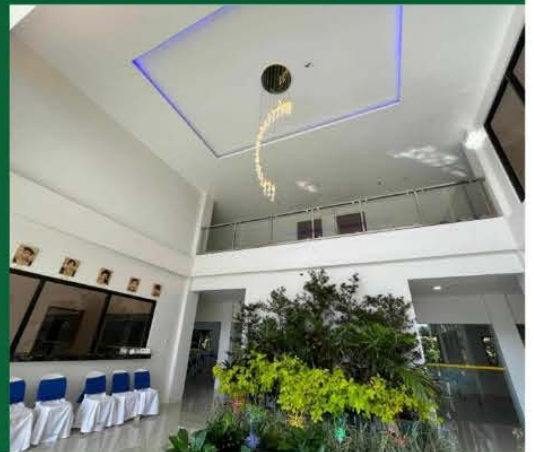




University of the Philippines  
**LOS BAÑOS**



**Graduate School**



# GRADUATE SCHOOL

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## INTRODUCTION

### Brief History

Graduate programs at the University of the Philippines Los Baños (UPLB) started as early as 1913 under the College of Agriculture. One graduate student of the College was awarded the degree of Master of Science in agricultural chemistry during that year. Graduate studies in the University of the Philippines were then supervised by the University Graduate Committee which administered the graduate programs of all the units of the University.

Realizing the need for more adequate instruction at the graduate level, the Board of Regents established the University Graduate School headed by a dean on 26 October 1950. Under this set-up, the UP Graduate School administered the graduate program at Los Baños through a subcommittee. The dean of the College of Agriculture was the *ex-officio* chairman of this subcommittee. Within the next few years, curricular offerings at Los Baños continued to expand and enrollment increased. The first PhD graduate obtained their doctoral degree in soil science in 1962-63. To cope with the expansion, the Office of the Director of Graduate Studies was created in January 1970.

The field of higher education took a historic step on 20 November 1972 when Presidential Decree No. 58 was issued. This decree authorized the UP Board of Regents to establish a University of the Philippines System, including an autonomous University of the Philippines at Los Baños. Consequently, a full-fledged and distinct UPLB Graduate School was established on 21 December 1972.

### Purpose

The Graduate School administers all graduate programs of UPLB. Graduate studies at UPLB aim to develop the ability of students for critical inquiry and independent research towards the advancement of knowledge as well as to develop professional leadership. Besides paving the way to specialization in selected fields, graduate work is designed to encourage independent work and to promote research. Graduate students, therefore, are admitted to candidacy for a degree only after demonstrating distinct ability in graduate work.

### Organization

Graduate studies are supervised by more than 500 graduate faculty members from the nine different colleges and one school of UPLB. It is headed by the dean who, with the assistance of the college secretary, implements the policies, rules, and regulations of the Graduate School. The dean is advised by the Graduate Academic Advisory Council composed of the deans of the different colleges and the chairs of the standing committees of the Graduate School. Graduate students constitute about 10% of the UPLB student population.

## Degree Programs Offered

The Graduate School offers twelve (12) degree programs:

- Doctor of Philosophy (PhD)
  - a) Regular PhD
  - b) Straight PhD
  - c) PhD by Research
  - d) Dual PhD by Research

- Master of Agriculture (MAgr)
- Master of Arts (MA)
- Master in Communication Arts (MCA)
- Master of Development Management and Governance (MDMG)
- Master of Forestry (MF)
- Master of Information Technology (MIT)
- Master of Management (MM)
- Master in Public Affairs (MPAf)
- Master of Science (MS)
- Master of Professional Studies (MPS)
- Master in Veterinary Epidemiology (MVE)
- Professional Masters

## ADMISSION

### Requirements

Applicants for admission to graduate work for the master's degree must be holders of bachelor's degree or its equivalent from any recognized institution. For the regular Doctor of Philosophy degree, applicants must have a master's degree or its equivalent from any recognized institution. Admission requirements to the Straight PhD program and PhD by Research program are listed on pages 167.

A duly accomplished application form must be submitted to the Graduate School together with the following documents:

- a) One official/original and a photocopy of transcript of record, in English language, for each college previously attended. Transcript of record should not have remarks such as "for employment/ for evaluation/ for reference only or not valid for transfer". Remarks should be graduated with a degree or granted honorable dismissal by the school;
- b) Two letters of recommendation from former professors. If with a master's degree, a third letter of recommendation from the major professor is required.
- c) Proof of English proficiency is required for international applicants from countries where English is not the medium of instruction and/ or not the native language;
- d) A nonrefundable application fee of P500 for Filipino citizens or US\$40 for foreign nationals in bank draft or money order remitted to the Graduate School.

The Graduate School and the individual programs reserve the right to require additional information or documents from an applicant when deemed necessary. All application materials become part of the permanent records of UPLB and will not be returned to the applicant.

**International Applicants**

If English is not the medium of instruction or the TOEFL score is below 500 (250 Computer-Based) or IELTS is below 5.5, an applicant is required to take the English Proficiency Examination (EPE) in UPLB. This is to determine their level of proficiency.

The fee for EPE is P250. If the applicant's level of proficiency is Level A, they are required to take the Level A English Intensive Course offered by the Language Instruction Towards Excellence (LITE) Program.

**Application Deadlines**

All documents must be received by the Graduate School not later than 30 May for First Semester (August) admission, and 30 October for Second Semester (January) admission.

**Incomplete Applications**

Applications lacking the required documents will not be processed until after all the papers are received by the Graduate School. Processing will then commence at the earliest succeeding evaluation period.

**Evaluation of Applications**

The complete set of application documents of an applicant is forwarded to the Graduate Admissions Committee of the appropriate program for evaluation. The committee, upon careful review of the academic credentials of the applicant, submits its recommendations, with endorsement of the department chair or institute director to the dean of the Graduate School for approval. The Graduate School then informs the applicant of the action taken.

**Admission Categories**

An applicant to a degree program may be admitted on either regular or probationary status. Regular admission is offered to an applicant whose academic records and supporting documents indicate that they are qualified to undertake graduate study in their chosen field.

Probationary admission is offered to an applicant whose academic records and supporting documents indicate deficiencies but show promise of success in graduate study. An applicant must meet the specific requirements of their admission before their probationary status can be changed to regular. An applicant who fails to meet the terms of probationary admission is disqualified from the intended program of study.

**Deferment of Admission**

An applicant who cannot enroll in the semester for which admission was offered may send a written request to the dean of the Graduate School to have their admission deferred for a period not exceeding one year. If the request is approved, the student cannot register for graduate course work as a non degree or special student in UPLB while their deferment is in effect.

**Non-regular Admission**

An applicant for non degree or special programs may be offered admission to the Graduate School but not to any graduate degree program upon recommendation of the Graduate Admissions Committee of the department for which the applicant intends to enroll courses. The recommendation must be endorsed by the department chair and approved by the dean of the Graduate School. An applicant admitted on non degree status may take a maximum of 12 units of course work for credit but shall not be allowed to enroll for more than one semester, except by special permission of the dean of the Graduate School and the Registrar. An applicant admitted on special status shall not be allowed to enroll for more than 9 units a semester or to register for more than 2 years, except by special permission of the dean of the Graduate School; subjects taken shall not be credited.

**Readmission**

An applicant offered readmission to a degree program shall undergo the same procedure as that of a newly admitted graduate student. Applications for readmission to a graduate program can be made only once.

**Applicants not admitted**

Applicants who are denied admission due to lack of preparatory or fundamental courses in the intended graduate program of study may have their applications reconsidered only after submission of additional documents not submitted at the time of original evaluation. Applicants denied admission due to poor academic credentials are discouraged from reapplying for admission.

**Non-registration**

A student who does not register in the current semester without an approved leave of absence or does not return from an approved leave of absence is considered to have withdrawn without official leave from the Graduate School. As such the student's degree status shall be discontinued.

**Reinstatement**

A graduate student whose degree status was discontinued may petition the dean of the Graduate School to be reinstated for the semester in which the decision to discontinue their status was taken. Such a petition requires a reinstatement fee.

