours
Bachelor of Science in Agribusiness	4*	120
Bachelor of Science in Agriculture (Agronomy, Animal Systems or Plant Biotechnology Major)	4*	120
Bachelor of Science in Agroecology	4*	120
Bachelor of Science in Food Science (Science or Business Option)	4*	120
Pre-veterinary Program	2**	60
Diploma in Agriculture (Business Management, Crop Management, Livestock Management or General Agriculture Option)	2	93

*This includes one year (30 credit hours) of study in University 1.

** Two full years of university training are required for admission to the Western College of Veterinary Medicine (Saskatoon) comprised of 30 hours from University 1 and 30 hours in the Faculty of Agricultural and Food Sciences.

Faculty Overview

The Faculty of Agricultural and Food Sciences has earned a reputation for its high-calibre teaching programs and its friendly helpful staff. Students benefit not only from the expertise of staff in the Faculty, but also from the close proximity of other faculties on campus, federal research facilities, and a vibrant Winnipeg-based agricultural community.

Information on the Faculty's History, Vision and Mission Statements, Research, Programs, Centres, and Departments can be found on our website at: umanitoba.ca/afs.

Degree Programs

The degree programs in the faculty are designed to prepare graduates for service in professions concerned with the production, processing and marketing of food. Professional agriculturists hold positions in extension, resource management and conservation, teaching, research and business. Professional food science graduates hold similar positions related to food manufacturing and processing. Graduates from the faculty have important contributions to make in the economy of Canada and the well-being of its citizens. Other graduates accept international responsibilities, particularly in the developing countries. Programs of study in the faculty include courses in physical and biological sciences, mathematics, social sciences, and humanities. With these courses as background, major studies may be taken in areas represented by programs in the faculty. The faculty also offers a two year pre-veterinary program for students who plan to take the degree Doctor of Veterinary Medicine.

Diploma Program

The two-year Agriculture Diploma program offers a practical education for persons interested in operating a farm or working in an agricultural business. Although many diploma graduates return to family farms after graduating, an increasing number of graduates can be found working for farm supply companies, feed companies, financial institutions and grain handling companies, as well as doing technical work for various government agencies.

The Agriculture Diploma program covers a wide range of agricultural subjects, from production through to marketing and business management. Communication and leadership skills also receive considerable emphasis. The program culminates in assignments and a major project that relate directly to the student's individual farm or business interests. The program ex-

tends over two winters. Classes begin in late September and end in early April to accommodate students with obligations to plant and harvest crops.

1.2 Available Programs, Options and Minors

1.2.1 Bachelor of Science in Agriculture (Degree)

Available Programs: Agronomy
Animal Systems
Plant Biotechnology

1.2.2 Bachelor of Science in Agribusiness (Degree)

Available Options: Agricultural Economics
Agribusiness Management
International Agribusiness

1.2.3 Bachelor of Science in Agroecology (Degree)

1.2.4 Bachelor of Science in Food Science (Degree)

Available Options: Science Option
Business Option (New)

1.2.5 Pre-Veterinary Program (Degree)

1.2.6 Diploma in Agriculture

Available Options: Business Management
Crop Management
Livestock Management
General Agriculture

1.2.7 Cooperative Education Program (Degree and Diploma Options)

1.2.8 Minors (Degree Program Only)

Available Minors: Animal Systems
Entomology
Food Science
Plant Biotechnology
Soil Science

1.3 Professional Designations

Graduates of the B.Sc. (Agriculture), B.Sc. (Agribusiness), B.Sc. (Agroecology) and B.Sc. (Food Science) degrees are eligible to practice agrology as members of the Manitoba Institute of Agrologists. An agrologist is a "person who is qualified to teach or to practice the science and art of agriculture or to conduct scientific experiments and research in relation thereto." The motto of the profession is *Ciba ad Omnes* (Food for All). B.Sc. (Food Science) graduates are eligible to become members of the Canadian Institute of Food Science and Technology (CIFST), a professional society associated with the manufacturing, processing and packaging of food.

SECTION 2: Admission Requirements

The following is a summary of the admission requirements. Equivalent academic courses completed at recognized universities elsewhere will be considered. All admission requirements, as well as application deadline dates and forms, are included in an applicant information bulletin that is available from the Admissions Office, Enrolment Services, 424 University Centre; this information is also posted on the university's website.

2.1 Admission Requirements for the Degree Programs

The requirement for admission to the Faculty of Agricultural and Food Sciences is a minimum cumulative grade point average of 2.00 on a minimum of 24 credit hours.

It is recommended that students take the following courses in University 1 to allow completion of the degrees in the minimum amount of time.

B.Sc. (Agribusiness)

- Economics (6 credit hrs)
ECON 1200
- Mathematics (6 credit hrs)

MATH 1520 or MATH 1500 and MATH 1310 or MATH 1300 or MATH 1200 or MATH 1210 (See Note 1)

- Agriculture (9 credit hrs)
ABIZ 1000
AGRI 1500
AGRI 1510
 - Biology (6 credit hrs)
BIOL 1020 (See Note 2)
BIOL 1030 (See Note 2)
 - Open Electives (3 credit hrs)
- B.Sc. (Agriculture) and B.Sc. (Agroecology)
- Chemistry (6 credit hrs)
CHEM 1300 and CHEM 1310 or CHEM 1320
 - Economics (6 credit hrs)
ECON 1200 or (ECON 1210 and ECON 1220)
 - Mathematics (3 credit hrs)
MATH 1520 or MATH 1500 or MATH 1310 or MATH 1300 or MATH 1200 or MATH 1210
 - Biology (6 credit hrs)
BIOL 1020
BIOL 1030
 - Agriculture (6 credit hrs)
AGRI 1500
AGRI 1510
 - Open Electives (3 credit hours)
- B.Sc. (Food Science)
- Chemistry (6 credit hrs)
CHEM 1300 and CHEM 1310 or CHEM 1320 (See Note 3)
 - Economics (6 credit hrs)
ECON 1200 or (ECON 1210 and ECON 1220)
 - Mathematics (6 credit hrs)
MATH 1520 or MATH 1500 and MATH 1310 or MATH 1300 or MATH 1200 or MATH 1210 (See Note 1)
 - Biology (6 credit hrs)
BIOL 1020
BIOL 1030
 - Agriculture (6 credit hrs)
AGRI 1500
AGRI 1510
 - Open Electives (nil)

Notes:

1) 6 credit hours of Math courses including MATH 1500 Introduction to Calculus or MATH 1520 Introduction to Calculus for Management and Social Sciences are required for the B.Sc. (Agribusiness) and B.Sc. (Food Science) programs.

2) Students planning to enter the B.Sc. (Agribusiness) degree program are recommended to take BIOL 1020 and BIOL 1030 but may substitute BIOL 1000 and BIOL 1010.

3) Both CHEM 1310 and 1320 are required for the B.Sc. (Food Science) Science Option Program.

Other requirements:

High school requirements include Math 40S (Pre-Calculus) (60%) and Biology 40S (50%) for all degree programs, Chemistry 40S (50%) for B.Sc. (Agriculture), B.Sc. (Agroecology) and B.Sc. (Food Science) students; pre-veterinary students should include Physics 40S.

Students are required to take three credit hours of Philosophy in their degree.

The written English and mathematics requirement are met by completing the required courses in Agriculture.

Applicants who do not meet the above-mentioned course requirements may be eligible for admission. Please contact the Academic Advisor (Degree), Faculty of Agricultural and Food Sciences at (204) 474-8269, for further information.

First Year Agriculture: Brandon University

Brandon University offers the first year of the Agriculture degree program of the Faculty of Agricultural and Food Sciences. Under arrangements between the two universities, students who complete the first-year Agriculture program at Brandon University may apply for admission with full credit into the second year programs of the University of Manitoba.

Transfers of Credit

School of Agriculture graduates who have obtained a GPA of 3.0 in the Agriculture Diploma program are eligible for 60 credit hours of transfer into

the following degree programs: Bachelor of Science (Agribusiness), Bachelor of Science (Agroecology), Bachelor of Science (Agriculture) – Agronomy or Animal Systems, when transferring into the same stream. If students choose to change streams it may not be possible to transfer the entire 60 credit hours due to program requirements; students should contact the Student Services Office for details. Grades will be transferred for those courses considered on a one-to-one basis; the remaining credit hours will be transferred without grades. This transfer articulation is applicable to diploma graduates who have entered the degree program as of September 2005.

Students wishing to enter a degree program without the above qualifications will be evaluated on a course-by-course basis. Students should have a cumulative grade point average of 2.50 and a C+ or better in courses for which transfer is being considered.

The Bachelor of Science (Agriculture), Plant Biotechnology, and the Bachelor of Science (Food Science) are not part of this articulation. Students should contact the Student Services Office for details on transfer into these programs.

A Table of the Transfer of Credit courses between Diploma and Degree can be found at umanitoba.ca/afs. Students inquiring about transfer of credits should contact the Student Services Office at 474-9295.

Courses taken outside the Faculty of Agricultural and Food Sciences or outside of the University of Manitoba may also qualify for credit towards the degree if the course content and the student's performance are deemed appropriate by the department concerned.

2.2 Admission Requirements for the Diploma Program

Diploma students enter directly to the Agriculture diploma program from high school; University 1 is not required.

Applicants must be high school graduates with Senior 4 standing in English, Mathematics, and one Science course – normally either Biology, Chemistry or Physics.

Students without a suitable high school standing may be admitted upon the recommendation of the Diploma Selection Committee. The committee will review each application and interview the applicant. The maturity, scholastic ability and agricultural experience of the applicant will be considered. Please contact the Academic Advisor (Diploma), Faculty of Agricultural and Food Sciences at (204) 474-6066, for further information.

Transfer of Credit

Courses taken within the degree program in the Faculty of Agricultural and Food Sciences as well as outside the Faculty of Agricultural and Food Sciences or outside of the University of Manitoba may also qualify for credit towards the diploma if the course content and the student's performance are deemed appropriate by the department concerned.

SECTION 3: Faculty Academic Regulations

3.1 Academic Regulations for Degree Program

The B.Sc. (Agriculture), B.Sc. (Agribusiness), B.Sc. (Agroecology) and B.Sc.(Food Science) degree programs have the triple objectives of vocational, professional and cultural education. To fulfil the objectives, the degrees are offered in a program of study. Most courses in first year, which are taken in University 1 and some in second year, are prescribed. The remainder of second year courses and all courses in third and fourth years are determined by the program of study, and by the student's selection of elective courses.

It is strongly recommended that all students plan their coursework for third and fourth years before the end of their second academic year.

The provisions of the chapter, General Academic Regulations and Requirements, and the chapter, University Policies, apply to all students. In addition, the Faculty of Agricultural and Food Sciences has regulations and requirements, published below, that apply specifically to its students. Supplementary academic regulations are on file in the general office. Admission information can be found in the Admissions chapter of this *Calendar*.

Scholastic Requirements

To obtain a B.Sc. (Agriculture), B.Sc. (Agribusiness), B.Sc. (Agroecology) or B.Sc. (Food Science) degree, a student must pass 120 credit hours normally comprised of 30 hours from University 1 and 90 hours in the Faculty of Agricultural and Food Sciences (i.e., a total of 20 full-courses or the equivalent).

A maximum of 144 credit hours (24 full-courses or the equivalent) may be attempted to obtain the 120 credit hours.

A minimum passing grade of "D" in prescribed courses is required of all students in the faculty.

Elective courses in which passing grades were not obtained need not be repeated.

A student's Grade Point Average (GPA) will be determined from the number of "effective" courses which apply at a particular stage. The effective courses consist of all courses passed in addition to all failures which have not been cleared or substituted for in the student's record.

In order to graduate, students must obtain a minimum GPA of 2.0 calculated over the minimum 120 credit hours before graduation.

Residence Requirements of Degree Program

The residence requirements for the degrees offered by the Faculty of Agricultural and Food Sciences, can be found in the chapter, General Academic Regulations and Policy.

Time Limits and Lapse of Credit

The normal maximum time allowed for the completion of the Agriculture degree programs is ten years from the date of first registration. A candidate for a degree will not be permitted to count toward that degree any courses taken more than ten years prior to the date of awarding the degree.

Probational Standards

Effective Courses to Date		Minimum GPA
1-5	(6-30 credits)	1.80
5 1/2-10	(33-60 credits)	1.85
10 1/2- 15	(63-90 credits)	1.90
15 1/2- 20	(93-120 credits)	1.95
20+	(120+ credits)	2.00

Academic Suspension Regulations

A student is placed on academic suspension when one of the following occurs:

- When a student fails to obtain 12 Weighted Grade Points in the first year program; or
- When a student fails to meet the probational standards after attempting a minimum of 24 credit hours while on probation; or
- When a student accumulates failures in excess of 24 credit hours.

Re-entry Regulations

A student must remain out of faculty for a period of one year and then apply for re-entry.

The student must complete at least 12 credit hours with a minimum Grade Point Average of 2.50 in courses approved by the faculty in the academic term or session in which reinstatement is being attempted.

The student loses credit for all courses in which a grade of "D" was obtained prior to being reinstated.

The student is given credit for courses in which grades of "C" or better were obtained, as well as the courses attempted for reinstatement.

The student is reinstated and placed in the category of "good academic standing."

A student who is placed on academic suspension for the second time, will not be permitted reinstatement in the faculty.

Appeals

Appeals of academic assessment of students must be submitted to the general office of the Faculty of Agricultural and Food Sciences within 21 days of the date of notification of the action sent to the student.

Supplemental Exams

Supplemental Exams are not permitted in the Faculty of Agricultural and Food Science Degree Programs.

Graduation With Distinction: Degree Programs

The B.Sc. (Agriculture), B.Sc. (Agribusiness), B.Sc. (Agroecology), and the B.Sc. (Food Science) degrees with distinction will be awarded to students who have achieved a minimum degree GPA of 3.75 upon graduation.

Dean's Honour Roll

Students who have completed a minimum of 12 credit hours of study in either the Fall or Winter terms and who achieved a Term GPA of 3.50 or higher will be placed on the Dean's Honour Roll.

Course Load Limits

A normal "course load" is 30 credit hours during the regular session, with 15 credit hours normally taken in each academic term. A student may attempt a maximum of 39 credit hours during the regular session, with not more than 21 credit hours in an academic term, provided the student is in a good academic standing and has completed at least 24 credit hours in the previous regular session.

University Written English and Mathematics Requirements

All students are required to complete the university written English and mathematics requirement within the first 60 credit hours of their program. This requirement is described in the chapter, General Academic Regulations and Requirements of this *Calendar*.

For the degree program in Agriculture, the university written English requirement can be met by AGRI 2030 Technical Communications, or by ENGL 1200, or ENGL 1300. (NOTE: Technical Communications cannot be taken in University 1). The mathematics requirement can be met by completing MATH 1300 or MATH 1310 and MATH 1500 or MATH 1520, or STAT 1000.

3.2 Academic Regulations for Diploma Program

Requirements for Graduation

To qualify for the Diploma in Agriculture a student must have attained a cumulative GPA of at least 2.00 with a minimum grade of "D" in courses totalling 93 credit hours including all those on the prescribed list. Elective courses in which failures were obtained may be substituted for and need not be repeated, except to help meet the requirements of the scholastic standards described previously.

Part-Time vs. Full-Time Status for Students

A student is considered to be equivalent to full-time if at least 60 per cent of the normal full-time course load is attempted in the academic term or session. (A normal full-time course load is usually 48-52 credit hours during the regular session.) A student will be allowed to take a partial course load with the permission of the Director of the School of Agriculture and the payment of pro-rated fees.

Transfers of Credit From Other Programs

Courses taken within the undergraduate degree programs of the Faculty of Agricultural and Food Sciences can qualify for credit towards the Agricultural Diploma program. See Academic Regulations in the Degree section. Courses taken outside the Faculty of Agricultural and Food Sciences or outside of the University of Manitoba can qualify for credit towards the Agriculture Diploma program if the course content and the student's performance are deemed appropriate by the department concerned.

Students who desire to receive such credit should contact the Academic Advisor of the School of Agriculture.

Scholastic Standards

To maintain good academic standing a student must maintain a Cumulative GPA that meets or exceeds the minimum academic standards described in the table below. The standards are based on the total number of credit hours accumulated while in the Agriculture Diploma program, including courses taken during the term in question. A student who fails to meet the standard is placed on probation or on academic suspension.

Cumulative Credit Hours Cumulative Grade Point Average

	Probation	Suspension
0 – 17	—	1.00
18 – 24	1.80	1.60
25 – 48	1.90	1.70

Over 48 2.00 1.85

NOTES:

- 1) Cumulative Credit Hours includes courses passed and failures not removed by supplemental exams or successful reattempts.
- 2) When both a final and supplemental exam are written the higher grade obtained will be used to determine Grade Point Averages.
- 3) A minimum of 18 credit hours must be attempted between successive determinations of standing. The minimum does not apply to students who graduate before completing an additional 18 credit hours.

Probational Standards and Academic Suspension Regulations

Students on probation must improve their academic performance and regain good academic standing to avoid being suspended. Specifically, after an attempt of a minimum of 18 additional credit hours, students on probation are required to equal or exceed the probation standard in order to regain good academic standing, otherwise they will be placed on academic suspension.

A student on academic suspension is not allowed to register for the subsequent term of the regular academic session (a student suspended in January may not be reinstated until the following September; a student suspended in April may not be reinstated until the following January). Reinstatement requires the approval of the Director. Students should contact the Academic Advisor for further instructions. If reinstatement is granted, all courses from the student's previous attempt will be transferred, except those with a grade of "D" or "F" from their last term (the term during which the student was placed on suspension).

Appeals

Appeals of academic assessment of students must be submitted to the general office of the School of Agriculture within 21 days of the date of notification of the action sent to the student.

Supplemental Exams

Any student in good academic standing (i.e., not on probation or suspension; see previous table of Scholastic Standards) is eligible to write one supplemental exam during each academic session in a course in which an "F" was received. The student must have written the final exam. The supplemental exam shall be considered as a replacement for the final exam only, not for term work. The passing grade in supplementals must be at least "C" (2.0). Students are normally required to carry a full-term program in order to be eligible. Accordingly, students who are granted incomplete or deferred status may not be eligible. When both a final and supplemental exams are written the higher grade obtained will be used to determine the final grade.

Supplemental Exams will be held in January for courses taken in the first term and in June for courses in the second term.

Time Limits and Lapse of Credit

The normal maximum time allowed for the completion of the Agriculture Diploma is five years from the date of first registration. A candidate for a Diploma in Agriculture will not be permitted to count toward that diploma any courses taken more than five years prior to the date of awarding the diploma.

Students who desire an exemption from this maximum must apply, in writing, to the Director.

Dean's Honour Roll

Students registered in at least 36 credit hours and who obtain a sessional GPA of 3.50 or higher will be placed on the Dean's Honour roll.

Graduation with Distinction

The Diploma in Agriculture with Distinction will be awarded to Diploma students who obtain a cumulative GPA of 3.75 or better with 75 per cent of the courses taken within the Diploma in Agriculture.

SECTION 4: Program and Graduation Requirements

4.1 Degree Programs

In order to fulfil the requirements for a degree in the Faculty of Agricultural and Food Sciences, students must complete five components:

- Faculty Core
- Degree Core
- Program Core

- Restricted Electives
- Free Electives

These requirements are outlined for all four degrees in the sections which follow.

4.1.1 Faculty Core

Course No.		Credit Hours
ABIZ 1000	Introduction to Agribusiness Management (see Note 1)	3
AGRI 1500	Natural Resources and Primary Agricultural Production	3
AGRI 1510	Production, Distribution and Utilization of Agricultural Products	3
AGRI 2030	Technical Communications	3
BIOL 1020	Biology 1: Principles and Themes (See Note 2)	3
BIOL 1030	Biology 2: Biological Diversity, Function and Interactions (See Note 2)	3
CHEM 1300	University 1 Chemistry: Structure and Modelling in Chemistry (see Notes 3) and one of the following two courses:	3
CHEM 1310	University 1 Chemistry: An Introduction to Physical Chemistry (see Notes 3) or	3
CHEM 1320	University 1 Chemistry: An Introduction to Organic Chemistry (see Notes 3)	3
ECON 1200	Principles of Economics	6
MATH 1200	Elements of Discrete Mathematics or	
MATH 1210	Techniques of Classical and Linear Algebra or	
MATH 1300	Vector Geometry and Linear Algebra (See Note 3) or	
MATH 1310	Matrices for Management and Social Sciences or	
MATH 1500	Introduction to Calculus (See Note 4) or	
MATH 1520	Introductory to Calculus for Management and Social Sciences (See Note 4)	3
STAT 1000	Basic Statistical Analysis 1	3
Three credit hours from the following:		
PHIL 1290	Critical Thinking (3)	
PHIL 2740	Ethics and Biomedicine (3)	
PHIL 2750	Ethics and the Environment (3)	
PHIL 2830	Business Ethics (3)	3
Total credit hours		33-39

NOTES:

- 1) ABIZ 1000 is not required for B.Sc. (Food Science) Science option. It is required in the B.Sc. (Food Science) Business option.
- 2) Students planning to enter the B.Sc. (Agribusiness) degree program are recommended to take BIOL 1020 and BIOL 1030 but may substitute BIOL 1000 and BIOL 1010.
- 3) Students planning to enter into the B.Sc. (Agribusiness) degree program are not required to take chemistry at the university level.
- 4) 6 credit hours of Math courses including MATH 1500 Introduction to Calculus or MATH 1520 Introduction to Calculus for Management and Social Sciences are required for the B.Sc. (Agribusiness) and B.Sc. (Food Science) programs.
- 5) Both CHEM 1310 and 1320 are required for the B.Sc. (Food Science) Program.

4.1.2 Bachelor of Science (Agriculture)

The four year program (one year in University 1 and three years in the Faculty of Agricultural and Food Sciences) leading to the B.Sc. (Agriculture) is a professional program which prepares graduates for careers in the public and private sectors related to the production and distribution of agricultural commodities. Graduates will also be prepared to enter directly into a program of graduate studies. In addition to the faculty core courses, all students are required to take the following B.Sc. (Agriculture) degree core requirements and the respective program core courses.

B.Sc. (Agriculture) Degree Core

Course No.		Credit Hours
AGEC 2370	Principles of Ecology	3
(BIOL 2300)		
CHEM 2770	Elements of Biochemistry 1	3
(MBIO 2770)		
PLNT 2520	Genetics	3
Total credit hours		9

Within the B.Sc. (Agriculture) students will elect one of three programs of study or specialities – Agronomy, Animal Systems or Plant Biotechnology. Students will normally begin the program of study of their choice in second year. A description of each program and their requirements follows.

Agronomy Program

Chair: P. Bullock
Office: 313 Ellis Building
Telephone: (204) 474-8666

The Agronomy program, which students enter into after completing University 1, will provide an integrated and comprehensive study of the factors and processes associated with the science of crop production and the management and use of land and water resources. The program emphasizes land management and the sustainability of agronomic and horticultural crop systems.

Agronomy Core

Course No.		Credit Hours
ABIZ 2510	Introduction to Agricultural and Food Marketing	3
ANSC 2500	Animal Production	3
BIOL 2242	The Flowering Plants	3
PLNT 2500	Crop Production	3
PLNT 3500	Plant Physiology	3
PLNT 3510	Cropping Systems	3
PLNT 4590	Physiology of Crop Plants	3
SOIL 3600	Soils and Landscapes in Our Environment	3
SOIL 4510	Soil and Water Management	3
SOIL 4520	Soil Fertility	3
Total credit hours		30

Restricted Electives

Group 1

Two courses (six credit hours) from the following:

ENTM 3170	Crop Protection Entomology (3)	
PLNT 3540	Weed Science (3)	
PLNT 4270	Plant Disease Control (3)	6

Group 2

One course (three credit hours) from the following:

ANSC 4410/	Grassland Agriculture: Plant, Animal and Environment (3)	
PLNT 4410	Environment (3)	
PLNT 2510	Fundamentals of Horticulture (3)	
PLNT 3520	Principles of Plant Improvement (3)	3

Group 3

One course (three credit hours) from the following:

SOIL 3060	Introduction to Agrometeorology (3)	
SOIL 4060	Physical Properties of Soils (3)	
SOIL 4130	Soil Chemistry and Mineralogy (3)	
SOIL 4400	Soil Ecology (3)	3

Group 4

One course (three credit hours) from the following:

BIOE 2090	Machinery for Agricultural Production (4)	
BIOE 4500	Water Management (3)	
BIOE 4520	Crop Preservation and Handling (3)	
GEOG 2250	Introduction to Geographic Information Systems (3)	3/4
Free Electives		24

Suggested progression of program:

Second Year

Course No.		Credit Hours
ABIZ 1000	Introduction to Agribusiness Management	3
AGRI 2030	Technical Communications	3
BIOL 2242	The Flowering Plants	3
CHEM 2770	Elements of Biochemistry 1	3
(MBIO) 2770		
PLNT 2500	Crop Production	3
PLNT 2520	Genetics	3
SOIL 3600	Soils and Landscapes in Our Environment	3
	Free elective(s)	9
Total credit hours		30

Third Year

ABIZ 2510	Introduction to Agricultural and Food Marketing	3
AGEC 2370	Principles of Ecology	3
(BIOL 2300)		
ANSC 2500	Animal Production	3
PLNT 3500	Plant Physiology	3
PLNT 4590	Physiology of Crop Plants	3

STAT 1000	Basic Statistical Analysis 1	3
	Restricted and/or Free Electives	12
Total credit hours		30

Fourth Year

PLNT 3510	Cropping Systems	3
SOIL 4510	Soil and Water Management	3
SOIL 4520	Soil Fertility	3
	Restricted and/or Free Electives	21
Total credit hours		30

Animal Systems Program

Chair: M. L. Connor

Office: 201 Animal Science Building

Telephone: (204) 474-9219

The Animal Systems program, which students enter after completing University 1, will provide an integrated and comprehensive study of the factors and processes associated with the science of animal production. The program will be based on a strong foundation in the scientific disciplines underlying growth and reproduction in animals and how they respond to a range of environmental systems and constraints.

Animal Systems Core

Course No.		Credit Hours
ABIZ 2510	Introduction to Agricultural and Food Marketing	3
ANSC 2500	Animal Production	3
ANSC 2510	Anatomy and Physiology 1: Control Systems	3
ANSC 2520	Anatomy and Physiology 2: Nutrient Utilization	3
ANSC 3500	Principles of Animal Genetics	3
ANSC 3510	Feeds and Feeding	3
ANSC 3520	Animal Reproduction	3
ANSC 3530	The Animal and Its Environment	3
ANSC 4560	Issues in Animal Agriculture	3
CHEM 2780	Elements of Biochemistry 2 (MBIO 2780)	3
PLNT 2500	Crop Production	3
Total credit hours		33

Restricted Electives

Group 1

One course (three credit hours) from the following:

ANSC 4520	Ruminant Production Systems - Meat (3)	
ANSC 4530	Ruminant Production Systems - Milk (3)	3

Group 2

One course (three credit hours) from the following:

ANSC 4540	Monogastric Production Systems (3)	
ANSC 4550	Avian Production Systems (3)	3

Group 3

Two courses (six credit hours) from the following:

AGEC 4510	Applications in Agroecology (3)	
ANSC 2530	Nutritional Toxicology (1.5) and AGRI 2190 Toxicology Principles (1.5)	
ANSC 2540	Companion Animal Nutrition and Management (3)	
ANSC 4090	Livestock Problems (3)	
ANSC 4220	Animal Science Investigations (3)	
ANSC 4240	Mathematical Modeling of Biological Systems (3)	
ANSC 4280	Applied Animal Genetics (3)	
ANSC 4410	Grassland Agriculture: Plant, Animal and Environment (3)	
PLNT 4410		
ANSC 4500	Animal Health (3)	
ANSC 4510	Domesticated Animal Behaviour (3)	
ANSC 4570	Advanced Applied Animal Nutrition (3)	
ENTM 3160	Veterinary and Wildlife Entomology (3)	
FOOD 3500	Processing of Animal Food Products (3)	
PLNT 2530	Plant Biotechnology (3)	6

Group 4

One course (three credit hours) from the following:

GMGT 2070	Introduction to Organizational Behaviour (3)	
GMGT 3120	Regulation (3)	
HRIR 2440	Human Resource Management (3)	3

Free Electives 24
Students are encouraged to take free electives from the following courses:

ANSC 2530	Nutritional Toxicology (1.5)	
ANSC 4570	Advanced Applied Animal Nutrition (3)	
ANSC 4090	Livestock Problems (3)	
ANSC 4220	Animal Science Investigations (6)	
PLNT 2530	Plant Biotechnology (3)	
AGEC 4510	Applications in Agroecology (3)	

Suggested progression of program:

Second Year

Course No.		Credit Hours
ABIZ 1000	Introduction to Agribusiness Management	3
AGRI 2030	Technical Communications	3
ANSC 2500	Animal Production	3
ANSC 2510	Anatomy and Physiology 1	3
ANSC 2520	Anatomy and Physiology 2	3
CHEM 2770	Elements of Biochemistry 1 (MBIO 2770)	3
CHEM 2780	Elements of Biochemistry 2 (MBIO 2780)	3
PLNT 2500	Crop Production	3
PLNT 2520	Genetics	3
	Restricted and free electives	3
Total credit hours		30

Third Year

ABIZ 2510	Introduction to Agricultural and Food Marketing	3
AGEC 2370	Principles of Ecology (BIOL 2300)	3
ANSC 3500	Principles of Animal Genetics	3
ANSC 3510	Feeds and Feeding	3
ANSC 3530	The Animal and Its Environment	3
STAT 1000	Basic Statistical Analysis	3
	Restricted and/or Free Electives	12
Total credit hours		30

Fourth Year

ANSC 3520	Animal Reproduction	3
ANSC 4560	Issues in Animal Agriculture	3
	Restricted Elective - Group 1	3
	Restricted Elective - Group 2	3
	Restricted and/or Free Electives	18
Total credit hours		30

Plant Biotechnology Program

Program advisor: A. Brûlé-Babel

Office: 247A Agriculture Building

Telephone: (204) 474-6062

The Plant Biotechnology Program which students enter after University 1 will provide an integrated and comprehensive study of genetic, physiological and pathological factors and modern technological processes associated with the sciences of plant improvement, production, protection, and utilization. The program will provide an understanding of the biological principles that determine the heredity, growth, and responses of plants and plant pathogens to cultural and environmental factors.

Plant Biotechnology Core

Course No.		Credit Hours
BIOL 2242	The Flowering Plants	3
BIOL 2260	Biology of Fungi and Lichens	3
BIOL 2520	Cell Biology	3
CHEM 2780	Elements of Biochemistry 2 (MBIO 2780)	3
MBIO 2100	General Microbiology A	3
PLNT 2530	Plant Biotechnology	3
PLNT 3500	Plant Physiology	3
PLNT 4600	Issues in Agricultural Biotechnology	3
Total credit hours		24

Restricted Electives

Group 1

Two courses (six credit hours) of the following:

ANSC 2500	Animal Production (3)	
ANSC 4410/	Grassland Agriculture: Plant, Animal and Environment (3)	
PLNT 4410		

ENTM 3170	Crop Protection Entomology (3)	
PLNT 2500	Crop Production (3)	
PLNT 2510	Fundamentals of Horticulture (3)	
PLNT 3540	Weed Science (3)	6

Group 2

Five courses (fifteen credit hours) of the following:

PLNT 3520	Principles of Plant Improvement (3)	
PLNT 3570	Fundamentals of Plant Pathology (3)	
PLNT 4310	Introductory Plant Genetics	
PLNT 4330	Intermediate Plant Genetics (3)	
PLNT 4550	Developmental Plant Biology (3)	
PLNT 4560	Secondary Plant Metabolism (3)	
PLNT 4570	Research Methods in Plant Pathology (3)	
PLNT 4580	Molecular Plant-Microbe Interactions (3)	
PLNT 4590	Physiology of Crop Plants (3)	
PLNT 4610	Bioinformatics (3)	15

Free Electives 27

Suggested progression of program:

Second Year

Course No.		Credit Hours
BOTN 2010	Plant Structure and Function 1	3
BOTN 2210	Biology of Fungi and Lichens	3
CHEM 2770	Elements of Biochemistry 1 (MBIO 2770)	3
CHEM 2780	Elements of Biochemistry 2 (MBIO 2780)	3
ZOOL 2280	Cell Biology	3
PLNT 2520	Genetics	3
PLNT 2530	Plant Biotechnology	3
AGRI 2030	Technical Communications	3
	Free and/or restricted electives	6
Total credit hours		30

Third Year

STAT 1000	Basic Statistical Analysis 1	3
PLNT 3500	Plant Physiology	3
MBIO 2100	General Microbiology A	3
AGEC 2370	Principles of Ecology (BIOL 2300)	3
ABIZ 1000	Introduction to Agribusiness Management	3
	Free and/or restricted electives	15
Total credit hours		30

Fourth Year

PLNT 4600	Issues in Agricultural Biotechnology	3
	Free and/or restricted electives	27
Total credit hours		30

4.1.3 Bachelor of Science (Agribusiness)

Chair: B. Oleson

Office: 356 Agriculture Building

Telephone: (204) 474-9384

Program Advisor: G. Johnson

Office: 379 Agriculture Building

Telephone: (204) 474-9795

Agribusiness students specialize in the people component of agriculture. This begins with the consumer, ends with the producer and involves all those along the food chain. Food production and distribution is undertaken in a business environment and agribusiness is the study of decision-making within this setting. Graduates gain insight into the agribusiness environment through mastering concepts in economics, finance, marketing and management. In addition to the faculty core courses, all students are required to take the B.Sc. (Agribusiness) degree core requirements. Students in Agribusiness are not required to take University 1 Chemistry as part of the Faculty Core requirement.