**Fees and Financial Assistance**

Application Fee/Deferment Fee  
(Filipino): 500/200 PhP  
(International): 40/15 USD  
Leave of Absence: 300 PhP  
Reinstatement Fee: 500 PhP  
Certification: 50 PhP per copy  
Graduation Fee and English Translation of  
Diploma: 600 PhP  
True Copy of Grades /Certificate of Completion: 50 PhP

For International Students only  
 Graduate Education Development Fee (GEDF):  
 Summer: 200 USD  
 Semester: 500 USD  
 For Residency Only: 100 USD

## Refunds

A student who has paid their matriculation fees and who withdraws their registration or is granted honorable dismissal or leave of absence shall be entitled to a refund of their matriculation fees, except entrance and registration fees, in accordance with the following schedule:

Before the opening of classes: 100% Within 1 week from the opening of classes: 80% Within 2-4 weeks from the opening of classes: 50% After the fourth week: No refund

Laboratory fees will not be refunded after 1 week from the opening of classes where voluntary change is made from one course to another. Refund of tuition for a subject may be allowed only in the case of forced dropping of the subject.

## FINANCIAL ASSISTANCE

### Study Privileges for UP Personnel and Dependents

1. All full-time university personnel shall be entitled to 100% waiver of tuition and miscellaneous fees (except student fund fees) in any UP college or unit. This applies to full-time personnel-permanent or temporary, regular incumbents or substitutes, casual or contractual, including project personnel, regardless of the source of funds for their salaries as long as the funds either belong to the regular budget of the University or are institutional grants to the University, provided only that their appointments issued by the University are at least coextensive with the semester or term.

2. All regular part-time faculty (with at least 1 year of continuous service) shall be entitled to 100% waiver of tuition and miscellaneous fees (except student fund fees) in any UP college or unit provided the field of study is one of the academic thrusts of the faculty member's home department or college. This applies to all part-time faculty-permanent or temporary, regular incumbents, or substitutes.

### National and International Sources of Scholarships/ Grants

Graduate students who do not avail of reduced fee privileges carry their own source of financial support or grant.

#### National

1. Agricultural Support Services Projects (ASSP)
2. Abra State Institute of Science and Technology Faculty Development Program (ASIST)
3. Bureau of Forest Development (BFD)
4. Bicol University (BU)
5. Benguet State College (BSC)
6. Bukidnon State University (BSU)
7. Central Luzon State University (CLSU)
8. Central Mindanao University (CMU)
9. Catanduanes State College (CSC)
10. Cagayan State University (CSU)

11. UPLB Foundation Incorporated (FI)
12. Dingle Agricultural and Technical College (DATEC)
13. Don Severino Agricultural College (DSAC)
14. Dansalan College Staff Development Program (DCSDP)
15. Department of Environment and Natural Resources (DENR)
16. Dr. Emilio B. Espinosa Sr. Memorial Agricultural College (DEBESMAC)
17. Department of Science and Technology (DOST)
18. Ecosystems Research and Development Bureau (ERDB)
19. Forest Products Research and Development Institute (FPRDI)
20. Farming System Development Project (FSDP)
21. Farming Systems and Soil Resources Institute (FSSRI)
22. Grants-in-Aid, UPLB (GIA, UPLB)
23. Institute of Plant Breeding (IPB)
24. Iloilo National College of Agriculture (INCA)
25. Ifugao State College of Agriculture and Forestry (ISCAF)
26. Mariano Marcos State University (MMSU)
27. Mindanao State University (MSU)
28. National Food and Agriculture Council (NFAC)
29. Negros Occidental Agricultural College (NOAC)
30. Nueva Viscaya State Institute of Technology (NVSIT)
31. Pampanga Agricultural College (PAC)
32. Panay State Polytechnic College (PSPC)
33. Palawan National Agricultural College (PNAC)
34. Philippine Association of State Universities and Colleges (PASUC)
35. Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD)
36. Philippine Rice Research Institute (PHILRICE)
37. Philippine Sugar Institute (PHILSUGIN)
38. Pangasinan State University Faculty Development (PSUF)
39. Philippine Training Center for Rural Development (PTCRD)
40. National Tobacco Administration (NTA)
41. Philippine Veterans Administration Office (PVAO)
42. Tarlac College Joint Projects (TAC)
43. Tarc Special Joint Projects (TARC)
44. University of Eastern Philippines (UEP)
45. University of Southern Mindanao (USM)
46. University of Southern Philippines (USP)
47. University of the Philippines Alumni Association Fonacier (UPCAAF)
48. University of the Philippines Visayas (UPV)
49. Visayas State College of Agriculture (ViSCA)

#### International

1. Asian Development Bank (ADB)
2. Agricultural Development Council (ADC)
3. Association of Southeast Asian Nations (ASEAN)
4. Bangladesh Agricultural Research Institute (BARI)
5. Canadian International Development Assistance (CIDA)
6. Centro Internacional Mejoramiento de Mais YTrigo (CIMMYT)
7. Food and Agriculture Organization (FAO)
8. German Foundation for International Development (DSE)
9. International Development Research Centre (IDRC)
10. International Potato Center (CIP)
11. International Rice Research Institute (IRRI)
12. Indonesian Government
13. Mandala Development Corporation (MADECOR)
14. Mary Blythe Petersen Marsman Scholarship (MARSMAN)

15. Midwestern University Consortium for International Assistance
16. Netherlands University Foundation for International Cooperation (NUFFIC)
17. Sacred Divine Mission Council (SDVM)
18. SEAMEO Regional Center for Graduate Study and Research in Agriculture (SEARCA)
19. United Nations Development Programme (UNDP)
20. United States Agency for International Development (USAID)
21. WINROCK International
22. World Bank
23. United Mission to Nepal (UMN)
24. World Health Organization (WHO)

## ACADEMIC REGULATIONS AND DEGREE REQUIREMENTS

It is the student's responsibility to become familiar with the academic regulations and degree requirements of the Graduate School as well as the special requirements of their academic program. A manual on the policies, rules, and regulations is available online or for a minimal fee at the Graduate School. Other information may be obtained from the Graduate School Catalog or the UPLB Catalog.

### Academic Freedom

The University has the right and the responsibility to exercise academic freedom. Academic freedom is both institutional and individual. Institutional academic freedom is freedom of the university from intervention and control in the conduct of its affairs as a university. Individual academic freedom is the right of the academic staff and students to conduct academic and scholarly inquiry and to discuss and publicize the results of such inquiry unhampered by prior restraint or subsequent punishment.

### Student's Pledge

Every student shall, upon admission, sign the following pledge: "In consideration of my admission to the University of the Philippines Los Baños and of the privileges of a student in this institution, I hereby promise and pledge to abide by and comply with all the rules and regulations laid down by competent authority in the University and in the college or school in which I am enrolled." Refusal to take this pledge or violation of its terms shall be sufficient cause for summary dismissal or denial of admission.

### Graduate Courses

Graduate credits may be earned in courses numbered 201 to 399; those numbered 301 to 399 are for PhD students only. Courses numbered 300 are for master's thesis while those numbered 400 are for PhD dissertation. Advanced undergraduate courses numbered 100 to 199 may be taken for graduate credit only upon recommendation of the student's guidance or advisory committee, endorsed by the department chair or institute director, and approved by the dean of the Graduate School.

### Academic Standards

A regular graduate student must maintain a weighted average grade of 2.00 or better in all courses prescribed in their approved plan of course work. Failure to do so disqualifies the

student from earning the degree to which they were admitted.

A graduate student on provisional admission status must obtain an average of 2.00 or better in at least 9 units of graduate courses in their area of specialization during their first semester of admission to have their status changed to regular. Failure to meet this criterion disqualifies the student from admission to the intended degree program.

If the student fails to obtain grades which carry graduate credit as required by the Graduate School, the university rules on scholastic delinquency shall be applied.

### Transfer of Credit

A duly matriculated graduate student may apply for advanced credits or transfer credits for work done in another institution upon:

- a) presentation of credentials showing that they have passed, in another institution, courses fully equivalent to those given in the UPLB Graduate School for which credit is sought; and
- b) passing the validating test given, if necessary, by the department concerned.

Not more than 9 units of advanced credit or transfer credit may be granted a student for course work done towards the graduate degree, unless course work is done in another institution of higher learning with prior approval of a duly constituted guidance or advisory committee. Application for advanced credit should be filed with the Graduate School during the first semester of residence.

No transfer credit shall be given for work that has been credited to any other degree.

## Southeast Asian University Consortium for Graduate Education in Agriculture and Natural Resources

### Background

The Southeast Asian University Consortium for Graduate Education in Agriculture and Natural Resources was launched on 19 September 1989. Five leading agricultural universities in Southeast Asia committed to share their academic facilities and strengths in the implementation and enrichment of top-quality graduate degree programs in agriculture and natural resources. The free exchange of information, facilities, and expertise among the universities is expected to improve teaching, research, and extension work in agriculture and related sciences, thereby benefiting the whole region.

### Objective of the Consortium

To share scarce resources and expertise existing at agricultural universities in Southeast Asia to enhance graduate education and research in the region.

### Founding Members

Institut Pertanian Bogor (IPB)  
Bogor, Indonesia



Universitas Gadjah Mada (UGM)  
Yogyakarta, Indonesia

Universiti Pertanian Malaysia (UPM)  
Serdang, Malaysia

University of the Philippines Los Baños (UPLB)  
Los Baños, Philippines

Kasetsart University (KU)  
Bangkok, Thailand Associate Members

University of Queensland (UQ)  
Brisbane, Australia

University of British Columbia (UBC)  
Vancouver, Canada

## Program Components

Student Exchange is one of the five program components.

SEAMEO SEARCA scholars and other graduate students in agriculture and related fields of any Consortium member university are considered consortium students. To enrich the quality of their graduate degree programs, consortium students are given the opportunity to cross-enroll in another Consortium member university whose academic strength lies in the student's field of specialization. The student is thus exposed to the graduate educational system in neighboring countries. Their outlook and professional competence are improved through the solid educational support from the host university. To facilitate student exchange, the Consortium universities have identified their programs of strength and potential. The universities are committed to offer courses in English in these programs, whenever the needs of Consortium students warrant it.

Students who go on exchange will pay tuition and other fees to their home institution.

Catalogs on Consortium courses and research expertise, library resources, and faculty are available at all Graduate Schools of each Consortium university. Students interested to go on exchange may inquire from their respective University Consortium coordinators. Other components of the University Consortium are thesis grants, faculty visits, professorial chairs, and research fellowship.

## MASTER'S DEGREE

### General Rules and Requirements

#### Guidance Committee

A student on regular status, in consultation with the chair of the department in which they wish to do their major work, selects their major professor who shall serve as chair of the guidance committee. Not later than two months after registration, the student, in consultation with the major professor, selects two or three other members of their committee. One member shall represent their minor or supportive field, and the chair and other members shall come from the major field. Membership in the guidance committee shall be limited to graduate faculty members and shall be with the mutual consent of the individuals selected to serve.

### Changes in Committee Composition

A student may request a revision in composition of their guidance committee upon endorsement of the department chair or institute director and in consultation with the professor concerned for approval by the dean of the Graduate School.

### Residence Requirement

A minimum of two semesters of residence are required for the master's degree. A student is in residence when they are registered for course work on campus, or work in absentia with due approval in advance by their guidance committee.

### Course Work Requirements

The Graduate School offers two types of master's degree programs: without thesis or with thesis.

#### a) Master's Degree Without Thesis

*Master of Communication Arts* - a minimum of 36 units of course work and 1 unit of seminar are required; 6 units are for core courses; at least 18 units must be in the major field; and at least 12 units must be in the minor field.

*Master of Agriculture* - a minimum of 36 units of course work and 1 unit of seminar are required; at least 27 units must be for courses above the 200 level; at least 24 units must be in the major field; and at least 12 units must be in the minor field.

*Master of Development Management and Governance* - a minimum of 31 units are required which include 15 units prescribed courses; 9 units chosen from the courses under each stream of specialization; 3 units for an elective; 3 units for field study; and 1 unit seminar.

*Master of Forestry* - a minimum of 30 units of course work and 1 unit of seminar are required; at least 24 units must be for courses above the 200 level; 18 to 21 units must be in the major field; and 9 to 12 units must be in the minor field.

*Master of Information Technology* - a minimum of 37 units of course work, 28 units of which are core courses and 9 units are elective courses.

*Master of Management* - a minimum of 36 units of course work and 1 unit of seminar are required; at least 27 units must be for courses above the 200 level; 9 units are common to all students; and a 3-unit field study is required.

*Master of Professional Studies* - a minimum of 36 units of course work and 1 unit of seminar are required; at least 18 units must be for courses above the 200 level.

*Master of Public Affairs* - a minimum of 31 units of course work; 13 units of which are common for all areas of specializations; 12 units for required courses; and 6 units for elective courses.

*Master in Veterinary Epidemiology* - a minimum of 30 units of course work, at least 18 units of major courses, 3 units of special topics, 6 units of field project and 3 units elective.

## b) Master's Degree With Thesis

*Master of Arts* - a minimum of 24 units of course work, 1 unit of seminar, and 6 units of thesis are required; at least 18 units must be for courses above the 200 level; at least 15 units must be in the major field; and at least 9 units must be in the minor field.

*Master of Science* - a minimum of 24 units of course work, 1 unit of seminar, and 6 units of thesis are required; at least 18 units must be for courses above the 200 level; at least 15 units must be in the major field; and at least 9 units must be in the minor field.

The cumulative units to be credited for courses numbered 290/291 and 299 should not exceed 6 and 2 units, respectively.

### English Language Requirement

International students whose English proficiency is Level A as determined from the English Proficiency Examination are required to present a certificate of English proficiency issued by the Language Instruction Towards Excellence (LITE) Program of the College of Arts and Sciences. The Graduate School monitors the fulfillment of the English language requirement and this must be satisfied prior to taking the general (for thesis programs) or final examination (for non-thesis programs).

### Official Plan of Study

Within the first semester of residence, a regular student must confer with their guidance committee to draw up their proposed plan of study which includes a detailed listing of the courses, and transfer of courses, if any, that they are proposing for the fulfillment of the degree requirements. A form is available in the Graduate School office. The proposed plan of study must be recommended by their guidance committee and endorsed by the department chair or institute director to the dean of the Graduate School for approval. Once approved, this becomes the official program of study and must be fulfilled in every detail to meet graduation requirements.

### Change in the Approved Plan of Study

A student who needs to revise their official plan of study may file a petition, upon recommendation of their guidance committee and endorsement of the department chair or institute director, to the dean of the Graduate School for approval. Any change in the official program should first be approved before courses to be deleted, added, or replaced are registered.

### Grade Requirement

A student must obtain a weighted average of "2.00" or better for all courses prescribed by their guidance committee under the major and minor fields to qualify for the final or general examination, whichever is applicable. They must also obtain "passing grades" in all other courses in which they enrolled.

### Course Examination

The course examination for master's degree without thesis is called final examination while that for the master's degree with thesis is called general examination.

Specific programs may have additional departmental course examination requirements.

After completing all the academic course requirements with an average grade of "2.00" or better, the student should submit their application for course examination, duly recommended by their guidance committee and noted by the chair of the major department or institute director, to the dean of the Graduate School for approval at least one month before the date of the examination. This examination, which is to be given by the guidance committee, shall test the student's competence in integrating knowledge in their major and minor fields and shall be based on all courses prescribed for the student. It shall be oral in form to be supplemented, if desired by the committee, with a written examination.

To pass the examination, a unanimous vote of the committee, all present and voting, is required. A student who fails this examination may be given one re-examination upon unanimous approval of the committee, at least one month but not later than 1 year after the first examination.

Failure to pass the second examination disqualifies the student permanently from earning the degree.

The chair of the committee shall submit a report of the result in a prescribed form to the dean of the Graduate School within one week after the examination.

### Master's Thesis

For MA and MS degrees only. After earning at least 12 units of courses with graduate credit, a student may be authorized to work on their thesis. A thesis outline must be approved by the guidance committee before actual research may be done. The student shall submit to the Graduate School the approved title and outline of the thesis.

The master's thesis shall have an equivalent of 6 units of graduate credit and shall have a numerical grade upon completion. The six (6) units of thesis shall be registered in three terms for two units each term (2-2-2) or two terms for three units each term (3-3).

A student who has already registered a total of six (6) units for thesis but still unable to finish the work should register one unit per term until they are able to submit the copies of approved manuscript, but only up to a maximum of six (6) terms (4 semesters, 2 summers). If at the end of this time limit, the student is still unable to submit copies of the approved manuscript, they shall be given a grade of "U" and should re-enroll all the six units of thesis. The same policies on how to enroll the number of thesis shall apply. However, a student who is a candidate for graduation during the semester and only has thesis to enroll may be allowed to register the whole six units total credit.