Through the choice of restricted electives, students will specialize in either agricultural economics, agribusiness management or international agribusiness. The respective agricultural economics, agribusiness management or

international agribusiness options involve selecting restricted electives from courses offered by either the Department of Economics, or the Faculty of Management, or the Faculty of Arts through their cross-disciplinary programs.

Students selecting an option in agricultural economics can declare a minor in economics, and by meeting the additional requirements can qualify for a major in economics as well.

The international agribusiness option involves taking a minor in one of the cross disciplinary programs in the Faculty of Arts. International agribusiness requires knowledge of languages, cultures, and international political history, in addition to the other business skills required by the B.Sc. (Agribusiness) degree.

B.Sc. (Agribusiness) Degree Core Course Requirements

Course No.		Credit Hours
ABIZ 2510	Introduction to Agricultural and Food Marketing	3
ABIZ 2520	Introduction to Management Science	3
ABIZ 3080	Introduction to Econometrics	3
ABIZ 3500	Agricultural and Food Policy	3
ABIZ 4500	Agribusiness Strategies Seminar	3
ACC 1100	Introductory Financial Accounting	3
ECON 2450	Microeconomic Theory and Its Applications 1	3
ECON 2470	Macroeconomic Theory and Its Applications 1	3
HRIR 2440	Human Resource Management	3
MATH 1500	Introduction to Calculus	
	or	
MATH 1520	Introduction to Calculus for Management and Social Sciences	3
STAT 2000	Basic Statistical Analysis 2	3
Total Credit Hours		33

Restricted Electives

Group 1

Three courses (nine credit hours) from the following:

ABIZ 2390	Introduction to Environmental Economics (3)	
AGEC 2370	Principles of Ecology (3) (BIOL 2300)	
ANSC 2500	Animal Production (3)	
PLNT 2500	Crop Production (3)	9

*These courses require BIOL 1020 and BIOL 1030

Group 2

Two courses (six credit hours) from the following:

ABIZ 3120	Commodity Futures Markets (3)	
ABIZ 3530	Farm Management (3)	
ABIZ 3540	Financial Risk Management (3)	
ABIZ 4260	Price Analysis (3)	6

Students must fulfil the requirements of one of the following options:

Agricultural Economics Option

At least nine credit hours from the Department of Economics, with three credit hours at the 3000 level. 9

Agribusiness Management Option

At least nine credit hours from the Faculty of Management 9

International Agribusiness Options

Minor in Asian Studies or Central and East European Studies or Lat in American Studies as defined in the Faculty of Arts chapter of this Calendar under cross-disciplinary programs. 18

Free electives 21-30

Students are encouraged to take free electives from the following ten courses:

ABIZ 1010	Economics of World Food Issues and Policies
ABIZ 2120	World Agribusiness Study Tour
ABIZ 2210	Transportation Principles
ABIZ 3120	Commodity Futures Markets
ABIZ 3520	Food Distribution and International Merchandising
ABIZ 3530	Farm Management
ABIZ 3550	Environmental Policy
ABIZ 3560	Agribusiness Portfolio Management
ABIZ 4120	Intermediate Econometrics
ABIZ 4260	Price Analysis

Suggested progression of program:

Second Year

Course No.		Credit Hours
ABIZ 1000	Introduction to Agribusiness Management*	3
ABIZ 2510	Introduction to Agricultural and Food Marketing	3
ABIZ 2520	Introduction to Management Sciences	3
AGRI 2030	Technical Communications	3
ACC 1100	Introductory Financial Accounting	3
ECON 2450	Microeconomic Theory and Its Applications 1	3
ECON 2470	Macroeconomic Theory and Its Applications 1	3
STAT 1000	Basic Statistical Analysis 1	3
STAT 2000	Basic Statistical Analysis 2	3

One course (three credit hours) from Restricted Electives

Total credit hours 30

*Recommended in second year only if not taken during University 1

Third Year

ABIZ 3080	Introduction to Econometrics	3
ABIZ 3500	Agricultural and Food Policy	3
ABIZ 3540	Financial Risk Management	3
HRIR 2440	Human Resource Management	3

Two courses (six credit hours) from Restricted Electives

	Electives for Option and/or Free Electives	12
Total credit hours		30

Fourth Year

ABIZ 4500	Agribusiness Strategies Seminar	3
	Restricted Elective, Electives for Option and/or Free Electives	27

Total credit hours 30

4.1.4 Bachelor of Science (Agroecology)

Chair: B. Amiro

Office: 364 Ellis Building

Telephone: (204) 474-9155

Program Advisor: N. Holliday

Office: 214A Animal Science Building

Telephone: (204) 474-6020

The Agroecology program, which students enter after completing University 1, provides students with an understanding of the natural processes in the agroecosystem and the impact of agricultural practices on these processes. The program emphasizes three areas: ecological sciences, agricultural production, and the social and economic implications of environmental management. Students will develop an understanding of how to manage natural and agricultural resources in a manner that enhances economic production while maintaining the integrity of natural and agricultural environments. An undergraduate research project is completed during third and fourth years as part of AGECE 3510 and AGECE 4540. Graduates are prepared for careers at the technical and management levels in government and non-government agencies involved in planning and management of natural and agricultural resources. By appropriate choice of free elective courses, students can prepare for graduate studies.

In addition to the courses prescribed in the faculty core for all students in the Faculty of Agricultural and Food Sciences, the following courses are prescribed for students in the program leading to the B.Sc. Agroecology.

B.Sc. Agroecology Degree Core

Course No.		Credit Hours
ABIZ 2390	Introduction to Environmental Economics (ECON 2390)	3
AGECE 2370	Principles of Ecology (BIOL 2300)	3
AGECE 3510	Agroecology	3
AGECE 4510	Applications in Agroecology	3
AGECE 4540	Agroecology Research Project	3
ANSC 2500	Animal Production	3
BIOL 3312	Community Ecology	3
CHEM 2770	Elements of Biochemistry 1 (MBIO 2770)	3
PLNT 2500	Crop Production	3
PLNT 2520	Genetics	3
SOIL 3600	Soils and Landscapes in Our Environment	3
Total credit hours		33

Restricted Electives

Group 1 – Agricultural Science

Three courses (nine credit hours) of the following:

From any 2000, 3000 or 4000 level course from -
ANSC (Animal Science)

or

ENTM (Entomology)

or

PLNT (Plant Science)

9

Group 2- Land Science

Two courses (six credit hours) of the following:

From any 3000 or 4000 level course from -

SOIL (Soil Science)

or

GEOG 2250 Introduction to Geographic Information Systems

6

Group 3 – Policy and Economics

One course (three credit hours) of the following:

From any 3000 or 4000 level course from -

ABIZ (Agribusiness)

3

Free Electives

30

Suggested Progression of Program:

Second Year

CHEM2770 Elements of Biochemistry 1 (MBIO2770) 3

STAT 1000 Basic Statistical Analysis 1 3

ANSC 2500 Animal Production 3

PLNT 2500 Crop Production 3

ABIZ 1000 Introduction to Agribusiness Management 3

AGRI 2030 Technical Communications 3

AGECE 2370 Principles of Ecology 3

(BOTN 2370)

ZOOL 2370)

PLNT 2520 Genetics 3

Restricted Electives 6

Total credit hours 30

Third Year

BOTN 3540 Community Ecology 3

SOIL 3600 Soils and Landscapes in Our Environment 3

ABIZ 2390 Introduction to Environmental Economics (ECON 2390) 3

AGECE 3510 Agroecology 3

Restricted and/or Free Electives 18

Total credit hours 30

Fourth Year

AGECE 4510 Applications in Agroecology 3

AGECE 4540 Agroecology Research Project 3

Restricted and/or Free Electives 24

Total credit hours 30

NOTES:

* ENTM 2050 Introductory Entomology is a prerequisite for most courses in entomology. Students contemplating additional entomology courses as free electives are advised to take ENTM 2050 in second year.

4.1.5 Bachelor of Science (Food Science)

Program Advisor: A. Hydamaka

Office: 234 Ellis Building

Telephone: (204) 474-9642

The B.Sc. degree program in Food Science, which students enter into after completing University 1, provides the academic foundation of knowledge and skills for the wide range of activities in food science and technology. The degree program is structured in course offerings and content to enhance the competence of graduating students by providing greater emphasis in communications, critical thinking, computer literacy and statistics which are basic requirements of a modern professional environment. The B.Sc. degree program in Food Science is accredited by the Institute of Food Technologists (IFT).

The B.Sc. (Food Science) degree program offers two options: A Science Option and a Business Option. Students will elect one of two options of study.

A description of each program and their requirements follows after the B.Sc. Food Science Degree Core.

B.Sc. Food Science Degree Core

Course No.		Credit Hours
CHEM 2770 (MBIO 2770)	Elements of Biochemistry 1	3
FOOD 2500	Food Chemistry	3
FOOD 3010	Food Process 1	3
FOOD 4120	Food Science Seminar	3
FOOD 4150	Food Microbiology 1	3
FOOD 4160	Food Analysis 1	3
FOOD 4200	Quality Control	3
FOOD 4510	Food Product Development	3
HNSC 1210	Nutrition for Health and Changing Lifestyles	3
MATH 1500	Introduction to Calculus	
or		
MATH 1520	Introduction to Calculus for Management and Social Sciences	3
STAT 2000	Basic Statistical Analysis 2	3
Total credit hours		33

Food Science – Science Option

The principal areas covered are food processing, chemistry, analysis and safety. The Food Science program specifies ten required and a minimum of three restricted elective courses in Food Science. As well, students must select a minimum of three credit hours from a prescribed list of courses in critical thinking and ethics. Twenty-one credit hours of free electives are available and can be selected in Food Science. This will ensure a strong academic base in Food Science and accommodate a satisfactory level of Food Science specialization. In addition, the principle areas covered are food processing, chemistry, analysis and safety.

In addition to the courses required for the faculty core for all students in the Faculty of Agricultural and Food Sciences the following courses are prescribed for the program leading to a B.Sc. in Food Science – Science Option.

Food Science – Science Option Core

Course No.		Credit Hours
BIOE 3530	Engineering Fundamentals	3
CHEM 1310	University 1 Chemistry – An Introduction to Physical Chemistry*	3
CHEM 1320	University 1 Chemistry – Introduction to Organic Chemistry*	3
FOOD 3210	Food Engineering Fundamentals	3
FOOD 4010	Food Process 2	3
FOOD 4250	Food Analysis 2	3
MBIO 2100	General Microbiology A	3
MKT 2210	Fundamentals of Marketing	3
Total Credit Hours*		21

*Both CHEM 1310 and CHEM 1320 are required for the Food Science-Science Option program. One of these courses will be credited as part of the Faculty Core.

Restricted Electives

Group 1 – Food Safety

One course (three credit hours) from the following:

AGRI 2190	Toxicology Principles (1.5)	
and		
ANSC 2530	Nutritional Toxicology (1.5)	
FOOD 1000	Food Safety, Today and Tomorrow (3)	
FOOD 4310	Introduction to HACCP (3)	
FOOD 4500	Food Safety and Regulations (3)	3

Group 2 - General

Two courses (six credit hours) from the following:

FOOD 3160	Frozen Dairy Products (3)	
FOOD 3170	Cheese and Fermented Milk Products (3)	
FOOD 3220	Grains for Food and Beverage (3)	
FOOD 3500	Processing of Animal Food Products (3)	
FOOD 4230	Food Research (3)	
FOOD 4260	Water Management in Food Processing (3)	
FOOD 4540	Functional Foods and Nutraceuticals (3)	
HNSC 4270	Sensory Evaluation (3)	6
Food Science – Science Option Free Electives		21

Suggested Progression of Program:

Second Year

Course No.		Credit Hours
CHEM 1310	University 1 Chemistry: Introduction to Physical Chemistry** or	3
CHEM 1320	University 1 Chemistry: Introduction to Organic Chemistry**	
CHEM 2770 (MBIO 2770)	Elements of Biochemistry 1	3
STAT 1000	Basic Statistical Analysis 1	3
STAT 2000	Basic Statistical Analysis 2	3
MBIO 2100	General Microbiology A	3
AGRI 2030	Technical Communications	3
FOOD 2500	Food Chemistry	3
Restricted/and or Free Electives:		9
Total credit hours		30

Third Year

HNSC 1210	Nutrition for Health and Changing Lifestyles	3
BIOE 3530	Engineering Fundamentals	3
FOOD 3210	Food Engineering Fundamentals	3
FOOD 3010	Food Process 1	3
FOOD 4150	Food Microbiology 1	3
FOOD 4160	Food Analysis 1	3
FOOD 4250	Food Analysis 2	
MKTG 2210	Fundamentals of Marketing	3
Restricted and/or Free Electives:		6
Total credit hours		30

Fourth Year

FOOD 4010	Food Process 2	3
FOOD 4120	Food Science Seminar	3
FOOD 4200	Quality Control in Foods	3
FOOD 4510	Food Product Development	3
Restricted and/or Free Electives:		18
Total credit hours		30

**While both CHEM 1310 and CHEM 1320 are required for the Food Science-Science Option program, normally only one is taken in second year.

Food Science – Business Option

The B.Sc. degree Program in Food Science now offers a Business option which now allows students to specialize in the program. The Business option specifies eight required courses and a minimum of one course from selected groups of Food Science courses plus one course from a selected group of philosophy courses. Additional required courses from Agribusiness and The Faculty of Management provide a level of specialization in economics, finance, marketing and management. There are also twenty-one credit hours (seven courses) available for free electives.

In addition to the courses required for the faculty core for all students in the Faculty of Agricultural and Food Sciences the following courses are prescribed for the program leading to a B.Sc. in Food Science – Business Option.

Food Science – Business Option Core

Course No.		Credit Hours
ABIZ 3500	Agricultural and Food Policy	3
ACC 1100	Introductory Financial Accounting	3
ECON 2450	Microeconomic Theory and Its Applications 1	3
ECON 2470	Macroeconomic Theory and Its Applications 1	3
FOOD 4500	Food Safety and Regulations	3
HRIR 2440	Human Resource Management	3
Total Credit Hours		18

Restricted Electives

Group 1 - Marketing

Two courses (six credit hours) from the following:

ABIZ 2510	Introduction to Agricultural and Food Marketing (3)	
ABIZ 3520	Food Distribution and International Marketing(3)	
MKT 2210	Fundamentals of Marketing(3)	6

Group 2 - General

One courses (three credit hours) from the following:

AGRI 2190	Toxicology Principles (1.5)	
and		
ANSC 2530	Nutritional Toxicology (1.5)	
FOOD 1000	Food Safety, Today and Tomorrow (3)	
FOOD 3160	Frozen Dairy Products (3)	
FOOD 3170	Cheese and Fermented Milk Products (3)	
FOOD 3220	Grains for Food and Beverage (3)	
FOOD 3500	Processing of Animal Food Products (3)	
FOOD 4250	Food Analysis (3)	
FOOD 4260	Water Management in Food Processing (3)	
FOOD 4310	Introduction to HACCP (3)	
FOOD 4540	Functional Foods and Nutraceuticals (3)	3
Free Electives		21

Suggested Progression of Program:

Second Year

Course No.		Credit Hours
ACC 1100	Introductory Financial Accounting	3
CHEM 2770 (MBO 2770)	Elements of Biochemistry 1	3
STAT 1000	Basic Statistical Analysis 1	3
STAT 2000	Basic Statistical Analysis 2	3
ABIZ 1000	Introduction to Agribusiness Management	3
AGRI 2030	Technical Communications	3
FOOD 2500	Food Chemistry	3
HRIR 2440	Human Resource Management	3
	Restricted/and or Free Electives:	6
Total credit hours		30

Third Year

HNSC 1210	Nutrition for Health and Changing Lifestyles	3
ECON 2450	Microeconomic Theory and Its Applications 1	3
ECON 2470	Microeconomic Theory and Its Applications 1	3
FOOD 3010	Food Process 1	3
FOOD 4150	Food Microbiology 1	3
FOOD 4160	Food Analysis 1	3
	Restricted and/or Free Electives:	12
Total credit hours		30

Fourth Year

ABIZ 3500	Agricultural Policy	3
FOOD 4120	Food Science Seminar	3
FOOD 4200	Quality Control in Foods	3
FOOD 4500	Food Safety and Regulations	3
FOOD 4510	Food Product Development	3
	Restricted and/or Free Electives:	15
Total credit hours		30

4.1.6 Biosystems Engineering

Head: D. Mann

Office: E2-376 EITC (Engineering Building)

Telephone: (204) 474-6033

Students in the Bachelor of Science degree in Biosystems Engineering must be admitted to the Faculty of Engineering. The Biosystems Engineering program is outlined in the Faculty of Engineering chapter of this *Calendar*.

The courses below are for students studying in the various majors in Agricultural and Food Sciences and for non-Agriculture students with a special interest in the subjects.