Copies of the completed and editorially acceptable thesis draft shall be submitted to the student's guidance committee for critique, evaluation, and suggestions for improvement. It shall be the responsibility of the adviser to ensure that final copies conform to the format prescribed by the Graduate School.

The thesis shall be subjected to external review. The dean of the Graduate School appoints an external reviewer from three

nominees recommended by the guidance committee.

The external reviewer shall have expertise along the student's field of study and shall come from outside the student's major department. The external reviewer is required to submit an independent report to the dean that indicates a recommendation for either acceptance or rejection of the thesis with explanation based on the critical review and evaluation that they have made.

The guidance committee certifies to the publishable quality of the thesis--that the thesis is suitable for publication in a journal that practices a thorough and credible review process.

The student is required to submit to the dean one article based on the thesis and written in a format that is ready for publication in a refereed journal.

Three copies of the thesis manuscript and an e-copy in PDF and in Word format must be submitted to the dean of the Graduate School not later than the deadline set for submission of all requirements for graduation.

Three copies of the thesis shall be distributed as follows: one copy each for the major department, major adviser, and the UPLB Graduate School.

### **Work in Absentia**

The thesis of a candidate may be done in absentia with the approval of the guidance committee if their research can be better done outside UPLB. In such cases, the candidate working in absentia shall make periodic reports of their progress to their thesis adviser.

### **Final Examination**

*For MA and MS degree programs only.* The student shall be given an oral examination on their thesis by their guidance committee. The thesis adviser shall be the chair of the examining committee.

The candidate may apply for the examination when their thesis is complete and in a form acceptable to their guidance committee as indicated by their recommendation for approval of the application for final examination.

The application for final examination, duly recommended by their guidance committee and noted by the chair of the major department or institute director, and a copy of the final draft of the thesis shall be submitted to the dean of the Graduate School at least two weeks before the examination. The candidate must also submit a copy of the final draft of their thesis to each member of their committee.

To pass the examination, the student must receive not more than one negative vote from the committee. A student who fails the examination may be given a re-examination upon unanimous approval of the committee. Failure to pass this second examination shall disqualify the student permanently from earning the degree.

The chair of the examining committee shall submit a report on the result of the examination to the dean of the Graduate School on a prescribed form not later than the working day following the examination.

### **Time Limit for Earning the Master's Degree**

The maximum time allowed for the completion of the master's degree is five years. The 5-year period begins with the earliest course work listed in the official plan of study, including validated and/or transfer courses.

### **Extension of Residency**

A student who was not able to complete the requirements for the degree within the time limit of their residence may apply for an extension of residency provided the student has satisfied all the following conditions:

- a) has completed all coursework requirements based on the approved plan of course work with a GWA of 2.00 or better;
- b) has already passed the general examination and has a recommending approval of their Guidance Committee

Students must apply for extension at least one month before reaching maximum residency. Upon approval, a formal notice of extension will be sent to the student and their Guidance Committee. Prescription of additional courses is optional and is dependent on the collective decision of the student's Guidance Committee.

A second and last year of extension may be granted to a student if they have already successfully defended the thesis, and is in the process of finalizing the manuscript. In cases of force majeure, such as typhoons and major calamities, which the Graduate School, upon the recommendation of the Guidance Committee, will determine, the student may be allowed an additional, or third extension, to complete their program.

## **DOCTOR OF PHILOSOPHY DEGREE**

### **General Rules and Requirements**

#### **Advisory Committee**

Membership in the advisory committee shall be limited to graduate faculty members who are professors and/or PhD degree holders and shall be with the mutual consent of individuals selected to serve. Other graduate faculty members may act as member or chair of the committee only by exceptional merit to be approved by the dean upon recommendation of the department chair or institute director.

The student, in consultation with the chair of the department or institute director in which they desire to do their major work, selects their major professor who shall serve as chair of the advisory committee.

Not later than two months after registration, the student, in consultation with the major professor, selects one or two cognate fields and the other members of their advisory committee. This committee shall be composed of four or five members with the major field and cognate field(s) represented.

The chair of the major department or institute director recommends to the dean of the Graduate School the composition of the advisory committee.



**Changes in Committee Composition**

A student may request a revision of the composition of their advisory committee upon endorsement of the department chair or institute director and in consultation with the professor concerned for approval by the dean of the Graduate School.

**Qualifying Examination**

The student must take the qualifying examination to be conducted by the advisory committee before the registration of the second semester of residence. The result of the examination will be the basis for evaluating the student's ability to pursue doctoral study and for determining a suitable program of course work.

The student should submit their application for the qualifying examination, duly recommended by their advisory committee and noted by the chair of the major department, or institute director, to the dean of the Graduate School not later than one month before the date of examination. Details of the qualifying examination shall be left to the discretion of the advisory committee.

To pass the examination, the student must receive not more than one negative vote of the committee.

If the student fails the qualifying examination, no re-examination shall be allowed except with the unanimous approval of their advisory committee. If the student fails the re-examination, they shall be permanently disqualified from earning the degree.

The chair of the advisory committee shall submit to the dean of the Graduate School a report on the result of the examination within one week after the examination.

**Residence Requirement**

A minimum of four semesters of residence is required for the doctoral degree. A student is in residence when they are registered for course work on campus, or work in absentia with due approval in advance by their advisory committee.

**Course Work Requirement**

After passing the qualifying examination, the student shall confer with their advisory committee to plan their course work. The plan of course work shall be recommended by the advisory committee and endorsed by the department chair or institute director to the dean of the Graduate School for approval. The UPLB Registrar shall be furnished the approved copy of the plan of course work.

A minimum of 24 units of course work beyond the master's degree is required with at least 18 units of the course work in the above-200 level.

At least 12 units of courses shall be in the major field and 6 units in each cognate field. In case the student selects to have only one cognate, the minimum number of units for the major and cognate fields shall be 15 and 9 units, respectively.

The cumulative units to be credited for courses numbered 290/291 and 299 should not exceed 6 and 2 units, respectively.

**English Language Requirement**

Foreign students whose English proficiency is Level A as determined from the English Proficiency Examination are required to present a certificate of English proficiency issued by the Language Instruction Towards Excellence (LITE) Program of the College of Arts and Sciences. The Graduate School monitors the fulfillment of the English language requirement and this must be satisfied prior to taking the written comprehensive examination.

**Official Plan of Study**

Within the first semester of residence, a regular student must confer with their advisory committee to draw up their proposed plan of study which includes a detailed listing of the courses, and transfer of courses, if any, that they are proposing for the fulfillment of the degree requirements. A form is available in the Graduate School office. The proposed plan of study must be recommended by their advisory committee and endorsed by the department chair or institute director to the dean of the Graduate School for approval. Once approved, this becomes the official program of study and must be fulfilled in every detail to meet graduation requirements.

**Changes in the Approved Plan of Study**

A student may request a revision in their approved plan of study upon recommendation of their advisory committee and endorsement of the department chair or institute director to the dean of the Graduate School for approval. Any change in the official program should first be approved before courses to be deleted, added, or replaced are registered.

**Grade Requirement**

A student must obtain a weighted average of "2.00" or better in all courses prescribed by their advisory committee under the major and minor fields to qualify for the comprehensive examination. They must also obtain "passing grades" in all other courses in which they enrolled.

**Comprehensive Examination**

The student may apply for a comprehensive examination after completing satisfactorily all courses prescribed by their committee and the foreign language requirement, if any, and upon recommendation of their advisory committee.

Application for comprehensive examination duly recommended by the advisory committee and noted by the chair of the major department, or institute director, shall be submitted to the dean of the Graduate School at least one month before the date of examination.

The comprehensive examination shall test the student in their major and cognate fields. A written examination shall be given for each area indicated in their plan of course work. An integrative oral examination shall be given after passing the written examination. The details of the examination shall be left to the discretion of the advisory committee.

To pass the examination, a unanimous vote of the committee is required.

A student who fails the comprehensive examination may apply for re-examination not earlier than one month but not later than one year after the first examination. If the student fails the re-examination, they shall be permanently disqualified from earning the degree.

The chair of the advisory committee shall submit to the dean of the Graduate School a report on the result of the examination within one week after the examination.

### **Doctoral Candidacy**

Candidacy is established when a student has passed the oral comprehensive examination.

### **Doctoral Dissertation**

After earning at least 12 units of course work, a doctoral student may start working on their dissertation. The title and outline of the dissertation as recommended by the adviser must be approved by all members of the advisory committee and submitted to the dean of the Graduate School for approval.