Course No.		Credit Hours
BIOE 2050	Metalworking Methods	3
BIOE 2090	Machinery for Agricultural Production	4
BIOE 3530	Engineering Fundamentals	3
BIOE 4500	Water Management	3
BIOE 4510	Agricultural Waste Management	3
BIOE 4520	Crop Preservation and Handling	3

4.2 Pre-Veterinary Program

A pre-veterinary program is offered to students who plan to take the degree Doctor of Veterinary Medicine. Pre-veterinary students whose academic standing is acceptable may be admitted to the Western College of Veterinary Medicine (WCVM), University of Saskatchewan. Acceptance into the Western College of Veterinary Medicine from the pre-veterinary program at the University of Manitoba is normally restricted to residents of Manito-

ba. Students from outside Manitoba may be accepted as residents of their own province or country. Students entering the pre-veterinary program are responsible for establishing their residence status.

Western College of Veterinary Medicine, Saskatoon

Two full years of university training are required for admission comprised of 30 hours from University 1 and 30 hours in the Faculty of Agricultural and Food Sciences, during which credit must be secured in the number of courses considered a standard load in the curriculum in which they are obtained. The deadline for applications is December.

The program of Pre-Veterinary study must include one full course in each of: English*, Physics, Biochemistry, Mathematics or Statistics; one half course in Microbiology, one and a half full courses in Biology or Zoology (including genetics), Chemistry (including organic chemistry); plus electives sufficient to complete two full years.

The following program is designed to meet the above requirements within the constraints of present course offerings*. Some modifications may be possible.

First Year/University 1

Course No.		Credit Hours
CHEM 1300	University 1 Chemistry: Structure and Modelling in Chemistry	3
CHEM 1320	University 1 Chemistry: An Introduction to Organic Chemistry	3
MATH 1300	Vector Geometry and Linear Algebra	6
	Or	
MATH 1310	Matrices for Management and Social Sciences	
	And	
MATH 1500	Introduction to Calculus	
	Or	
MATH 1520	Introductory Calculus for Management and Social Sciences	
AGRI 1500	Natural Resources and Primary Agricultural Production	3
AGRI 1510	Production, Distribution and Utilization of Agricultural Products	3
BIOL 1020	Biology 1: Principles and Themes	3
BIOL 1030	Biology 2: Biological Diversity, function and Interactions	3
ENGL 1200*	Representative Literary Works (6)	6
	Or	
ENGL 1300*	Literature Since 1900 (6)	
Total credit hours		30

NOTE: * In place of ENGL 1200 or ENGL 1300, Technical Communications (AGRI 2030) may be taken in second year; and one of the following Philosophy courses: PHIL 1290, PHIL 2740, PHIL 2750, PHIL 2830.

Second Year

CHEM 1310	University 1 Chemistry: An Introduction to Physical Chemistry	3
CHEM 2770 (MBO 2770)	Elements of Biochemistry 1	3
CHEM 2780 (MBO 2780)	Elements of Biochemistry 2	3
PHYS 1020	General Physics 1	3
PHYS 1030	General Physics 2	3
PLNT 2520	Genetics	3
MBO 2100	General Microbiology A	3
	Electives (See note * above)	9
Total credit hours		30

Please note: The courses outlined here relate to the entrance requirements for WCVM. Students intending to apply to the Ontario Veterinary College (OVC) should consult an OVC advisor or the Animal Systems Advisor.

4.3 Minors

As part of the electives portion of their programs, students may declare and complete a Minor from departments in which a Minor is offered. Course requirements are outlined in sections below. Minors are also available in the Faculties of Arts, Environment, Human Ecology, and Science and can be found within the departmental sections of each of these faculties. A Management Minor is offered by the Asper School of Business; Agriculture, Agroecology and Food Science students may complete this minor (this minor is not available to Agribusiness students). The Minor consists of 18 credit hours of Management courses. Students must meet prerequisites for all courses. Completion of a Minor is optional. All program minors must be declared before 90 credit hours of study have been completed. All 2nd pro-

gram majors must be declared before 75 credit hours of study have been completed.

Minors in the Faculty of Agricultural and Food Sciences

Animal Systems

Students may obtain a minor in Animal Systems (18 credit hours) by completing ANSC 2500 Animal Production plus an additional 15 credit hours in Animal Science courses.

Entomology

Students may obtain a minor in Entomology (18 credit hours) by completing ENTM 2050 Introductory Entomology plus an additional 15 credit hours from the following list of courses: ENTM 1000 World of Bugs, ENTM 3160 Veterinary and Wildlife Entomology, ENTM 3170 Crop Protection Entomology, ENTM 3162 Manitoba's Insect Fauna, ENTM 4000 Topics in Entomology; ENTM 4280 Aquatic Entomology, ENTM 4320 Pollination Biology, ENTM 4500 Insect Taxonomy and Morphology, ENTM 4520 Physiological Ecology of Insects. Many courses are offered in alternating years, so students should consult the Department Head of Entomology to plan their program.

Food Science

Students may obtain a minor in Food Science (18 credit hours) by completing FOOD 1000 Food Safety Today and Tomorrow and FOOD 2500 Food Chemistry plus an additional 12 credit hours in FOOD courses excluding FOOD 4230 Food Research and FOOD 4120 Food Science Seminar.

Plant Biotechnology

Students may obtain a minor in Plant Biotechnology (18 credit hours) by completing PLNT 2530 Plant Biotechnology plus an additional 15 credit hours from the following list of courses: PLNT 3140 Introductory Cytogenetics, PLNT 3520 Principles of Plant Improvement, PLNT 3570 Fundamentals of Plant Pathology, PLNT 4330 Intermediate Plant Genetics, PLNT 4540 Plant Genomics, PLNT 4550 Developmental Plant Biology, PLNT 4560 Secondary Plant Metabolism, PLNT 4570 Research Methods in Plant Pathology, PLNT 4580 Molecular Plant-Microbe Interactions, PLNT 4590 Physiology of Crop Plants, PLNT 4600 Issues in Agricultural Biotechnology.

Soil Science

Students may obtain a minor in Soil Science (18 credit hours) by completing SOIL 3600 Soils and Landscapes in our Environment plus an additional 15 credit hours from the following list of courses: SOIL 3060 Introduction to Agrometeorology, SOIL 3520 Pesticides: Environment, Economics and Ethics, SOIL 3160 Field Methods in Land Resource Science, SOIL 4060 Physical Properties of Soils, SOIL 4130 Soil Chemistry and Mineralogy, SOIL 4400 Soil Ecology, SOIL 4500 Remediation of Contaminated Land, SOIL 4510 Soil and Water Management, SOIL 4520 Soil Fertility, SOIL 4530 Land Use and Environment.

4.4 Diploma in Agriculture

The core curriculum of prescribed courses, common to all students, provides a broad yet integrated education in the production, management and marketing of agricultural products and the principles of managing a business. Students are taught to use this knowledge to evaluate the technical and economic feasibility of a variety of alternative agricultural practices.

Within the program, students are able to specialize in areas of interest. Options are available in Business Management, Crop Management, Livestock Management and General Agriculture. These options are chosen by the student during the first term, first year.

Prescribed Courses for all Students in these options

First Year, Fall Term

Course No.	Credit Hours
BIOE 0600 Farm Machinery	4
ANSC 0420 Animal Biology and Nutrition	4
ABIZ 0440 Agricultural Economics and Marketing 1	4
ABIZ 0460 Financial Management 1	4
DAGR 0410 Communication and Learning Skills	4
DAGR 0420 Introduction to Soils and Crops	4
DAGR 0680 Management Planning Project 1	4
Total credit hours	24

First Year, Spring Term

PLNT 0410 Cereal and Oilseed Production Practices	4
SOIL 0420 Soil Productivity and Land Use	4

ABIZ 0470 Financial Management 2	4
DAGR 0680 Management Planning Project 1 ¹	3
Total credit hours	15

+ 3 courses, according to option*

¹continuation of course from fall term

Second Year

ABIZ 0450 Agricultural Economics and Marketing 2	4
ENTM 0620 Pest Management and Farm Insects	4
DAGR 0690 Management Planning Project 2	5
Total credit hours	13

+ courses, according to option*

Total credit hours for prescribed courses	52
Total credit hours for prescribed courses for option	18-24
Total credit hours of free electives	17-23
Total credit hours for Agriculture Diploma	93

NOTE:

*These additional courses will consist of those required within an option plus free electives, in accordance with the four options described below:

Options

In order to accommodate a modest level of specialization, the students will be required to elect one of four options by the end of first term, first year. Each of these four options has a series of required courses. However, within each option there are also unrestricted electives available to the student who wishes to blend training available in two or more option areas to increase the degree of specialization.

Business Management Option

This option offers a more in-depth education in business management to those people who intend to manage farms or work as employees, managers and/or business owners in the agricultural service sector (agricultural lending, fertilizer, feed and chemical sales, etc.).

Prescribed Courses for Business Management Option

Course No.	Credit Hours
ABIZ 0680 Agribusiness Management	4
ABIZ 0690 Agricultural Finance and Credit	4
ABIZ 0720 Farm Business Management	4
Plus at least one of the following:	
ABIZ 0700 Merchandising and Sales	3
ABIZ 0710 Agricultural Policy	3
ABIZ 0730 Financial Risk Management	3
Plus one Biosystems Engineering course:	
BIOE 0400 Farm Power	4
BIOE 0710 Materials Handling and Electrical Controls	3
BIOE 0690 Water Management	4
BIOE 0700 Agricultural Buildings and Environments	4
Total prescribed credit hours, within option.	18-19
Plus 22-23 credit hours of electives, to complete 93 credit hours within the program.	

Crop Management Option

This option emphasizes soil and crop management. It is designed for people who plan to manage farms where crops are the primary farm enterprise or for those who are interested in careers in industries or businesses that provide services to these types of farms (e.g. crop supply businesses).

Prescribed Courses for Crop Management Option

Course No.	Credit Hours
PLNT 0770 Weed Management	4
PLNT 0780 Plant Disease Management	4
SOIL 0620 Soil Conservation and Management	4
SOIL 0630 Soil Fertility	4
Plus at least one of the following:	
PLNT 0750 Forage and Pasture Management	4
PLNT 0760 Special Crops	4
PLNT 0800 Diversification With Horticultural Crops	4
PLNT 0820 Organic Crop Production on the Prairies	3
Plus one Biosystems Engineering course:	
BIOE 0400 Farm Power	4
BIOE 0710 Materials Handling and Electrical Controls	3
BIOE 0690 Water Management	4
Total prescribed credit hours, within option	22-23
Plus 17-19 credit hours of electives, to complete 93 credit hours in the program.	

Livestock Management Option

This option emphasizes the principles of livestock production, with some degree of specialized attention to beef, dairy, swine, poultry or horse production. It is designed for people who plan to manage farms where livestock production is the primary enterprise or for those who are interested in the agricultural service industries that support livestock production (e.g. feed suppliers).

Prescribed Courses for Livestock Management Option

Course No.	Credit Hours
ANSC 0600 Animal Health and Welfare	3
PLNT 0750 Forage and Pasture Management	4
Plus at least one of the following:	
ANSC 0670 Beef Cattle Production and Management	4
ANSC 0680 Dairy Cattle Production and Management	4
Plus at least one of the following:	
ANSC 0690 Swine Production and Management	4
ANSC 0700 Poultry Production and Management	4
ANSC 0730 Horse Production and Management	3
Plus one Biosystems Engineering course:	
BIOE 0710 Materials Handling and Electrical Controls	3
BIOE 0700 Agricultural Buildings and Environments	4
Total prescribed credit hours, within option	17-19
Plus 22-24 credit hours of electives to complete 93 credit hours in the program.	

General Agriculture Option

This option exposes the student to crop and livestock production, business management and biosystems engineering beyond the exposure contained in the core curriculum. It is designed for those people who intend to manage diversified farm operations and for those who desire a general education in applied agricultural science.

Prescribed Courses for General Agriculture Option

Course No.	Credit Hours
At least one of the following:	
ANSC 0670 Beef Cattle Production and Management	4
ANSC 0680 Dairy Cattle Production and Management	4
ANSC 0690 Swine Production and Management	4
ANSC 0700 Poultry Production and Management	4
ANSC 0730 Horse Production and Management	3
Plus at least one of the following:	
PLNT 0750 Forage and Pasture Management	4
PLNT 0760 Special Crops	4
PLNT 0800 Diversification with Horticultural Crops	4
PLNT 0820 Organic Crop Production on the Prairies	3
Plus at least one of the following:	
SOIL 0620 Soil Conservation and Management	4
SOIL 0630 Soil Fertility	4
Plus at least one of the following:	
ABIZ 0680 Agribusiness Management	4
ABIZ 0720 Farm Business Management	4
Plus one Biosystems Engineering course:	
BIOE 0400 Farm Power	4
BIOE 0710 Materials Handling and Electrical Controls	3
BIOE 0690 Water Management	4
BIOE 0700 Agricultural Buildings and Environments	4
Total prescribed credit hours, within option	17-20
Plus 21-24 credit hours of electives, to complete 93 credit hours in the program.	

4.5 Cooperative Education Program

Cooperative Education is a process of learning, which formally integrates the student's academic study with work experience in employer organizations. Work-related experience is found in industry, government and the farming profession. The work terms provide the students with practical experience, help to finance their education and provide guidance for further career specialization. All regulations governing regular Faculty of Agricultural and Food Sciences degree programs apply to the Cooperative Education Program.

Academic Term Requirements

Once having been accepted into the Cooperative Education program there are three requirements for completion of the Work Term(s). Failure to do any of them in a timely fashion will result in a failing grade. Please note the

Degree Program requires three four month work terms and the Diploma Program requires one five month Work Term. Please see each program's "Employment Term Requirements" for details.

Part way through the work term, the Cooperative Education Coordinator will contact the student for a work site evaluation. During the evaluation both the student and employer will be interviewed and the work assessed. The student will need to make him/herself available for the interview.

Two weeks after the end of the work term, a work term report is due and must be submitted to the Cooperative Education Coordinator. Both content and format will be marked. (Details as to format and what is required in the report can be found in "Guidelines for Cooperative Education Work Term Report" which can be obtained from the Cooperative Education Coordinator.)

Also, two weeks after the end of the work term, a post employment review is required to be submitted to the Cooperative Education Coordinator.

For Degree, the appropriate department head, in consultation with the student's program chair, will assign each participating student a faculty advisor. For Diploma, the Director of the School of Agriculture, in consultation with the Academic Advisor, will assign each participating student a faculty advisor. The faculty advisor will be responsible for evaluating the student's work term report and assigning the student a grade based on the report, the employer's evaluation and Cooperative Education Coordinator's site evaluation. Grades of "Pass" or "Fail" will be assigned. Students successfully completing the work term(s) will have their "Cooperative Education Option" acknowledged on their graduation parchment.

Degree Program

Admission: To be considered for admission in the Cooperative Education Program, an undergraduate degree student must have a minimum GPA of 2.5, have completed at least 75 credit hours of study by the end of the academic year of application but still need to complete 21 credit hours in their last year of academic study.

Students are advised that satisfying the entrance requirements does not guarantee a place in the Cooperative Education Program. Acceptance into the program is dependant upon the student receiving a job placement through the Cooperative Education Office.

Employment Term Requirements: The Cooperative Education Program is a five year program in which 12 months are spent in three-four month work terms with a faculty approved employer. The student will receive three credits for completing the Cooperative Education Program (one credit for each completed term). Students are required to register in the appropriate employment term course and pay the fee prior to starting the employment term. Normally each employment term will be completed with a different employer. While on a work term, a cooperative education student is not permitted to take more than six hours of academic credit and may not take more than one course at a time.

Diploma Program

Admission: To be considered for admission in the Cooperative Education Program, a first year diploma student must have a minimum GPA of 2.5, and have completed at least 47 credit hour of studies by the end of the academic year of application.

Students are advised that satisfying the entrance requirements does not guarantee a place in the Cooperative Education Program. Acceptance into the program is dependant upon the student receiving a job placement through the Cooperative Education Office.

Employment Term Requirements: The Cooperative Education Program is a five month program between the first and second year with a faculty-approved employer. The student will receive two credits for completing the Cooperative Education Program. Students are required to register in the employment term course and pay the fee prior to starting the employment term.

SECTION 5: Course Descriptions

5.1 Degree

5.1.1 Agribusiness and Agricultural Economics

ABIZ 1000 Introduction to Agribusiness Management Cr.Hrs.3 ABIZ 1000 Introduction to Agribusiness Management Cr. Hrs. 3 (Formerly 061.100) Introduction to management principles applied to agribusiness. Topics covered will include cooperative

and corporate organizations, financial analysis, marketing and planning. All students will prepare a business plan. Students will use spreadsheet skills with respect to processing information and preparing forecasts. Not to be held with the former 061.100 or 061.250.

ABIZ 1010 Economics of World Issues and Policies Cr.Hrs.3 ABIZ 1010 Economics of World Food Issues and Policies Cr. Hrs. 3 (Formerly 061.101) Determinants of global food consumption, production and the factors underpinning food security and malnutrition. The importance of international trade in balancing countries' supply and demand for food, examination of trade barriers and institutions facilitating trade. Not to be held with the former 061.210.

ABIZ 2120 World Agribusiness Study Tour Cr.Hrs.3 ABIZ 2120 World Agribusiness Study Tour Cr. Hrs.3 (Formerly 061.212) Provides an understanding of world agribusiness, including areas such as agri-marketing, agricultural trade, agri-finance, agricultural policy, risk management, and economics of the environment and resources through an international study trip. A particular region of the world will be visited each time the course is offered. Offered at the discretion of the Department of Agribusiness. Prerequisite: Approval of instructor.

ABIZ 2210 Transportation Principles Cr.Hrs.3 (Formerly 061.221) Demand forecasting, cost analysis, regulation of carriers, role of transport in economic development, project appraisal, and transport planning. Not to be held with the former 061.351 or 018.354. Also offered as SCM 2210 by the Department of Supply Chain Management.

ABIZ 2390 Introduction to Environmental Economics Cr.Hrs.3 ABIZ 2390 Introduction to Environmental Economics Cr. Hrs.3 (Formerly 061.239) Economics of management of water, air and land resources quality, and conservation. Economic implications of current issues in environmental standards, licensing criteria and pollution charges. Also offered as ECON 2390 by the Department of Economics. Students may not hold credit for both ABIZ 2390 and ECON 2390 (or 018.239) Prerequisite: ECON 1200 (or 018.120).

ABIZ 2510 Introduction to Agricultural and Food Marketing Cr.Hrs.3 (Formerly 061.251) Economic principles and institutions involved in the Canadian agricultural and food marketing system. Farm and Agribusiness applications. Pre or co requisite: ECON 1200 (or 018.120).

ABIZ 2520 Introduction to Management Sciences Cr.Hrs.3 (Formerly 061.252) An introduction to management science techniques and models. Topics include linear programming, distribution problems, decision theory and queuing models. Students may not hold credit for ABIZ 2520 and MSCI 2150 (or 164.215 or 027.215) or 061.414. Prerequisites: MATH 1680 (or 136.168), or MATH 1300 (or 136.130 or 136.131) and MATH 1500 (or 136.150 or 136.152). Pre-Co requisite STAT 1000 (or 005.100) or equivalent.

ABIZ 3080 Introduction to Econometrics Cr.Hrs.3 (Formerly 061.308) The application of statistical tools, especially regression analysis for estimating economic relationships and testing economic hypotheses through the use of spreadsheets and data sets. Students may not hold credit for both ABIZ 3080 and the former 018.344. Prerequisite: STAT 2000 (or 005.200) or equivalent, or a grade of "C" in ECON 3170 (or 018.317). Also offered as ECON 3180 by the Department of Economics, and ECON 1200 or equivalent.

ABIZ 3120 Commodity Futures Markets Cr.Hrs.3 (Formerly 061.312) Theory and economic functions of commodity markets including futures and options markets. The roles of the various participants; the determination of inter-temporal prices and various aspects of hedging will be studied. Prerequisites: ECON 1200 (or 018.120) and STAT 2000 (or 005.200)

ABIZ 3500 Agricultural and Food Policy Cr.Hrs.3 (Formerly 061.350) Economics of market intervention; trade policy analysis, and agricultural protection, exports, subsidies, tariffs, quotas; intermediate versus final goods; currency exchange rates and agricultural trade policy; trade agreements. Not to be held with the former 061.418. Prerequisites: ECON 2450 (or 018.245) and ECON 2470 (or 018.247).

ABIZ 3520 Food Distribution and International Merchandising (3-0-0-0) Cr.Hrs.3 (Formerly 061.352) An introduction to logistics management concepts and their application to domestic and international merchandising. Prerequisites: (ABIZ 1000 (or 061.100) or 061.250), and (ABIZ 2510 (or 061.251) or MKT 2210 (or 118.221).

ABIZ 3530 Farm Management Cr.Hrs.3 ABIZ 3530 Farm Management Cr. Hrs.3 (Formerly 061.353) Management decisions and business planning as they relate to farm production, marketing and financing activities. Identifying potential markets; comparative advantage analysis; organizational form and contractual requirements; alternative marketing and production strategies; financing production and marketing activities; develop farm business plan. Prerequisite: ABIZ 1000 (or 061.100) or 061.250.

ABIZ 3540 Financial Risk Management Cr.Hrs.3 ABIZ 3540 Financial Risk Management Cr. Hrs.3 (Formerly 061.354) Risk expected returns and valuation of capital; capital budgeting and dealing with risk; derivative securities and financial risk management; agricultural production and management of risk; agricultural risk management and public policy. Prerequisites: STAT 1000 (or 005.100) and ACC 1100 (or 009.110) and ABIZ 1000 (or 061.100) or 061.250 or ABIZ 2510 (or 061.251).

ABIZ 3550 Environmental Policy Cr.Hrs.3 (Formerly 061.355) Environmental policy development and enactment in Canada; federal and provincial review processes; socio-political aspects of policy development; chemical and pesticide licensing procedures and environmental effects monitoring; environmental policy and sustainability; case studies; discussion of various policies; ethics of development, preservation and conservation; environmental risk management. Prerequisite: ABIZ 2390 (or 061.239) or ECON 2390 (or 018.239).

ABIZ 3560 Agribusiness Portfolio Management Cr.Hrs.3 (Formerly 061.356) The application of portfolio management to agribusiness, including asset allocation, portfolio construction and analysis, and operation of investment instruments and capital markets. Includes Canadian Securities Course. Prerequisite: Major in Agribusiness or Ac-

counting and/or Finance, with 60 credit hours, ACC 1100 (or 009.110) and ECON 1200 (or 018.120), or permission from instructor. Recommended G.P.A. of 2.80 or higher.

ABIZ 4120 Intermediate Econometrics Cr.Hrs.3 (Formerly 061.412) A course in applied econometrics that explores the regression model and how it may be applied. Special emphasis is placed on violations to the assumptions of least squares, specification error, and applying the model to production, marketing, forecasting and other applications. Prerequisite: Written consent of instructor; this course assumes students have had a sound background in economic theory (e.g. micro and macro), as well as single variable calculus, linear algebra, and basic statistics. ABIZ 3080 (or 061.308) or ECON 3180 (or 018.318) is highly recommended. Also offered as ECON 4120 by the Department of Economics.

ABIZ 4240 Agricultural Economics Special Project Cr.Hrs.3 (Formerly 061.424) Students will undertake a project to analyze an applied problem and present results in a research and/or extension paper. A list of relevant readings will be assigned. Permission of the Department Head required.

ABIZ 4250 Commodity Market Analysis Cr.Hrs.3 (Formerly 061.425) Theory and methods of price analysis, commodity markets and the demand and supply factors that underpin seasonal, cyclical and secular changes in commodity prices. Prerequisites: (ECON 2450 (or 018.245 or 018.270)) and (ABIZ 3080 (or 061.308) or ECON 3180 (or 018.318)). Not to be held with the former 061.404.

ABIZ 4260 Price Analysis Cr.Hrs.3 Theory and methods of price analysis, commodity markets and the demand and supply factors that underpin seasonal, cyclical and secular changes in commodity prices. Prerequisites: ECON 2450 (or 018.245 or 018.270) and (ABIZ 3080 (or 061.308) or ECON 3180 (or 018.318)). Not to be held with ABIZ 4250 (formerly 061.425) or the former 061.404

5.1.2 Agriculture

AGRI 1500 Natural Resources and Primary Agricultural Production Cr.Hrs.3 (Formerly 065.150) Introduces students to natural resources and climate, primary production of crops and livestock, production and resource economics and rural society. A model of the entire agri-food system will be used to show interrelationships among disciplines, processes, etc.

AGRI 1510 Production, Distribution and Utilization of Agricultural Products Cr.Hrs.3 (Formerly 065.151) Introduction to the aspects of agriculture that follow primary production and includes confined animal production and a presentation of a model of the entire agri-food system. Special emphasis on processing, marketing, transportation and food safety. Laboratory sessions will use small groups to examine problem based case studies.

AGRI 2030 Technical Communications Cr.Hrs.3 (Formerly 065.203) Lectures and workshops to develop written and oral communication skills for preparing and presenting scientific and technical reports. Basic composition skills, communication graphics and job interview techniques are included. Prerequisite: 24 credit hours of University.

AGRI 2180 Introductory Toxicology Cr.Hrs.3 (Formerly 065.218) A survey of general principles underlying the effects of toxic substances on biological systems, including history, scope and applications of toxicology, the mechanisms of toxic action, and some major types of toxicants. Not to be held with BOTN 2180 (or 001.218), BOTN 2190 (or 001.219), ENVR 2180 (or 128.218), ENVR 2190 (or 128.219), ZOOL 2180 (or 022.218), ZOOL 2190 (or 022.219), and the former 001.337. Prerequisite: BIOL 1020 (C) and BIOL 1030 (C) or the former 071.125 (C) and CHEM 1310 (or 002.131 or 002.128) or CHEM 1320 (or 002.132).

AGRI 2190 Toxicology Principles Cr.Hrs.2 (Formerly 065.219) A survey of general principles underlying the effects of toxic substances on biological systems, including the history, scope and applications of toxicology, the mechanisms of toxic action. Not to be held with BOTN 2180 (or 001.218), BOTN 2190 (or 001.219), ENVR 2180 (or 128.218), ENVR 2190 (or 128.219), ZOOL 2180 (or 022.218), ZOOL 2190 (or 022.219), AGRI 2180 (or 065.218) and the former 001.337. Prerequisite: BIOL 1020 (C) and BIOL 1030 (C) or the former 071.125 (C) and CHEM 1310 (or 002.131 or 002.128) or CHEM 1320 (or 002.132).

AGRI 2200 Principles of Plant and Animal Physiology for Engineers Cr.Hrs.4 (Formerly 065.220) Plant and animal physiology as affected by environment for use in the design of agricultural machines, structures and food processes for biological products; models of simulation of plant and animal growth. Prerequisite: BIOE 2590 (or 034.259) or the former 071.201.

AGRI 3030 Modern Topics in Agriculture 1 Cr.Hrs.3 (Formerly 065.303) An interdisciplinary course including topical national and international issues in agriculture. The course will vary from year to year to provide material of current interest in a wide variety of subject areas. Student participation by means of seminars will be encouraged.

AGRI 3040 Modern Topics in Agriculture 2 Cr.Hrs.3 (Formerly 065.304) Similar to AGRI 3030 (or 065.303).

AGRI 4550 Agriculture Cooperative Education Work Term 1 Cr.Hrs.1 (Formerly 065.455) Special four-month work assignment in business, industry, government or research for cooperative education students. Requires submission of a written report covering the work completed during the four-month professional assignment.

AGRI 4560 Agriculture Cooperative Education Work Term 2 Cr.Hrs.1 (Formerly 065.456) Special four-month work assignment in business, industry, government or research for cooperative education students. Requires submission of a written report covering the work completed during the four-month professional assignment.

AGRI 4570 Agriculture Cooperative Education Work Term 3 Cr.Hrs.1 (Formerly 065.457) Special four-month work assignment in business, industry, government or research for cooperative education students. Requires submission of a written report covering the work completed during the four-month professional assignment.

5.1.3 Agroecology

AGEC 2370 Principles of Ecology Cr.Hrs.3 (Formerly 065.237) Principles of ecology at the individual, population, community, and ecosystem levels. This course is also given in the Faculty of Science as BOTN 2370 or ZOOL 2370. It is the normal prerequisite to other courses in ecology. Not to be held with BOTN 2280 (or 001.228) or ZOOL 2290 or BOTN 2291 (or 022.229), or BOTN 2370 or BOTN 2371 (or 001.237), or ZOOL 2370 or ZOOL 2371 (or 022.237). Prerequisite: A grade of "C" in BIOL 1020 or BIOL 1021 and BIOL 1030 or BIOL 1031 or the former 071.125. Pre- or co-requisite: STAT 1000 or STAT 1001.

AGEC 2500 Population Genetics Cr.Hrs.3 (Formerly 065.250) Principles of population genetics as they apply to plants and animals in both natural and managed systems. Prerequisites: A grade of "C" in BIOL 1020 and BIOL 1030 or the former 071.125; AGECE 2370 (or 065.237) or BOTN 2370 (or 001.237) or ZOOL 2370 (or 022.237).

AGEC 3510 Agroecology Cr.Hrs.3 (Formerly 065.351) Examination of how ecological principles and processes apply to, and function in, managed ecosystems, with emphasis on agricultural ecosystems. Influence of agricultural practices on populations and ecosystem function. Ecological concepts as tools in managing systems. Prerequisite: AGECE 2370 (or 065.237) or BOTN 2370 (or 001.237) or ZOOL 2370 (or 022.237).

AGEC 4510 Applications in Agroecology Cr.Hrs.3 (Formerly 065.451) Integration of information on ecological principles, agricultural production technology and environmental and socio-economic issues through in-depth studies of issues and problems in agro ecology. Students must complete the undergraduate thesis for which preliminary work was done in AGECE 3510. Prerequisite: AGECE 3510 (or 065.351).

AGEC 4540 Agroecology Research Project Cr.Hrs.3 (Formerly 065.454) Completion of independent research project for which preliminary work was done in AGECE 3510 (or 065.351). Students perform research and meet regularly with supervisors beginning in September. Progress reports are required, and final results will be presented in written and verbal reports in April. Prerequisite: AGECE 3510 (or 065.351)

5.1.4 Animal Science

ANSC 2500 Animal Production Cr.Hrs.3 (Formerly 035.250) Built on concepts introduced in AGRI 1500 and AGRI 1510, by elaborating on the basic essentials of animal production. Prerequisites: AGRI 1500 (or 065.150) and AGRI 1510 (or 065.151).

ANSC 2510 Anatomy and Physiology 1: Control Systems Cr.Hrs.3 (Formerly 035.251) Will deal with the structure, functions and interactions of the coordinating/regulatory systems in the animal body; including the nervous, muscular, cardiovascular, respiratory, renal and endocrine systems. Co-requisite: CHEM 2770 (or 002.277) or MBIOL 2770 (or 060.277) or CHEM 2360 (or 002.236) or MBIOL 2360 (or 060.236).

ANSC 2520 Anatomy and Physiology 2: Nutrient Utilization Cr.Hrs.3 (Formerly 035.252) The digestion, absorption and utilization of nutrients by farmed species. Basic characteristics of the digestive system, aspects of regulation of feed intake and rates of passage, intermediary metabolism of nutrients, growth and development, health and other factors influencing nutrient utilization. Prerequisite: ANSC 2510 (or 035.251). Co-requisite: CHEM 2780 (or 002.278) or MBIOL 2780 (or 060.278), or CHEM 2370 (or 002.237) or MBIOL 2370 (or 060.237).

ANSC 2530 Nutritional Toxicology Cr.Hrs.2 (Formerly 035.253) The Science of dietary toxins and their interrelationships with nutrition: mode of action and metabolism of toxic chemicals that occur in food and animal feedstuffs. Prerequisite: AGRI 2190 (or 065.219)

ANSC 2540 Companion animal nutrition and management Cr.Hrs.3 Course material will cover the functional anatomy, genetics, nutrition, reproduction, behaviour, and diseases of non-equine companion animals and ornamental fish. Pre- or Co-requisite: CHEM 2770 or MBIOL 2770 or CHEM 2360 or MBIOL 2360 or consent of instructor.

ANSC 3500 Principles of Animal Genetics Cr.Hrs.3 (Formerly 035.350) Topics discussed will include population genetics, quantitative variation, selection and mating systems with particular reference to domestic species. Prerequisite: PLNT 2520 (or 039.252).

ANSC 3510 Feeds and Feeding Cr.Hrs.3 (Formerly 035.351) A detailed discussion of feedstuffs used for domestic animals, animal nutrient requirements, ration balancing, feedstuff processing and feed safety. Prerequisite: ANSC 2520 (or 035.252).

ANSC 3520 Animal Reproduction Cr.Hrs.3 (Formerly 035.352) The comparative anatomy and physiology of reproduction of farmed animals will be emphasized. Focus will be on the natural synchronization of reproductive processes and the potential to regulate and improve reproductive efficiency. Prerequisite: ANSC 2510 (or 035.251).

ANSC 3530 The Animal and Its Environment Cr.Hrs.3 (Formerly 035.353) Deals with how the animal is influenced by its environment to affect health, welfare and performances. Principles of farmed animal behaviour, welfare and behavioural management, health, and facility design and modification will be considered in the context of animal/environment interactions. Co-requisite: ANSC 2520 (or 035.252).

ANSC 3540 Companion animal nutrition and management Cr.Hrs.3 Course material will cover the functional anatomy, genetics, nutrition, reproduction, behaviour, and diseases of non-equine companion animals and ornamental fish. Pre- or Co-requisites: CHEM 2770 or MBIOL 2770 or CHEM 2360 or MBIOL 2360 or consent of instructor.

ANSC 4090 Livestock Problems Cr.Hrs.3 (Formerly 035.409) A minor thesis on livestock problems, prepared by the student under direction. (For Animal Systems Majors only). Prerequisite: Consent of department head.

ANSC 4220 Animal Science Investigations Cr.Hrs.6 (Formerly 035.422) Minor research on some problem in animal science. Instruction and supervision in setting up the project, in collecting and processing data, and in writing the report. (For fourth-year students in Animal Systems Major only.) Prerequisite: Consent of Department Head.