The doctoral dissertation shall have an equivalent of 12 units of graduate credit and shall have a numerical grade upon completion. The 12 units of dissertation can be enrolled in three terms for four units each term (4-4-4) or four terms for three units each term (3-3-3-3).

A student who has already registered a total of 12 units for dissertation but still unable to finish the work should register one unit per term until they are able to submit the copies of approved manuscript, but only up to a maximum of six terms (4 semesters, 2 summers). If at the end of this time limit, the student is still unable to submit copies of the approved manuscript, they shall be given a grade of "U" and should re-enroll all the 12 units of thesis. The same policies on how to enroll the number of units for dissertation shall apply. However, a student who is a candidate for graduation during the semester and only has dissertation to enroll may be allowed to register the whole 12 units total credit.

The candidate must present a copy of their dissertation that is satisfactory to all members of the advisory committee. The dissertation which should be in the prescribed form must show that (1) the candidate possesses mastery of the field in which they present himself; (2) they are capable of doing independent scholarly work; and (3) they are able to draw or infer such conclusions as may, in some respect, modify or enlarge upon what has been previously known. It shall be the responsibility of the adviser to ensure that final copies conform to the format prescribed by the Graduate School.

The dissertation shall be subjected to external review. The Dean of the Graduate School appoints an external reviewer from three nominees recommended by the advisory committee. The external reviewer shall have expertise along the student's field of study and shall come from outside the student's major department. The external reviewer is required to submit an independent report to the Dean that indicated their recommendation for either acceptance or rejection of the dissertation with explanation based on the critical review and evaluation that they have made.

The advisory committee certifies to the publishable quality of the dissertation that the dissertation is suitable for publication in a

journal that practices a thorough and credible review process. The student is required to submit to the Dean of the Graduate School two articles based on the dissertation and written in a format that is ready for publication in a refereed journal or journals.

Three printed copies of the dissertation manuscript and an e-copy in PDF and in Word format must be submitted to the dean of the Graduate School not later than the deadline set for submission of all requirements for graduation.

The three copies of the dissertation shall be distributed as follows: one copy each for the major department, major adviser, and the UPLB Graduate School.

### **Work in Absentia**

The dissertation of a candidate may be done in absentia with the approval of the advisory committee, if their research project requires work outside the University or will be facilitated by the resources of other institutions.

A candidate working in absentia shall make periodic reports of their progress to their adviser. The candidate must be registered if their work is to be recognized.

### **Final Examination**

The final oral examination has two purposes: to test the candidate's ability to defend their dissertation and to provide the advisory committee the opportunity to suggest modifications in the dissertation proper.

The candidate may apply for the examination when their dissertation is complete and in a form acceptable to their major professor who indicates their favorable judgment by recommending the approval of the application for final examination.

The application for final examination duly recommended by the candidate's advisory committee and noted by the chair of the major department or institute director and the final draft of the dissertation shall be submitted to the dean of the Graduate School not later than two weeks before the examination. The candidate must also submit a copy of the final draft of their dissertation to each member of their advisory committee who shall conduct the examination.

To pass the examination, the candidate must receive not more than one negative vote of the committee.

A candidate who fails in their final examination may apply for a re-examination, which should take place not earlier than one month but not later than one year after the final examination only upon the unanimous approval of the advisory committee. If the student fails the reexamination, they shall be permanently disqualified from earning the degree.

The chair of the advisory committee shall report the result of the examination to the dean of the Graduate School not later than three days after the examination.

Interested members of the Graduate Faculty may attend and participate without any voting power in the final examination.

### Time Limit for Earning the Doctoral Degree

The maximum time allowed for the completion of the doctoral degree is seven years. The 7-year period begins with the earliest course work listed in the official plan of study, including validated and/or transfer courses.

### Extension of Residency

A student who was not able to complete the requirements for the degree within the time limit of their residency may apply for extension of residency provided the student has satisfied the following conditions:

- a) has completed all coursework requirements based on the approved plan of course work with a GWA of 2.00 or better;
- b) has already passed the written and oral comprehensive examinations; and
- c) has the recommending approval of their Advisory Committee.

Students must apply for extension at least one month before reaching maximum residency. Upon approval, a formal notice of extension will be sent to the student and their Advisory Committee. Prescription of additional courses is optional and is dependent on the collective decision of the student's Advisory Committee.

A second and last year of extension may be granted to a student if they have already successfully defended the thesis, and is in the process of finalizing the manuscript.

In cases of force majeure, such as typhoons and major calamities, which the Graduate School, upon the recommendation of the Advisory Committee, will determine, the student may be allowed an additional, or third extension, to complete their program.

## STRAIGHT DOCTOR OF PHILOSOPHY

### Admission Requirements

A master of science student in UPLB who has completed 18 units of 200-level graduate courses in two consecutive semesters during their first year in the graduate program, with a grade point average of 1.25, may shift to the straight PhD program.

The applicant shall undergo the following procedures prior to their admission to the straight PhD program:

- 1) Obtain a certification of their grade point average and record of their grades for each course they have taken at the 200-level from the Office of the UPLB Registrar. These documents must be attached to their application for a qualifying examination.
- 2) After securing the foregoing documents, apply for a qualifying examination to the department chair upon the recommendation of their guidance committee.
- 3) Take the qualifying examination before the opening of classes following their completion of the first 18 units of 200-level graduate courses. The qualifying examination shall determine whether the following criteria are met.
  - a) Substantial scholarship and high attainment in a particular

field of knowledge;

- b) Marked ability and scholarship in some relatively broad field of knowledge;
- c) High critical ability and powers of imagination and synthesis; and
- d) Knowledge in the use of research techniques.

### Examination Committee

The department chair shall organize the Examination Committee after they have approved the application of the student for a qualifying examination. The Examination Committee shall perform the following tasks:

- 1) Assess the scholastic standing of the candidate;
- 2) Examine the subject areas taken by the student which will receive emphasis in the doctoral program;
- 3) Interview the candidate;
- 4) Prepare and administer the written qualifying examination;
- 5) Evaluate the result of the written qualifying examination and measure them against the criteria set forth in the foregoing; and
- 6) Submit to the department chair the results of the evaluation of the candidate's performance in the written qualifying examination.

A student who passes the written qualifying examination shall be recommended by the department chair to the dean of the Graduate School who will issue the official letter of admission. An applicant who fails to meet the admission requirements retains their status in the master's program.

### Shifting Process

Upon admission to the Straight PhD degree program, the applicant must nominate their advisory committee following the general rules and requirements of the doctoral degree program given on pages 164.

## DOCTOR OF PHILOSOPHY BY RESEARCH

### Admission Requirements

An applicant for admission to graduate work for the degree of Doctor of Philosophy (PhD) by research must:

- a) Be a holder of a Master of Science (MS) degree in the same area as the PhD degree being applied for from a recognized institution;
- b) Have a grade point average of 1.75 or better in the MS degree program;
- c) Have at least three (3) years of relevant experience in research certified by their agency;
- d) Have at least one refereed publication, senior or sole author, in a reputable journal;



- e) Must undergo and pass the assessment process conducted by the evaluation committee of the relevant academic unit.

A duly accomplished application form must be submitted to the Graduate School together with the following documents:

- a) Original and a photocopy of the official transcript of academic records, in English language, with no remarks and with an explanation of the grading system used, from all tertiary and graduate institutions attended;
- b) Photocopy of BS and MS diplomas;
- c) Certification from the immediate head of the agency that the applicant has at least three (3) years of satisfactory research experience;
- d) Reprints or copies of the applicant's research outputs;
- e) A research proposal which shall include the title, rationale, objectives, methodology, and references;
- f) For international students, certification from the Office of the University Registrar of previous university attended that the medium of instruction is English (if applicable), or results of Test of English as a Foreign Language (TOEFL) or results of the International English Language Testing System (IELTS), or its equivalent;
- g) Application fee (maybe paid by bank transfer or postal money order); and
- h) Sealed letters of references from two former professors, superiors or colleagues, and a letter of reference from the applicant's former master's degree adviser.

All documents must be in the Graduate School at least one month before the start of classes every semester. For international students, documents must be submitted earlier to have ample time to process travel papers. Submitted documents pertinent to the application become part of the university files and cannot be returned to the applicant.