ANSC 4240 Mathematical modeling of biological systems Cr.Hrs.3 Lectures and computer based laboratory exercises will be used to discuss mathematical modeling methods applied to biological systems taking aspects of animal science as a model to develop modeling techniques. Prerequisite: MATH 1500 or MATH 1520 or Equivalent.

ANSC 4280 Applied Animal Genetics Cr.Hrs.3 (Formerly 035.428) Application of principles of animal breeding. Modern methods, techniques, and programs for genetic improvement of cattle, sheep, and swine. Prerequisite: ANSC 3500 (or 035.350).

ANSC 4410 Grassland Agriculture: Plant, Animal and Environment Cr.Hrs.3 (Formerly 035.441) Inter-relationships between the biological components of grassland agriculture as they relate to forage production on the Canadian Prairies. Topics include utilization by wild and domestic animals, plant community relationships and role of forages in multiple land use planning. This course also given in Plant Science as PLNT 4410.

ANSC 4500 Animal Health Cr.Hrs.3 (Formerly 035.450) Responses of basic animal functions to challenge by potentially pathogenic organisms, genetic or metabolic disorders, and toxicants will be discussed. Strategies for prevention and treatment will be outlined. Prerequisite: ANSC 2520 (or 035.252).

ANSC 4510 Domesticated Animal Behaviour Cr.Hrs.3 (Formerly 035.451) An awareness and understanding of normal behaviours of animals will be emphasized. Relationships between behaviour, welfare and management will be explored. Emphasis will be on farmed animals but companion animals, wild animals and laboratory species will also be discussed. Prerequisite: ANSC 2520 (or 035.252) or consent of the instructor.

ANSC 4520 Ruminant Production Systems-Meat Cr.Hrs.3 (Formerly 035.452) To provide an appreciation of the industry in terms of size, complexity and relationship to the economy and give an understanding of the breeding, feeding, management and marketing strategies for modern ruminant production systems. Open only to students holding at least 60 credit hours. Prerequisite: ANSC 2500 (or 035.250).

ANSC 4530 Ruminant Production Systems-Milk Cr.Hrs.3 (Formerly 035.453) Will describe the industry in terms of size, complexity and relationship to the economy and give an understanding of the breeding, feeding, management and marketing practices in a modern system for milk production. Open only to students holding at least 60 credit hours. Prerequisite: ANSC 2500 (or 035.250).

ANSC 4540 Monogastric Production Systems Cr.Hrs.3 (Formerly 035.454) Describes the swine industry in terms of size, complexity and relationship to the economy and gives an understanding of the breeding, feeding, management and marketing practices in a modern production unit. Outlines other monogastric production systems of relevance to the agriculture industry. Open only to students holding at least 60 credit hours. Prerequisite: ANSC 2500 (or 035.250).

ANSC 4550 Avian Production Systems Cr.Hrs.3 (Formerly 035.455) Describes the various avian systems in terms of size, complexity, and relationship to the economy and gives an understanding of the management and marketing practices in the usual poultry systems. Open only to students holding at least 60 credit hours. Prerequisite: ANSC 2500 (or 035.250).

ANSC 4560 Issues in Animal Agriculture Cr.Hrs.3 (Formerly 035.456) Through a combination of lectures and independent group learning activities students will develop an appreciation of the scope and complexities of current issues facing the animal industry and integrate knowledge accumulated through the Animal Systems Program using case study problems and group project work.

ANSC 4570 Advanced Applied Animal Nutrition Cr.Hrs.3 (Formerly 035.457) An advanced study of theoretical and applied aspects of monogastric and ruminant nutrition. A laboratory component will provide training in current techniques in feed analyses and computer modeling. Prerequisite: ANSC 3510 (or 035.351)

ANSC 4610 Bioinformatics Cr.Hrs.3 An introduction to the theory, strategies, and practice of data management and analysis in molecular biology. Topics include DNA and protein sequence analysis, biological databases, genomic mapping, and analysis of gene expression data. The course will include problem-solving exercises using Unix server-based software.

5.1.5 Biosystems Engineering

BIOE 2050 Metalworking Methods Cr.Hrs.3 (Formerly 034.205) Principles of operation of the lathe, milling machine, shaper, planer, drill, and grinding machine. Laboratory project requiring the use of the above machines. Limited practice in gas and electric welding.

BIOE 2090 Machinery for Agricultural Production Cr.Hrs.4 (Formerly 034.209) Farm machinery selection. Machine performance. Ownership and operating costs. Analysis of machine functions for safety and efficiency.

BIOE 2222 Precision Agriculture Concepts and Applications Cr.Hrs.4 Precision agriculture is a philosophy of agricultural management that has been enabled by modern technology. This course examines the technology and the techniques of precision agriculture including GPS, GIS, variable rate technologies, and yield monitoring that can be used to improve the efficiency of agricultural operations by decreasing costs, increasing profits, and decreasing hazards to the environment.

BIOE 3530 Engineering Fundamentals Cr.Hrs.3 (Formerly 034.353) Principles of heat transfer, steam, psychometrics, fluid mechanics, material balances, electricity and refrigeration. Cannot be held for credit in the Faculty of Engineering. Not to be held with the former 034.329. Prerequisite: MATH 1680(136.168M) or the former 013.129 or 013.128.

BIOE 4500 Water Management Cr.Hrs.3 (Formerly 034.450) Introduction to the design of irrigation and drainage systems. Topics in irrigation include sprinklers, laterals, mainline and pumps. Drainage topics cover both the surface and subsurface systems. Analysis of precipitation and runoff. Environmental impacts of water management. Of-

ferred alternate years.

BIOE 4520 Crop Preservation and Handling Cr.Hrs.3 (Formerly 034.452) Interaction of biological and physical factors related to methods of preserving, storing, and handling cereals, oilseeds, and other agricultural crops. Offered alternate years.

5.1.6 Entomology

ENTM 1000 World of Bugs Cr.Hrs.3 A survey of insect biology and life styles with emphasis on insect diversity and human-insect interactions.

ENTM 2050 Introductory Entomology Cr.Hrs.3 (Formerly 038.205) A basic course for students requiring a foundation in entomology. The anatomy, life history, identification, adaptations, and relations of insects to humans are examined along with methods of collecting and preserving insect specimens. Students may not hold credit in ENTM 2050 (or 038.205) and the former 038.315 or 022.349.

ENTM 3160 Veterinary and Wildlife Entomology Cr.Hrs.3 (Formerly 038.316) An introduction to the insects and their relatives that affect domestic animals, pets and wildlife. Special consideration is given to life histories, insect/host interaction, evolutionary relationships, impact on host vertebrates and pest management. Not all courses are offered every year. Please contact the department regarding course availability.

ENTM 3162 Manitoba's Insect Fauna Cr.Hrs.3 A collection of insects is required. Emphasis is placed on collecting techniques, specimen preparation, diversity of species collected, organization and curatorial skills, and accuracy of identification. Students should contact instructors in April preceding registration in this course. Prerequisite: ENTM 2050.

ENTM 3170 Crop Protection Entomology Cr.Hrs.3 (Formerly 038.317) A course for students requiring a foundation in entomology and knowledge of major insect pest groups in Western Canada. The pests and principles for their control (chemical, cultural, mechanical, physical and biological methods) are explored with emphasis on the entire ecosystem. Students may not hold credit in ENTM 3170 and 038.413 or 038.431.

ENTM 4000 Topics in Entomology Cr.Hrs.3 A Course of assigned readings and literature review essays for students in the minor in Entomology program. Prerequisite ENTM 2050 (or 038.205) and consent of department head.

ENTM 4250 Pesticide Toxicology Cr.Hrs.3 (Formerly 038.425) Action, behaviour, and fate of pesticides in target and non-target species and in the environment. Past, present, and future chemical control agents will be discussed on the basis of chemical and biochemical knowledge. Prerequisite: A course in biochemistry. Not all courses are offered every year. Please contact the department regarding course availability.

ENTM 4280 Aquatic Entomology Cr.Hrs.3 (Formerly 038.428) Adaptations and significance of insects to aquatic habitats, with emphasis on identification. Aquatic insects as indicator species of pollution and their response to chemical pesticide application. A collection of aquatic insects is required. Prerequisites: ENTM 2050 (or 038.205); AGEC 2370 (or 065.237) or ZOOL 2370 (or 022.237) or BOTN 2370 (or 001.237); or consent of instructor. Not all courses are offered every year. Please contact the department regarding course availability.

ENTM 4320 Pollination Biology Cr.Hrs.3 (Formerly 038.432) The biology, ecology of social, semisocial and solitary insect pollinators and their ecological interactions with entomophilous plants. Offered alternate years.

ENTM 4500 Insect Taxonomy and Morphology Cr.Hrs.3 (Formerly 038.450) Study of insect structure combined with evolution of insect orders. Modern concepts of sub-species, species and higher taxa. Collection required (contact instructor for details in April/May of preceding year.) Students may not hold credit for ENTM 4500 (or 038.450) and the former 038.412. Prerequisite: ENTM 2050 (or 038.205) or consent of instructor. Offered alternate years.

ENTM 4520 Physiological Ecology of Insects Cr.Hrs.3 (Formerly 038.452) The effect of environmental factors such as temperature, moisture, light and other organisms on the physiology and ecology of insects. Prerequisite: ENTM 2050 (or 038.205) or consent of instructor. Not all courses are offered every year. Please contact the department regarding course availability.

5.1.7 Food Science

FOOD 1000 Food Safety Today and Tomorrow Cr.Hrs.3 (Formerly 078.100) A contemporary examination of the safety of the food supply - where, how and why problems may rise and what is and can be done to consistently achieve high quality, safe food. Controversial issues (residues, organic, biotechnology, irradiation) will be discussed in a balanced manner, and prospects for the future presented.

FOOD 2500 Food Chemistry Cr.Hrs.3 (Formerly 078.250) The chemical components of food. Chemical problems and chemical changes which exist uniquely in foods. Prerequisite: CHEM 2770 (or 002.277) or MBIO 2770 (or 060.277) or CHEM 2360 (or 002.236) or MBIO 2360 (or 060.236). Not to be held with the former 078.422.

FOOD 3010 Food Process 1 Cr.Hrs.3 (Formerly 078.301) The basic principles and practices of the major techniques used in food processing and preservation are covered. Emphasis is placed on thermal processing, drying, evaporation, chilling, freezing, separation, packaging and sanitation. Also preservation by salting, smoking, microwave, radiation and chemical techniques is presented. Critical issues in food regulations are introduced. Prerequisite: any MATH course at the 1000 level.

FOOD 3160 Frozen Dairy Products Cr.Hrs.3 (Formerly 078.316) Technology of frozen dairy products, including selection and processing of materials and handling of products. Standards and quality control programs for major dairy products will be covered.

FOOD 3170 Cheese and Fermented Milk Products Cr.Hrs.3 (Formerly 078.317) Selection and evaluation of raw materials and lactic cultures are covered. Processing, packaging and distribution of cheddar and cottage cheese, cultured milk, cream and

yogurt are studied.

FOOD 3210 Food Engineering Fundamentals Cr.Hrs.3 (Formerly 078.321) Applications of engineering fundamentals to unit operations on the food industry. Prerequisite: BIOE 3530 (or 034.353).

FOOD 3220 Grains for Food and Beverage Cr.Hrs.3 The science and technology behind the functionality of major Canadian cereal grains and grain legumes for food and beverage. Grains covered include wheat, barley, oats, peas, beans, and lentils in the context of their processing into products such as bread, pasta and beer, and foods high in dietary fibre. Details are presented on the differing physical and chemical attributes of grains to make quality products with focus on the roles of protein, starch, and non-starch polysaccharides. Prerequisite: FOOD 2500 or equivalent.

FOOD 3500 Processing of Animal Food Products Cr.Hrs.3 (Formerly 078.350) Processing of materials of animal origin will be studied with emphasis on product quality and safety. Impact of initial characteristics as well as processing technologies will be discussed in relation to nutritive value, convenience, functionality, aesthetic factors and food safety. Prerequisite: CHEM 2770 (or 002.277) or MBIO 2770 (or 060.277) or CHEM 2360 (or 002.236) or MBIO 2360 (or 060.236).

FOOD 4010 Food Process 2 Cr.Hrs.3 (Formerly 078.401) The processing of specific food groups is covered. The functions and changes in the primary chemical components (carbohydrates, proteins and lipids) of the commodities receive special consideration. New technologies including thermal/nonthermal processing, radiation, extrusion, minimal processing and other advance processing methods will be studied. Prerequisite: FOOD 3010 (or 078.301).

FOOD 4120 Food Science Seminar Cr.Hrs.3 (Formerly 078.412) Written and verbal presentations of selected topics of current interest in the food science area. Should be taken in fourth year.

FOOD 4150 Food Microbiology 1 Cr.Hrs.3 (Formerly 078.415) Relationships of microorganisms to processing and spoilage of food.

FOOD 4160 Food Analysis 1 Cr.Hrs.3 (Formerly 078.416) This course exposes students to the principles, methods, and techniques of qualitative and quantitative physical, chemical and biological analyses of foods. Major emphasis is placed on understanding the basic principles of classical and instrumental methods of analysis. Criteria for the choice of various analytical methods, methods for treating data and sampling techniques will be studied. Prerequisite: FOOD 2500 (or 078.250).

FOOD 4200 Quality Control in Foods Cr.Hrs.3 (Formerly 078.420) Fundamentals of quality control and their industrial application through physical, chemical, microbiological, statistical and sensory methods will be studied. Statistical process control (SPC) will be mainly covered; required background knowledge of statistics will be reviewed briefly. Prerequisite: FOOD 3010 (or 078.301).

FOOD 4230 Food Research Cr.Hrs.3 (Formerly 078.423) Research interests and aptitudes of students are developed through specific project assignments related to the food industry. Prerequisite: Permission of Department Head required.

FOOD 4250 Food Analysis 2 Cr.Hrs.3 (Formerly 078.425) Advanced techniques employed in the physico-chemical analysis of food products as preparation for research, development, and inspection roles in government and in industry. Prerequisite: FOOD 4160 (or 078.416).

FOOD 4260 Water Management in Food Processing Cr.Hrs.3 The course is devoted to the management of water and wastewater in food processing. The roles of water in food processing, recycle and reuse opportunities, treatment options for water and wastewater are presented. The course also discusses water stewardship in relation to food processing, water and wastewater regulations and implication for HACCP and ISO. Laboratory sessions are designed for the student to become familiar with Standard Methods for the Examination of Water and Wastewater.

FOOD 4310 Introduction to HACCP Cr.Hrs.3 (Formerly 078.431) This course will cover the principles related to hazard analysis and critical control points (HACCP), a food safety and self-inspection system that is widely endorsed internationally by industry, consumer and regulatory groups. HACCP examines chemical, physical and biological hazards and identifies critical control points involved in producing, manufacturing and processing food products. Prerequisite or co requisite: FOOD 4150 (or 078.415) or consent of instructor.

FOOD 4500 Food Safety and Regulations Cr.Hrs.3 (Formerly 078.450) Current food safety issues; government, industry and consumers' role in organizing a safe food supply system; food laws and regulations in Canada and internationally. Preventative measures to increase food safety and sanitation will also be covered. Prerequisites: FOOD 4150 (or 078.415) or FOOD 4300 (or 078.430).

FOOD 4510 Food Product Development Cr.Hrs.3 (Formerly 078.451) This course will allow the student to gain an understanding of the product development procedure as it relates to the food industry. Emphasis will be on application of basic knowledge of foods and food processing in designing a new product. Prerequisites: MKT 2210 (or 118.221), STAT 2000 (or 005.200) or equivalent, FOOD 3010 (or 078.301). Cannot be held with HNSC 4280 (or 030.428).

FOOD 4540 Functional Foods and Nutraceuticals Cr.Hrs.3 (Formerly 078.454) The course will examine the bioactive components of functional foods and nutraceuticals, their sources, chemistry, process technology, efficacy, safety and regulation. Prerequisite: CHEM 2770 (or 002.277) or MIBO 2770 (or 060.277) or MBIO 2360 (or 060.236) or CHEM 2360 (or 002.236).

5.1.8 Plant Science

PLNT 2500 Crop Production Cr.Hrs.3 (Formerly 039.250) An introduction to the principles and practices of crop production in Canada. Topics will include physiological processes and factors affecting plant yield, plant improvement, seed production, and production of the major cereal, oilseed, forage and special crops. Prerequisite: AGRI 1500 (or 065.150).

PLNT 2510 Fundamentals of Horticulture Cr.Hrs.3 (Formerly 039.251) Principles of the culture, marketing, and utilization of fruits, vegetables, and ornamentals, their contribution to the economy and well-being of consumers, and impact of horticultural activities on the environment. Prerequisites: BIOL 1020 and BIOL 1030 or the former 071.125; AGRI 1500 (or 065.150); or consent of instructor. Offered alternate years.