All applicants from countries where English is not the medium of instruction and with TOEFL score below 500 or IELTS score below 5.5 should take the English proficiency examination. Those who do not meet the required level of proficiency for graduate studies in UPLB may be admitted in probationary status with the condition that they should take the Intensive English Course for International Students administered by the Language Instruction Towards Excellence (LITE) program of the College of Arts and Sciences prior to or during their first semester of residency in the program.

### **Admission Evaluation**

The Evaluation Committee composed of a chair and at least three (3) but not more than five (5) graduate faculty members shall assess the potential of an applicant as a PhD by research student.

The Evaluation Committee shall conduct the interview, assessment examination, and defense of the research proposal of the applicant. The assessment examination may be written or oral, or both, as unanimously approved by the Evaluation Committee.

Acceptance (or non-acceptance) to the program shall be based on the overall performance of the applicant in the interview, assessment examination, and in the defense of the applicant's research proposal.

To be accepted in the program, the applicant must receive not more than one negative vote from the Evaluation Committee.

### **Registration**

The student shall confer with the UPLB Registrar regarding their initial registration requirements only upon presentation of the letter of admission from the dean of the Graduate School.

### **Deferment of Registration**

Deferment of registration for a period not exceeding one year may be granted upon written request. A student unable to register within one year of admission needs to reapply for admission to the Graduate School.

### **Residency and Time Limit**

A student is in residence when they are registered for dissertation work on campus or work in absentia with due approval in advance by their Advisory Committee.

A minimum period of two (2) but not more than five (5) years is required for residency.

### **Advisory Committee**

The candidate, in consultation with the chair/director of the major department/institute, shall select their prospective major adviser who shall also be the chair of the student's advisory committee. The student, together with their major adviser, shall form the committee which shall be composed of at least five (5) members, including the adviser, with the major and related areas represented.

The chair of the advisory committee shall convene the committee not later than 1 month after the approval of its composition by the dean of the Graduate School. The candidate shall discuss with their advisory committee the details of the dissertation proposal including the place of work and its mechanics of monitoring, facilities needed, time required to accomplish the work, and the budget.

During their first semester, the student shall also discuss the required seminar presentations in relation to the dissertation research with the advisory committee.

The candidate shall discuss with their advisory committee the approval of portions of the dissertation which are ready for presentation in a seminar, and to be written and submitted for publication.

### **Work in Absentia**

The provisions on pages 166 shall apply to the PhD by Research program.

### **Final Examination Panel**

The final examination panel shall be composed of the student's advisory committee and one external reviewer to be appointed by the dean of the Graduate School from among three nominees of the department or institute. In addition, the doctoral dissertation outline as well as the manuscript will be externally reviewed to ensure quality.

## Final Examination

The candidate shall be given, by their Final Examination Panel, an oral examination which will be open to the public. The Graduate School shall publicize the schedule and place of the oral examination.

To pass the examination, the candidate must not receive more than one negative vote from the Final Examination Panel.

A candidate who fails the examination may be given a re-examination not earlier than one month but not later than one year after the first examination only upon unanimous approval of their Advisory Committee. Failure to pass the re-examination shall disqualify the candidate from earning the degree.

A student who passes the final examination shall be given a numerical grade by their adviser in consultation with the members of the advisory committee. This grade reflects the whole work done during the program to include the publications emanating from the research work and the results of the final examination.

## Requirements for Graduation

The candidate must register three (3) units of seminar (1 unit per semester) and present a seminar as a requirement for each enrollment. At least two of the seminar topics to be presented must include results of the dissertation. The student shall not be allowed to continue the program if they will not be able to give a satisfactory performance in their first seminar presentation.

Before the candidate can be awarded the degree, at least three articles from their dissertation work should have been published or at least accepted for publication in a refereed scientific journal. The first pages or title pages of the published articles shall be appended to the manuscript. If the articles are not yet published, the letter of acceptance can be appended instead.

Three printed copies of the dissertation and an e-copy in PDF and in Word format duly approved by the Advisory Committee members must be submitted to the Graduate School.

## READMISSION

A student who was not able to complete the requirements for the degree within the time limit, that is, five calendar years for the master's degree and seven calendar years for the regular doctoral degree may apply for readmission to the Graduate School. To be eligible for readmission, the student must have a general weighted average of "2.00" or better in all advanced undergraduate and graduate courses taken in the program that they were pursuing.

## Residence Requirement and Time Limit

The student is in residence when they are registered for course work, thesis, or dissertation work on the campus or work in absentia, with due approval in advance by their guidance/advisory committee.

Not more than five (5) calendar years from the start of initial registration as a readmitted student shall be allowed for the completion of all requirements for the master's degree and not more than seven (7) calendar years for the doctoral degree. The time limit allowed to complete a graduate degree excludes the period when the

student is on leave of absence. The 5-year or 7-year period begins with the earliest work listed in the official plan of study, including validated and/or transfer courses.

## GRADUATION

Requirements for graduation include the completion of all academic as well as non-academic requirements.

A student in the master's (with thesis) degree program is required to complete at least 30 units of course work and thesis, pass the general and final examinations, and submit three copies of the thesis and an e-copy.

A student in the master's (without thesis) degree program is required to complete from 30 to 42 units of course work and pass the final examination.

Candidates for the PhD degree are required to complete a minimum of 36 units of course work and dissertation, pass a qualifying examination, a written and an oral comprehensive examination, and a final examination based on the dissertation. Submission of three copies of the dissertation and an e-copy is also required.

*Deadlines for the submission of all requirements for graduation are:*

- a) For Mid-Year Term Graduation - the day before the first day of regular registration for the succeeding first semester.
- b) For First Semester Graduation - the day before the first day of regular registration for the succeeding second semester.
- c) For Second Semester Graduation - the day before the Graduate Academic Advisory Council meets.

If some graduation requirements are completed beyond the deadline, the student must register in the succeeding semester to be considered a candidate for graduation as of the end of the last semester of registration.

All candidates for graduation must have their deficiencies made up and their records cleared not later than 5 weeks before the end of their last semester with the exception of those in academic subjects in which the student is currently enrolled in.

A student who fails to pay the required graduation fee cannot be conferred any title or degree. They may, however, upon their request and payment of necessary fees, be issued a certified copy of their credentials without specifying their completion of the requirements toward any title or degree.

## Clearance for Graduation

Clearance may be obtained by accomplishing UP Form 13a. Students who have completed all academic and other requirements including submission of required clearance forms and fees qualify for graduation. Students who have completed all the academic requirements for their respective degrees may be recommended for graduation even if they have not processed their clearance. However, granting of honorable dismissal and the issuance of the transcript or checklist and diploma shall be withheld pending the submission of clearance by the student.

**Commencement Exercises**

Candidates for graduation are required to attend the commencement exercises. Those who are unable to do so because of illness or other valid reasons must submit a request for graduation in absentia to the dean of the Graduate School.



## Degree Programs Offered

The Graduate School offers the following degree programs:

Graduate Diploma in Environmental Planning

Master in Animal Nutrition

Master in Clinical Nutrition

Master in Food Engineering

Master in Public Affairs

- Agrarian and Rurban Development Studies
- Education Management
- Strategic Planning and Public Policy

Master in Veterinary Epidemiology

Master of Agriculture

- Agronomy
- Horticulture

Master of Development Management and Governance

Master of Forestry

- Forest Biological Sciences
- Forest Resource Management
- Silviculture and Forest Influences
- Social Forestry
- Wood Science and Technology

Master of Information Technology

Master of Management

- Agribusiness Management and Entrepreneurship
- Business Management
- Cooperative Management

Master of Professional Studies

- Food and Nutrition Planning

Professional Masters

- Tropical Marine Ecosystems Management Joint program with UP Marine Science Institute of UP Diliman, and UP Visayas

Master of Arts

- Communication Arts
- Environmental Planning
- Sociology

Master of Science

- Agricultural Chemistry
- Agricultural Economics
- Agricultural Engineering
- Agrometeorology
- Agronomy
- Animal Science
- Applied Nutrition
- Biochemistry
- Botany
- Chemical Engineering
- Chemistry
- Community Development
- Computer Science
- Development Communication
- Development Management and Governance
- Economics
- Entomology
- Environmental Science
- Extension Education
- Family Resource Management
- Food Science
- Forestry: Forest Biological Sciences
- Forestry: Forest Resources Management