PLNT 2520 Genetics Cr.Hrs.3 (Formerly 039.252) Basic principles of genetics and their practical application in the areas of DNA structure and function, genome organization and genetic analysis. Laboratory sessions provide practical experience in solving genetic problems and conducting genetic investigations. Not to be held with BIOL 22500 or the former BOTN 2460 (or 001.246). Prerequisite: a minimum grade of "C" in BIOL 1020 and BIOL 1030 or the former 071.125.

PLNT 2530 Plant Biotechnology Cr.Hrs.3 (Formerly 039.253) An introduction to current biotechnological techniques, including recombinant DNA, plant tissue culture, plant transformation and regeneration. A background to the techniques as well as a discussion of their applications in current biology and crop production will be examined. A laboratory will provide first hand experience with many of the techniques. Not to be held with the former 039.450. Prerequisites: CHEM 2770 (or 002.277) or M BIO 2770 (or 060.277) and PLNT 2520 (or 039.252) or BIOL 2500 or the former BOTN 2460 (or 001.246).

PLNT 3140 Introductory Cytogenetics Cr.Hrs.3 (Formerly 039.314) An introduction to the structure and function of eukaryotic genomes, from the gene to the chromosome. Topics include the cell cycle, meiosis, chromatin, chromosome and genome organization, karyotyping, changes in chromosome number and structure, physical mapping and chromosome evolution. Labs cover use of the microscope, meiosis, chromosome staining and banding, and bioinformatic analysis of chromosomes. Prerequisites: PLNT 2520 (or 039.252) or BIOL 2500 or the former BOTN 2460 (or 001.246).

PLNT 3370 Environmental Horticulture Cr.Hrs.3 (Formerly 039.337) Management principles involved in the production of ornamental perennial plants in the nursery and their establishment and maintenance in the urban environment with an emphasis on arboriculture. Includes a number of tutorials to allow for guest speakers, discussions and tour.

PLNT 3500 Plant Physiology Cr.Hrs.3 (Formerly 039.350) An integrative view of major physiological processes in plants, spanning the biochemical, cellular, tissue, organ and whole plant levels of organization and addressing the effects of environmental conditions on these processes. Topics covered: photosynthesis and respiration, water relations, plant nutrition, assimilate partitioning, and regulation of growth. Not to be held with BIOL 3452 or the former BOTN 3010 (or 001.301) or the former 1.317. Prerequisites: BIOL 1020 and BIOL 1030 or the former 071.125; CHEM 2770 (or 002.277) or M BIO 2770 (or 060.277) or CHEM 2360 (or 002.236) or M BIO 2360 (or 060.236); BIOL 2242 or the former BOTN 2010 (or 001.201) or the former 001.230 or consent of instructor.

PLNT 3510 Cropping Systems Cr.Hrs.3 (Formerly 039.351) Examination and analysis of sustainable prairie cropping systems. Emphasis will be placed on integrated systems that optimize the benefits of crop rotation, and conserve soil, water and wildlife resources. Conventional, traditional and alternative crop production systems will be discussed. Includes a limited number of tutorials to allow for field tours and guest speakers. Prerequisite: PLNT 2500 (or 039.250).

PLNT 3520 Principles of Plant Improvement Cr.Hrs.3 (Formerly 039.352) Basic objectives, principles, and methods of plant genetic improvement. Traditional and modern plant breeding, genetic resources, selection, and applications of tissue culture, genetic engineering and molecular markers to plant improvement. Prerequisite: PLNT 2520 (or 039.252) or BIOL 2500 or the former BOTN 2460 (or 001.246).

PLNT 3530 Horticultural Food Crops Cr.Hrs.3 (Formerly 039.353) Management practices, environmental considerations, and physiological factors involved in the production, marketing, and handling of the major vegetable and fruit crops. *Pre- or co requisite:* PLNT 2510 (or 039.251) or consent of instructor. Offered in alternate years.

PLNT 3540 Weed Science Cr.Hrs.3 (Formerly 039.354) Identification, biology and ecology of weeds of agricultural importance in western Canada, including principles of cultural, mechanical, biological and chemical control. Topics include weed interference, effects of rotational and management practices on weed species composition, herbicide selectivity and mechanism of action, and emerging control technologies. Prerequisites: BIOL 1020 and BIOL 1030 or the former 071.125; AGRI 1500 (or 065.150); or consent of instructor.

PLNT 3560 Organic Crop Production on the Prairies Cr.Hrs.3 (Formerly 039.356) Management principles and practices involved in the production of organic field and forage crops with a focus on the Canadian Prairie region. Also available in online delivered format. Prerequisites: PLNT 2500 (or 039.250) and SOIL 3600 (or 040.360) or the former 040.351 or consent of instructor.

PLNT 3570 Fundamentals of Plant Pathology Cr.Hrs.3 (Formerly 039.357) An introduction to the science of plant pathology. Topics include causal agents of diseases, symptoms and diagnoses, modes of infections and spread, mechanisms in disease and control, effects of the environment on disease development, and methods of disease control. This course is a prerequisite for more advanced courses in plant pathology. Prerequisite: BIOL 2260 or the former BOTN 2210 (or 001.221)

PLNT 4270 Plant Disease Control Cr.Hrs.3 (Formerly 039.427) Diseases attacking field crops and horticultural plants: recognition of symptoms, methods of prevention, alleviation, and control. Prerequisite: PLNT 2500 (or 039.250) or consent of instructor.

PLNT 4310 Introductory Plant Genomics Cr.Hrs.3 An introduction to plant genomics including mapping and sequencing genomes, gene expression and transcriptome, comparative, functional and integrative genomics; also covers gene constructs and plant transformation and a wide ranging consideration of transgenic crop issues. Theory and practice of genomics will be examined. A laboratory will provide hands-on

experience with several genomic techniques. Not to be held with the former PLNT 4540 (or 039.454). Prerequisites: [PLNT 2520 (or 039.252) OR BIOL 2500 or the former BOTN 2460 (or 001.246)] and PLNT 2530 (or 039.253) or consent of instructor. (Laboratory Required).

PLNT 4330 Intermediate Plant Genetics Cr.Hrs.3 (Formerly 039.433) A study of gene behaviour as related to genetic analyses of data from plant populations; multiple allelic systems and polygenic inheritance of quantitative traits; extra-chromosomal inheritance and the significance of cytoplasmic influence. Examples will be drawn from experimental data where available. Prerequisite: PLNT 2520 (or 039.252) or BIOL 2500 or the former BOTN 2460 (or 001.246).

PLNT 4380 Plant Science Thesis Cr.Hrs.6 (Formerly 039.438) An independent research project under the supervision of a staff member. A thesis including a literature review, methods, results and discussion is required. Enrollment limited. Open only to students in their 4th year. Not to be held with SOIL 4080 (or 040.408). Prerequisite: Consent of department head.

PLNT 4410 Grassland Agriculture: Plant, Animal and Environment Cr.Hrs.3 (Formerly 039.441) Inter-relationships between the biological components of grassland agriculture as they relate to forage production on the Canadian Prairies. Topics include utilization by wild and domestic animals, plant community relationships and role of forages in multiple land use planning. This course also offered in Animal Science as ANSC 4410.

PLNT 4530 Woody Plants in the Prairie Landscape Cr.Hrs.3 (Formerly 039.453) Classification, identification, ecological characteristics, landscape characteristics and use of native and introduced woody plants found in the prairie landscape. The course will include the preparation of a landscape plan incorporating a selection of the plants studied. Offered in alternate years.

PLNT 4550 Developmental Plant Biology Cr.Hrs.3 (Formerly 039.455) An introduction to mechanisms regulating morphogenesis and plant growth and development. Emphasis will be on experimental approaches used to investigate pattern formation at sub cellular, cellular, tissue and organ levels. A heavy tissue culture component in the lab will implement the lecture topics and will provide new insights into ways to study plant development in vitro. Prerequisite: PLNT 3500 (or 039.350)

PLNT 4560 Secondary Plant Metabolism Cr.Hrs.3 (Formerly 039.456) An examination of secondary plant metabolism at the biochemical and molecular levels covering chlorophylls and haems, lipids, amino acids, phenolics, terpenes, and alkaloids. Biosynthesis, structure, and function of these metabolites will be put in context of their roles as hormones, plant defense compounds, pharmaceuticals, mitigators of environmental stresses, and regulators of cellular and organ physiology. Prerequisite: PLNT 3500 (or 039.350) or consent of instructor.

PLNT 4570 Research Methods in Plant Pathology Cr.Hrs.3 (Formerly 039.457) Course will provide practical training in plant pathology and will cover plant disease diagnosis, pathogen isolation, identification, inoculation, and storage. Molecular techniques currently used in the study of plant pathogens will be covered. The laboratory component aims at preparing students for a professional career in plant protection and research in plant pathology. Prerequisite: PLNT 3570 (or 039.357) or consent of instructor.

PLNT 4580 Molecular Plant-Microbe Interactions Cr.Hrs.3 (Formerly 039.458) Course will cover general principles and mechanisms related to plant-pathogen interactions, such as in gene-to-gene and toxin models. Emphasis will be on biochemical/molecular mechanisms of plant-microbe recognition, pathogenesis, and plant reactions to infections. Both beneficial and deleterious associations will be covered. Prerequisite: PLNT 3570 (or 039.357).

PLNT 4590 Physiology of Crop Plants Cr.Hrs.3 Concepts dealing with the physiological response of crop plants to the environment from the time of seed germination through to reproduction. Students may not hold credit for PLNT 4590 and the former 039.452. Prerequisites: CHEM 2770 (or 002.277) (M BIO 2770 (or 060.277)) or CHEM 2360 (or 002.236) (M BIO 2360 (or 060.236)); PLNT 3500 (or 039.350) or BIOL 2242 or the former BOTN 2010 (or 001.201) and BIOL 3450 or the former BOTN 2020 (or 001.202) or the former 001.230 (PLNT 3500 (or 039.350) recommended).

PLNT 4600 Issues in Agricultural Biotechnology Cr.Hrs.3 By lecture, group discussion, individual/group projects selected topics related to the introduction and application of modern biotechnologies in agriculture will be examined. Acquiring a critical appreciation of the multidimensional issues associated with the application of biotechnology will be the goal. Students must have completed 84 credit hours towards a degree, or permission of instructor. Prerequisite: PLNT 2530 (or 039.253).

PLNT 4610 Bioinformatics Cr.Hrs.3 An introduction to the theory, strategies, and practice of data management and analysis in molecular biology. Topics include DNA and protein sequence analysis, biological databases, genomic mapping, and analysis of gene expression data. The course will include problem-solving exercises using Unix server-based software. Prerequisite: PLNT 2530 (039.253) or the former 039.450 or PLNT 3140 (039.314) or M BIO 3410 (060.341) or consent of instructor.

5.1.9 Soil Science

SOIL 3060 Introduction to Agrometeorology Cr.Hrs.3 (Formerly 040.306) Basic description and discussion of properties of the atmosphere, radiation, temperature, effect of temperature on plant growth, climate and animal response, water, evapotranspiration, insect adaptation, activity in relation to climate, climatic data.

SOIL 3520 Pesticides: Environment, Economics and Ethics Cr.Hrs.3 (Formerly 040.352) A comprehensive examination of the benefits and risks of pesticide use. Topics include: Characteristics of pesticide products and formulations used in Western Canada; History, practice, successes and failures in the use of pesticides in agriculture; Pesticide use for protecting human health; Pesticide fate processes in air, soil and aquatic environments; Economical and environmental impact of pesticide application drift; Atmospheric pesticide contamination; Pesticide surface and groundwater con-

tamination; Pesticide toxicity to organisms, including humans; Pesticide residues in food; Pesticide regulations; Pesticide risk indicators; Alternatives to pesticides. Not to be held with 040.411, 038.454 or 040.454.

SOIL 3600 Soils and Landscapes in Our Environment Cr.Hrs.3 (Formerly 040.360) Discover why soil is an essential resource. Explore the roles of soils and landscapes within natural and agricultural ecosystems by learning the fundamental biological, chemical and physical properties and processes; soil and landscape classification and evaluation. Not to be held with 040.350 or 040.351.

SOIL 3610 Field methods in Land Resource Science Cr.Hrs.3 This course provides students with training in field methods used in soil science and related sciences (hydrology, meteorology, ecology, geomorphology, and environmental science). Students participate in a biophysical survey of a field site and in a study of the management, assessment and monitoring of land resources. Prerequisite: SOIL 3600

SOIL 4060 Physical Properties of Soils Cr.Hrs.3 (Formerly 040.406) Physical properties of soils and their relation to plant growth. Topics discussed include particle size distribution, soil water, soil structure, soil temperature, and soil aeration. Prerequisite: SOIL 3600 (or 040.360) or 040.350 or 040.351 or consent of instructor.

SOIL 4080 Soils Thesis Cr.Hrs.6 (Formerly 040.408) The student will prepare a thesis on a problem in soil science. Each student will give two seminars: the first will be a review of literature pertinent to his/her problem; the second, a presentation and interpretation of results of his/her research. Not to be held with PLNT 4380 (or 039.438). Prerequisite: Consent of department head.

SOIL 4130 Soil Chemistry and Mineralogy Cr.Hrs.3 (Formerly 040.413) Composition of soil materials. Reactions of nutrients and contaminants with soil organic matter, silicate clays, oxides and other soil constituents which affect their mobility and bioavailability. Prerequisite: SOIL 3600 (or 040.360) or 040.350 or 040.351 or consent of instructor.

SOIL 4400 Cr.Hrs.3 Explore the application of soil biology to diversity in agro ecosystems, response of soil organisms to management, mediation of important environmental issues, and promotion of human health. Appreciate the vast array of soil organisms and their functions in soil ecosystems, understand cycling of nutrients by soil organisms, and discover quantitative methodology in determining soil biochemical processes. The laboratory provides hands-on experience in observing, quantifying and isolating soil organisms and the biochemical processes they conduct. Prerequisite: SOIL 3600 (040.360).

SOIL 4500 Remediation of Contaminated Land Cr.Hrs.3 (Formerly 040.450) Physical, chemical and biological approaches to remediation of land including; nature of contaminants, procedures for assessing the extent of the impact, consequences to the environment, approaches to remediation and case studies of contaminant remediation. Prerequisite: SOIL 3600 (or 040.360) or 040.350 or 040.351 or consent of the instructor.

SOIL 4510 Soil and Water Management Cr.Hrs.3 (Formerly 040.451) Topics include: capability of land for agriculture; storage, movement and use of water; saline and alkaline soils; soil conservation including erosion; sustainability of soil organic matter; effect and fate of soil amendments. Prerequisite: SOIL 3600 (or 040.360) or 040.350 or 040.351.

SOIL 4520 Soil Fertility Cr.Hrs.3 (Formerly 040.452) Forms and behaviour of plants nutrients in soil; soil fertility evaluation and management, including fertilizer sources and practices. Prerequisite: SOIL 3600 (or 040.360) or 040.350 or 040.351.

SOIL 4530 Land Use and Environment Cr.Hrs.3 (Formerly 040.453) Biophysical land classification and management tools; land ratings; effect of land use on environment; policy and legislation effects in land management. Prerequisite: SOIL 3600 (or 040.360) or 040.350 or 040.351.

5.2 Diploma

5.2.1 Agribusiness and Agricultural Economics

ABIZ 0440 Agricultural Economics & Marketing 1 Cr.Hrs.4 (Formerly 061.044) Introduction to key economic concepts and business principles and their application to Canadian agribusiness.

ABIZ 0450 Agricultural Economics & Marketing 2 Cr.Hrs.4 (Formerly 061.045) The application of economic analysis in the study of marketing: concepts, policy, practices and institutions. Prerequisite: ABIZ 0440 (or 061.044).

ABIZ 0460 Financial Management 1 Cr.Hrs.4 (Formerly 061.046) Study of accounting principles and financial information for the preparation and presentation of financial statements to facilitate the management of farms and agricultural businesses.

ABIZ 0470 Financial Management 2 Cr.Hrs.4 (Formerly 061.047) Study of analysis of financial statements and financial information by decision makers managing the finances of farms and agricultural businesses. Prerequisite: ABIZ 0460 (or 061.046).

ABIZ 0680 Agribusiness Management Cr.Hrs.4 (Formerly 061.068) The application of economic, accounting and management principles to organizing, operating and managing an agribusiness

ABIZ 0690 Agricultural Finance and Credit Cr.Hrs.4 (Formerly 061.069) Application of financial management concepts in evaluating investment options and risk in farm and agribusiness decision-making. Prerequisite: ABIZ 0460 (or 061.046).

ABIZ 0700 Merchandising and Sales Cr.Hrs.3 (Formerly 061.070) Analyzing food consumption, farm input usage and marketing trends and translating these into effective selling and distribution programs. Examination of the selling function and sales management.

ABIZ 0710 Agricultural Policy Cr.Hrs.3 (Formerly 061.071) Review of agriculture, international trade and food safety policies affecting the production and distribution of agricultural commodities and food products.

ABIZ 0720 Farm Business Management Cr.Hrs.4 (Formerly 061.072) Application of decision making principles in terms of farm production, finance, and marketing. Prerequisites ABIZ 0470 (or 061.047).