- Forestry: Silviculture and Forest Influences
- Forestry: Social Forestry
- Forestry: Wood Science and Technology
- Genetics
- Horticulture
- Mathematics
- Microbiology
- Molecular Biology and Biotechnology
- Natural Resources Conservation
- Physics
- Plant Breeding
- Plant Genetics Resources Conservation and Management
- Plant Pathology
- Rural Sociology
- Soil Science
- Statistics
- Veterinary Medicine
- Wildlife Science
- Zoology

Doctor of Philosophy

- Agricultural Chemistry
- Agricultural Economics
- Agricultural Engineering
- Agronomy
- Animal Science
- Applied Mathematics
- Biochemistry
- Botany
- Community Development
- Computer Science
- Development Communication
- Entomology
- Development Studies
- Environmental Diplomacy and Negotiations
- Environmental Science
- Extension Education
- Food Science
- Forestry: Forest Biological Sciences
- Forestry: Forest Resources Management
- Forestry: Silviculture and Forest Influences
- Forestry: Wood Science and Technology
- Genetics
- Horticulture
- Human Nutrition
- Microbiology
- Molecular Biology and Biotechnology
- Plant Breeding
- Plant Pathology
- Soil Science
- Statistics
- Veterinary Medicine

Straight Doctor of Philosophy

- Agricultural Economics
- Development Communication
- Environmental Science
- Soil Science

Doctor of Philosophy by Research

- Agribusiness Management and Entrepreneurship
- Agricultural and Applied Economics

- Agricultural Chemistry
- Agronomy
- Animal Science
- Biochemistry
- Botany
- Chemical Engineering
- Computer Science
- Data Analytics and Informatics
- Development Communication
- Economics
- Entomology
- Environmental Science
- Food Science
- Forestry
- Horticulture
- Human Development
- Plant Breeding
- Plant Pathology
- Soil Science
- Veterinary Medicine
- Wildlife Science
- Zoology

Dual Doctor of Philosophy by Research

— offered with University of Reading in the United Kingdom; University of Liverpool in the United Kingdom; University of Montpellier in France; and Curtin University in Australia in collaboration with UP Mindanao

## GRADUATE PROGRAMS AND COURSES

### AGRARIAN AND RURBAN DEVELOPMENT STUDIES (ARDS)

*Institute of Governance and Rural Development, College of Public Affairs and Development*

**Degree offered:** *Master in Public Affairs*

The MPAf ARDS program consists of 31 units, these are 13 units of core courses, 12 units of specialization courses and 6 units of electives. The core courses are PAF 201, PAF 203, PAF 204 and DM 224. The specialization courses are ARDS 201, AGRS 211, AGRS/ CED 291, AGRS 298 and AGRS 299. The 3 unit elective course can be selected from the following, AGRS 221, AECO 251 or DM 220.

#### Agrarian Studies

**AGRS 211. Economics of Agrarian Reform (3).** The role of agrarian reform in economic development; cost and financing of agrarian reform programs; economics of institution-building. 3 hrs (class). PRAECO 250 or COI. (1).

**AGRS 221. Legislation and Administration of Agrarian Reform Programs (3).** Statutes, executive orders, code, decrees on agrarian reforms; case studies and problems of adjudication; and comparison of agrarian reform organizations, management, policies, planning and programming. 3 hrs (class). PR. COI (2).

**AGRS 290. Special Problems (1-3).** May be taken twice provided that total number of units to be credited to the students program will not exceed 4 units. (1,2).

**AGRS 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. (1,2).

**AGRS 298. Field Studies (3).** Field work in agrarian reform situations, designing feasibility studies, training program evaluation, and related activities. PR. COI. (1,2,M).

**AGRS 299a. Graduate Seminar on Agrarian Reform (1).** May be taken twice. PR. COI. (1).

**AGRS 299b. Graduate Seminar on Agrarian Reform (1).** May be taken twice. PR. COI. (2).

#### Agrarian and Rurban Development Studies

**ARDS 201. Social Dynamics of Agrarian and Rurban Institutions. (3).** The interfluence between the agrarian and rurban sectors and the factors that affect the interrelationships among the institutions within those sectors. PR. ECO 11 or COI. (2).

*Please refer to Public Affairs for other courses.*

### AGRIBUSINESS MANAGEMENT AND ENTREPRENEURSHIP (ABME)

*Department of Agribusiness Management, College of Economics and Management*

**Degree offered:** *Master of Management*

Prior to regular admission to the program, prospective students will be required to attend a summer workshop on the problems and prospects of agribusiness today, fundamentals of accounting and financial statement analysis, quantitative management, and microcomputer applications. The 5-week workshop will serve both as a post-screening procedure and refresher course to prospective students.

The MM ABME is a non-thesis program, it requires a total of 39 units, these are: 9 units of core courses, and 30 units of major courses. The core courses are MGT 201, MGT 213 and MGT 231. The 30 units of major courses are ABME 203, ABME 207, ABME 240, ABME 298, ENTR 201, ENTR 271, MGT 215, MGT 221, MGT 251, and MGT 281.

#### Agribusiness Management and Entrepreneurship

**ABME 203. Advanced Agribusiness (3).** Analysis of agribusiness industries with emphasis on major agricultural commodity systems. 3 hrs (class). PR. MGT 201. (1)

**ABME 207. Innovative and Integrative Arrangements in Managing Agribusiness Enterprises (3).** Managing innovative opportunities and integrative arrangements relevant to the overall agribusiness enterprise decision making. 3 hrs (class). PR. ABME 203 (2)

**ABME 240. Agribusiness Operations Management (3.)** Operations management in agribusiness enterprises, application of analytical tools and techniques in agribusiness enterprise decision-making. 3 hrs (class). PR. MGT 221. (2)

**ABME 298. Field Studies (3).** PR. COI. (2)

### Entrepreneurship

**ENTR 201. Theory and Practice of Entrepreneurship (3).** Theories, principles, perspectives, practices, and trends in entrepreneurship. 3 hrs (class). PR. None. (1, 2)

**ENTR 271. Technology Commercialization and Technopreneurship (3).** Technology commercialization; technology-based enterprise identification and business plan development. 3 hrs (class). PR. ENTR 201 or COI. (1,2)

*Please refer to Business Management for the other courses.*

### AGRICULTURAL CHEMISTRY (ACHM)

*Institute of Chemistry, College of Arts and Sciences*

**Degrees offered:** Master of Science and Doctor of Philosophy

The MS ACHM program requires a minimum of 31 units, these are 15 units of major courses, 9 units of minor courses\*, 1 unit of seminar and 6 units of thesis\*\*. The major courses are composed of 9 units of core courses (CHEM 205, CHEM 220, CHEM 230, CHEM 242, CHEM 260) and 6 units of major courses of any CHEM or ACHM courses.

The PHD ACHM program has a total of 37 units, these are 15 units of major courses which should include at least three of the core courses of the MS ACHM program if not taken during master's; CHEM or ACHM courses that are aligned with the cognate must be taken to satisfy the number of units; 9 units of cognate\*; 12 units of dissertation units\*\* and 1 unit of seminar.

\*Minor/cognate must be from any field of specialization in Agriculture or Forestry, and the \*\*thesis/dissertation topic must be application of chemistry to these fields.

### Agricultural Chemistry

**ACHM 203. Advanced Agricultural Chemistry (2).** Chemistry and technology of compounds in relation to their application to agriculture. 2 hrs (class). PR. CHEM 160 or CHEM 161 or COI. (1)

**ACHM 231. Advances in Carbohydrate Chemistry (2).** 2 hrs (class). PR. CHEM 160 or CHEM 161 or COI. (1)

**ACHM 235. Research in Sugar By-Products (3).** 7 hrs (1 class, 6 lab). PR. CHEM 40 or its equivalent. (2)

**ACHM 238. Cereal Chemistry (3).** Chemistry of cereal with emphasis on rice and corn. 5 hrs. (2 class, 3 lab). PR. CHEM 160 or CHEM 161 or COI. (1)

**ACHM 250. Chemistry of the Coconut (3).** Composition of coconut parts and their uses; biochemical properties of the coconut. 3 hrs (class). PR. CHEM 160 or CHEM 161 or COI. (1)

**ACHM 290. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2,M)

**ACHM 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units.

**ACHM 299. Graduate Seminar in Agricultural Chemistry (1).** May be taken twice. PR. COI. (1,2)

**ACHM 300. Master's Thesis (6).** (1,2,M)

**ACHM 400. Doctoral Dissertation (12).** (1,2,M)

*Please refer to Chemistry for more courses.*

### AGRICULTURAL ECONOMICS (AECO)

*Department of Agricultural Economics, College of Economics and Management*

**Degrees offered:** Master of Science and Doctor of Philosophy

**Areas of specialization:** Agricultural Development, Agricultural Marketing, Agricultural Policy, Agricultural Prices, Farm Management, Production Economics, and Resource Economics.