ABIZ 0730 Financial Risk Management Cr.Hrs.3 (Formerly 061.073) Various approaches to managing market risk will be studied. This includes forward pricing, hedging and options along with insurance, diversification and technology to manage production risk. Prerequisites: ABIZ 0470 (or 061.047) or 061.047); or Pre- or Corequisite: ABIZ 0450 (061.045).

ABIZ 0740 Special Topics in Business Management Cr.Hrs.3 (Formerly 061.074) Selected topics of current interest in Business Management. Prerequisite: written consent of Director of the School of Agriculture.

5.2.2 Agriculture/Agricultural Finance

DAGR 0410 Communication and Learning Skills Cr.Hrs.4 (Formerly 065.041) A course designed to improve learning skills and abilities in written and oral communication.

DAGR 0420 Introductory Soils and Crops Cr.Hrs.4 (Formerly 065.042) Topics covered will include soil forming factors; soil characteristics, climate, nutrient supply and crop production, biology of crop plants, crop establishment and protection, harvest management, farming systems and crop rotations.

DAGR 0610 Advanced Communication and Rural Leadership Cr.Hrs.3 (Formerly 065.061) A course designed to improve leadership potential and understanding of the rural community.

DAGR 0630 Special Project Cr.Hrs.3 (Formerly 065.063) This project allows a student to make practical application of scientific knowledge acquired during the first year and/or to intensify the study of a topic of particular interest. A satisfactory report is required to qualify for credit. Students who intend to register for this course must obtain approval from the Director before the end of their first year.

DAGR 0660 Special Topics in General Agriculture Cr.Hrs.3 (Formerly 065.066) Selected topics of current interest in General Agriculture. Prerequisite: Written consent of Director of the School of Agriculture.

DAGR 0680 Management Planning Project 1 Cr.Hrs.3 (Formerly 065.068) Development of an objectives-driven plan that deals with production, personnel, marketing and financial management of a farm or off-farm business. Students may not hold credit for DAGR 0680 (or 065.068) and the former 065.064.

DAGR 0690 Management Planning Project 2 Cr.Hrs.5 (Formerly 065.069) Refinement of the plan developed in Management Planning Project 1 with emphasis on generating and analyzing a complete set of financial statements for a farm or off-farm business. Presentation of the management plan, in both written and verbal form. On-site visits will be used to illustrate and reinforce management principles and practices and address issues raised in class. Students may not hold credit for DAGR 0690 (or 065.069) and the former 065.065. Prerequisite: DAGR 0680 (or 065.068).

DAGR 0710 Agricultural Enterprise Cr.Hrs.3 (Formerly 041.071) On-site visits to various agricultural operations to illustrate and reinforce management principles and practices. Guest lectures will cover topics pertinent to the agricultural industry. Students may not hold credit for DAGR 0710 and DAGR 0690 (or 065.069) or the former 065.065.

DAGR 0720 Agricultural Industry Cr.Hrs.3 (Formerly 041.072) This course provides students with the opportunity to increase their awareness of agriculture and the agribusiness sector. The following will be emphasized: agriculture in other parts of the world, humane livestock practices, marketing of agricultural products, production of agricultural products for niche markets, and trade show. Students may not hold credit for DAGR 0720 and DAGR 0690 (or 065.069) or the former 065.065.

DAGR 0730 Case Studies in Institutional Lending 1 Cr.Hrs.4 (Formerly 041.073) Case studies will provide a primary look at assessing loan applications and determining financial need, production feasibility and repayment. Students will analyze lending portfolios and the management of various enterprises. Prerequisite: ABIZ 0470 (or 061.047). Pre- or Co requisite: ABIZ 0450 (or 061.045).

DAGR 0740 Case Studies in Institutional Lending 2 Cr.Hrs.4 (Formerly 041.074) This course is a continuation of Case Studies in Institutional Lending 1, and will examine and analyze more applications and financial statements of agricultural operations. Prerequisite: DAGR 0730 (or 041.073).

DAGR 0750 Money and Banking Cr.Hrs.3 (Formerly 041.075) Introduction to various financial institutions and the services they provide. Also, students will study interest rate determination, the Bank Act and money markets. This course is designed to provide an overview of the program of study in the Agricultural Finance option.

DAGR 0760 Agricultural Law Cr.Hrs.3 (Formerly 041.076) Discussion of the complexity of the agriculture industry and the laws affecting it. The course will illustrate laws critical for effective planning and the making of sound management decisions respecting the farm operations and agribusinesses. Topics include the Manitoba and Canadian legal systems, major laws affecting agriculture, and resolution of issues in Canadian agriculture. Offered in 2005-2006 and alternate years thereafter.

DAGR 0770 Tax Cr.Hrs.2 (Formerly 041.077) Examination of specific farm and agribusiness tax laws and filing procedures. Tax management strategies will also be discussed.

DAGR 0780 Succession and Estate Planning Cr.Hrs.2 (Formerly 041.078) An in-depth look at the legal requirements necessary for asset transfer and farm continuity. Topics include wills, asset divisions, tax planning, savings and opportunities.

DAGR 0790 Asset Appraisal Cr.Hrs.3 (Formerly 041.079) To learn the principles and concepts as they relate to the valuation of farm property, specifically, the process for various methods of appraisal of farm assets.

DAGR 0800 Intercultural Communications Cr.Hrs.2 (Formerly 041.080) A course designed to introduce written and verbal communication in a multicultural environ-

ment. Offered in 2006-2007 and alternate years thereafter.

DAGR 0810 Public Relations Cr.Hrs.2 (Formerly 041.081) Identification of and interaction with various public within an organization or business. Enhanced written and verbal communications. Offered in 2006-2007 and alternate years thereafter.

DAGR 0820 Business Writing Cr.Hrs.2 (Formerly 041.082) A course designed to enhance written business communications skills. Prerequisite: DAGR 0410 (or 065.041).

DAGR 0830 Agriculture Cooperative Education Work Term Cr.Hrs.2 Special five-month work assignment in business, industry, government or research for cooperative education students in the diploma program. Requires submission of a written report covering the work completed during the professional assignment.

5.2.3 Animal Science

ANSC 0420 Animal Biology and Nutrition Cr.Hrs.4 (Formerly 035.042) An introduction to animal structure and function. Genetics, growth and reproduction will be related to animal production. Further, the digestive systems of various livestock species will be studied and related to types of feedstuffs that each species can utilize. The general function of nutrients within animals will also be discussed. Nutrient content of feedstuffs and application to nutrient requirements will be discussed.

ANSC 0600 Animal Health and Welfare Cr.Hrs.3 (Formerly 035.060) This course will discuss the common livestock and poultry diseases of the prairie provinces. Emphasis will be placed on prevention through management and health programs but treatment of specific diseases will be addressed. Animal welfare as it relates to commercial animal production will be discussed. Prerequisite: ANSC 0420 (or 035.042) or equivalent.

ANSC 0670 Beef Cattle Production and Management Cr.Hrs.4 (Formerly 035.067) Beef cattle industry; the types of beef cattle enterprises and factors affecting profitability of production. Application of principles of nutrition, genetics and physiology in the management of beef cattle enterprises. Prerequisite: ANSC 0420 (or 035.042) or equivalent.

ANSC 0680 Dairy Cattle Production and Management Cr.Hrs.4 (Formerly 035.068) A study of current production practices in Canada's dairy industry with focus on nutrition, reproduction, genetics, health, replacement rearing and marketing. Prerequisite: ANSC 0420 (or 035.042) or equivalent.

ANSC 0690 Swine Production and Management Cr.Hrs.4 (Formerly 035.069) Swine industry; the types of swine enterprises and factors affecting profitability of production. Application of principles of nutrition, genetics and physiology in the management of swine. Prerequisite: ANSC 0420 (or 035.042) or equivalent.

ANSC 0700 Poultry Production and Management Cr.Hrs.4 (Formerly 035.070) The poultry industry; marketing system, breeding, hatchery practices, management and feeding of large scale turkey and chicken enterprises. Prerequisite: ANSC 0420 (or 035.042) or equivalent.

ANSC 0720 Special Topics in Livestock Management Cr.Hrs.3 (Formerly 035.072) Selected topics of current interest in livestock management. Prerequisite: Written consent of Director of the School of Agriculture.

ANSC 0730 Horse Production and Management Cr.Hrs.3 (Formerly 035.073) Principles of horse production, including genetics and breeding, reproductive management, nutrition and health. Applications to major sections of the horse industry. Prerequisite: ANSC 0420 (or 035.042) or equivalent.

5.2.4 Biosystems Engineering

BIOE 0222 Precision Agriculture Cr.Hrs.4 Precision agriculture is a philosophy of agricultural management that has been enabled by modern technology. This course will examine both the technology and the techniques that can be used to improve the efficiency of agricultural operations by decreasing costs, increasing profits, and decreasing hazards to the environment.

BIOE 0400 Farm Power Cr.Hrs.4 (Formerly 034.040) Basic operating principles of electric motors and gasoline, diesel, and LPG engines with emphasis on fuels, fuel systems, ignition systems, lubrication, and power transmission. Dynamometer tests for efficiency, traction, tractor testing, and power cost estimating.

BIOE 0600 Farm Machinery Cr.Hrs.4 (Formerly 034.060) Operating principles of basic farm implements with emphasis on seed cleaning, seeding, tillage, haying, and harvest machines including their selection, adjustment, efficiency, and cost of operation with respect to test data.

BIOE 0680 Shop Methods Cr.Hrs.4 (Formerly 034.068) Principles of operation of lathes, mills, drills, grinders and saws. Intensive instruction in the use of precision measuring tools. Laboratory project requiring the use of the above machines and tools.

BIOE 0690 Water Management Cr.Hrs.4 (Formerly 034.069) Surveying including use of the level instrument and steel tape, agricultural drainage, dugouts and wells for farm water supply, irrigation, pump selection, the Water Rights Act.

BIOE 0700 Agricultural Buildings and Environments Cr.Hrs.4 (Formerly 034.070) Factors that impact the practicality of farm buildings. Components of buildings, including materials and construction techniques. Techniques of maintaining building environments to facilitate production and/or storage.

BIOE 0710 Materials Handling and Electrical Controls Cr.Hrs.3 Fundamental concepts and systems approach to storing, conditioning, moving, processing, and metering of agricultural produce. Principles and practices of fans, grain drying, dust control, and electrical supply. Students may not hold credit for BIOE 0710 and the former 034.066.

5.2.5 Entomology

ENTM 0610 Beekeeping Cr.Hrs.2 (Formerly 038.061) Introduction to beekeeping

that includes economics and marketing of honey and beeswax, equipment and its construction, pollen and nectar plants, pollination, management systems, diseases and pests, honey handling, package bees, wintering of bees, etc.

ENTM 0620 Pest Management and Farm Insects Cr.Hrs.4 (Formerly 038.062) Characteristics, damage, and identification; insecticide use and safety; life histories and control of common Manitoba livestock, field and farmyard insects. General principles of pest management in agriculture will also be discussed.

5.2.6 Plant Science

PLNT 0410 Cereal and Oilseed Production Practices Cr.Hrs.4 (Formerly 039.041) Production practices for wheat (spring and winter), barley, oats, rye, triticale, canola and flax will be discussed, including tillage, seeding, fertility, pest control, harvesting, rotation and utilization. Prerequisite: DAGR 0420 (or 065.042).

PLNT 0660 Plant Propagation Cr.Hrs.4 (Formerly 039.066) Basic principles and practices in the propagation of plants by sexual and asexual methods. Special emphasis will be placed on regionally important horticultural crops. Equivalent course offered through the Prairie Horticulture Certificate Program; contact the Director of the School of Agriculture.

PLNT 0670 Landscape Plants Cr.Hrs.3 (Formerly 039.067) Classification, identification and quality characteristics of woody and herbaceous plants, and their value and use in the landscape. Equivalent course offered through the Prairie Horticulture Certificate program; contact the Director of the School of Agriculture.

PLNT 0680 Landscape Design Cr.Hrs.3 (Formerly 039.068) A study of landscape design principles and processes including contracting, construction, and establishment of plants in the environment. Equivalent course offered through the Prairie Horticulture Certificate program; contact the Director of the School of Agriculture.

PLNT 0690 Landscape Maintenance Cr.Hrs.3 (Formerly 039.069) Establishment and maintenance of trees, shrubs, herbaceous plants and turf grass in the landscape environment. Equivalent course offered through the Prairie Horticulture Certificate program; contact the Director of the School of Agriculture.

PLNT 0700 Nursery Management Cr.Hrs.3 (Formerly 039.070) A study of nursery methods of propagation and growing as they relate to bare root, container and caliper tree production in Manitoba. Equivalent course offered through the Prairie Horticulture Certificate program; contact the Director of the School of Agriculture.

PLNT 0710 Greenhouse Crop Production Cr.Hrs.3 (Formerly 039.071) A study of greenhouse construction, environmental control, growth regulation and special problems relating to cut flowers, pot and foliage plants, bedding plants, vegetables and woody plants. Equivalent course offered through the Prairie Horticulture Certificate program; contact the Director of the School of Agriculture.

PLNT 0730 Commercial Vegetable Production Cr.Hrs.3 (Formerly 039.073) Production problems and practices, environmental considerations, and the storage and marketing of the major vegetable crops. Equivalent course offered through the Prairie Horticulture Certificate program; contact the Director of the School of Agriculture.

PLNT 0740 Commercial Fruit Production Cr.Hrs.3 (Formerly 039.074) Cultural steps involved in the commercial production of tree fruits and small fruits with specific reference to Manitoba conditions. Equivalent course offered through the Prairie Horticulture Certificate program; contact the Director of the School of Agriculture.

PLNT 0750 Forage and Pasture Management Cr.Hrs.4 (Formerly 039.075) For forage crops and the continuum of improved and unimproved pasture land a discussion of production practices including: choice of species and cultivars of forage crops, cultural management including tillage practices, pest control, forage harvesting, grazing management and seed production. Prerequisite: DAGR 0420 (or 065.042).

PLNT 0760 Special Crops Cr.Hrs.4 (Formerly 039.076) Production practices of special crops for Manitoba including: quality and grade, crop and cultivar selection, cultural requirements including tillage, pest control, fertility requirements, harvesting, rotation and utilization. Prerequisite: DAGR 0420 (or 065.042).

PLNT 0770 Weed Management Cr.Hrs.4 (Formerly 039.077) General principles of pest management and pesticide use safety as they relate to weed control. Economic importance, principles of cultural, biological and chemical weed control, weed identification, introduction to herbicides and factors influencing their use and selectivity. Prerequisite: DAGR 0420 (or 065.042).

PLNT 0780 Plant Disease Management Cr.Hrs.4 (Formerly 039.078) General principles of pest management and pesticide use safety as they relate to plant disease control. Discussion of diseases attacking field and horticultural crops in the prairies including: disease symptoms, cycles, prevention and control. Prerequisite: DAGR 0420 (or 065.042).

PLNT 0790 Landscape Horticulture Cr.Hrs.4 (Formerly 039.079) Principles of the production and use of horticultural plants in the rural and urban landscape including the establishment and value of shelterbelts. Topics include basic plant propagation, the principles of choosing and establishing ornamental trees, shrubs, herbaceous perennials, annuals, lawns, and multi-use fruit-bearing plants in the landscape, and development of a landscape plan.

PLNT 0800 Diversification with Horticultural Crops Cr.Hrs.4 (Formerly 039.080) Principles of the production and unique characteristics of horticultural crops including potato, vegetable, fruit, herb, spice, and nutraceutical. The potential for diversifying into and adding value to these alternate crops is examined.

PLNT 0810 Special Topics in Crop Management Cr.Hrs.3 (Formerly 039.081) Selected topics of current interest in Crop Management. Prerequisite: written consent of the Director of the School of Agriculture.

PLNT 0820 Organic Crop Production on the Prairies Cr.Hrs.3 (Formerly 039.082) Management principles and practices involved in the production of organic field and forage crops with a focus on the Canadian Prairie Region. Prerequisites: DAGR 0420 (or 065.042), PLNT 0410 (or 039.041), SOIL 0420 (or 040.042), and ENTM 0620 (or

038.062) or consent of the instructor.

5.2.7 Soil Science

SOIL 0420 Soil Productivity and Land Use Cr.Hrs.4 (Formerly 040.042) Soil classification systems; soils of Manitoba and their properties; soil productivity and its maintenance; soil fertility and testing, fertilizer recommendations; environmental concerns. Prerequisite: DAGR 0420 (or 065.042).

SOIL 0620 Soil Conservation and Management Cr.Hrs.4 (Formerly 040.062) Land capability for agriculture; storage, use of water and water use efficiency; saline and al-

kaline soils; soil acidity; soil erosion and conservation; tillage, cropping systems and rotations; fate of biosolids, pesticides. Prerequisite: SOIL 0420 (or 040.042).

SOIL 0630 Soil Fertility Cr.Hrs.4 (Formerly 040.063) Soil nutrients and their behaviour; evaluation of soil fertility including soil testing for precision agriculture; crop response to fertilizers; manufacture, properties, reactions and applications of fertilizer. Prerequisite: SOIL 0420 (or 040.042)