The MS AECO program requires a minimum of 32 units, these are 15 units of major courses, 9 units of minor courses, 2 units of seminar and 6 units of thesis. The major courses are composed of core courses ECON 201, ECON 202, ECON 237 and other major courses to satisfy the minimum number of units.

The PhD AECO program requires a minimum of 38 units, these are 15 units of major courses, 9 units of cognate courses (or 12 units for double cognate), 2 units of seminar and 12 units of dissertation. The major courses are composed of core courses ECON 203, ECON 204, ECON 237 and other major courses to satisfy the minimum number of units. Other requirements: Graduate students are required to pass a departmental written comprehensive examination given once in a semester and an oral examination.

### Agricultural Economics

**AECO 210. Advanced Agricultural Production Economics (3).** Selected economic theories and their application to problems in agricultural production and their distribution. 3 hrs (class). PR. COI. (1)

**AECO 211. Advanced Farm Management (3).** Production problems of small and large farms; farm business analysis; production decision criteria; and labor management. 3 hrs (class). PR. AECO 111 and ECON 102 or COI. (2)

**AECO 220. Economics of Agricultural Marketing (3).** Economic theory applied to marketing; analysis of marketing functions, cost and prices of agricultural inputs and products; industry structure, marketing policies. 3 hrs (class). PR. AECO 120 or COI. (1)

**AECO 222. Agricultural Prices (3).** Price determination in product and factor markets; supply and demand; price variation and instability; dynamic analysis; price policy. 3 hrs (class). PR. ECON 102 or COI. (2)

**AECO 230. Advanced Agricultural Finance (3).** Conceptual bases



of agricultural finance; risks and uncertainties in farm-related financial intermediaries; issues in financing agricultural development. 3 hrs (class). PR. COI. (2)

**AECO 240. Natural Resource Economics (3).** Application of economic theory to developmental and intertemporal issues in the optimal management of agricultural land and other resource-evaluation of economic institutions affecting use of such resources. 3 hrs (class). PR. ECON 101 or COI. (1)

**AECO 241. Economic Analysis and Planning of Agricultural Projects (3).** Economic analysis of agricultural projects from national and individual viewpoints; identification of projects; preparation and evaluation of project plans. 3 hrs (class). PR. ECON 101 and ECON 102 or COI. (2)

**AECO 248. Economic Analysis and Design of Natural Resource and Environmental Policies (3).** Economic principles, methods and tools in the analyses and design of natural resource and environmental policies. 3 hrs (class). PR. AECO 240 or COI. (1,2)

**AECO 250. Agriculture and Economic Development (3).** Factors that accelerate or inhibit the growth of agriculture; survey of existing growth theories and establishment of their relevance to Philippine experience. 3 hrs (class). PR. ECON 101 and ECON 102 or COI. (2)

**AECO 251. Agricultural Programs for Economic Development (3).** Past and present action programs of government agencies and farmer's organizations; coordination of programs of viable private operating units and public agencies. 3 hrs (class). PR. ECON 101 and ECON 102 or COI. (1)

**AECO 253. Applied Regional Economics (3).** Application of economic theories and analytical tools to regional planning, development, and program implementation. 3 hrs (class). PR. ECON 101 and STAT 1 or COI. (2)

**AECO 260. Research in Agricultural Economics (3).** Methods and techniques of economic research, emphasis on current agricultural economic problems. 3 hrs (class). PR. ECON 101 and ECON 102 or COI. (1)

**AECO 261. Food and Nutrition Economics (3).** World food problems and the economic consequences of malnutrition; review of food and nutrition policies and programs. 3 hrs (class). (1)

**AECO 290. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2)

**AECO 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2)

**AECO 299. Graduate Seminar in Agricultural Economics (1).** May be repeated once for a maximum of 2 units. PR. COI. (1,2)

**AECO 300. Master's Thesis (6).** (1,2,M)

**AECO 320. Organization and Performance of Agricultural Markets (3).** Agricultural markets: structure, conduct and performance; policy and welfare analysis; research and development. 3 hrs (class). PR.

AECO 220 and ECON 202 or COI. (2)

**AECO 400. Doctoral Dissertation (12).** (1,2,M)

## AGRICULTURAL EDUCATION (AgED)

*Institute of Governance and Rural Development, College of Public Affairs and Development*

**Degrees offered:** *Master of Science and Doctor of Philosophy*

The MS AgED program requires a minimum of 37-38 units, these are 21-22 units of major courses, 9 units of minor courses, 1 unit of graduate seminar and 6 units of thesis. The major courses are composed of core courses (CED 232, CED 220, AERS 282, STAT 166 or CED 291); 6 units of specialization courses (CED 201, CED 211); and 3 units of electives (CED 210, CED 213, AGRI 121\*\*\*).

The PhD AgED program requires a minimum of 45-48 units, these are 23 units of major courses, 9 or 12 units of cognate courses, 1 unit of graduate seminar and 12 units of dissertation. The major courses are composed of core courses (CED 227, CED 301, CED 365, AERS 281, AERS 282\*, CED 291\*\*); 6 units of specialization courses (CED 201\*, CED 211\*, CED 217, CED 224); and 3 units of elective (CED 215, CED 226, CED 242, AGR 221\*\*\*)

\*Required if not taken in the MS program

\*\*If CED 291 has been taken, additional social science statistics or qualitative research methods may be required.

\*\*\*To be prescribed if student lacks background in agriculture

*Please refer to Community Development for the list of courses.*

## AGRICULTURAL ENGINEERING (AENG)

*Institute of Agricultural Engineering, College of Engineering and Agro-Industrial Technology*

**Degrees offered:** *Master of Science and Doctor of Philosophy*

**Areas of specialization:** For MS: Farm Power and Machinery, Crop Processing, and Soil and Water Engineering. For PhD: Land and Water Resources Engineering, Agricultural Power and Machinery and Agricultural Process Engineering

The MS AENG includes a minimum of 31 units, these are: 15 units of major courses; 9 units of minor, 1 unit of graduate seminar, and 6 units of thesis work.

The PhD AENG includes a minimum of 37 units, these are: 12 units of major courses\*; 6 units in each cognate field\*; 1 unit of seminar and 12 units of dissertation.

\*If only one cognate field is chosen, the minimum major and cognate courses must be 15 and 9 units, respectively

AENG 201, AENG 299 is required for Agricultural Power and Machinery and Agricultural Process Engineering.

**Agricultural Engineering**

**AENG 201. Advanced Engineering Mathematics (3).** Formulation and solution of differential and systems equations in engineering. 3 hrs (class). PR. MATH 28 or its equivalent. (1)

**AENG 202. Engineering Similitude (3).** Theory of similitude and its application to engineering models. 5 hrs (2 class, 3 lab). PR. COI. (2)

**AENG 203. Heat, Mass and Momentum Transport (3).** Principles of transport phenomena and their application to agricultural, biological, and food systems. 3 hrs (class) PR. COI. (2)

**AENG 204. Advanced Thermodynamics (3).** Thermodynamic theory of irreversible processes. Selected applications in physiological unit operations and separation processes. 3 hrs (class). PR. ENSC 14 or CHEM 102; MATH 151. (1)

**AENG 205. Numerical Methods in Thermo-Fluid Engineering (3).** Finite differences, finite elements analysis and application in agricultural process engineering. 3 hrs (class). PR. AENG 201 or COI. (2)

**AENG 225. Advanced Heat Transfer (3).** Analysis and application of steady state and transient heat conduction; radiant heat transfer; radiation networks; spectral properties, natural and forced convective transfer of heat and mass in boundary layers and in fluids with phase change. 3 hrs (class). PR. ENSC 14a. (2)

**AENG 226. Convective Heat Transfer (3).** Equations of convective heat transfer, solutions to laminar and turbulent forced convection; free and mixed convective transfer; property variation; condensation and heat transfer in porous media. 3 hrs (class). PR. AENG 225 or COI. (1)

**AENG 232. Drying, Storage, and Preservation of Cereal and Forage Crops (3).** Systems for drying, storage and preservation of cereal and forage crops; theory of heat and mass transfer in drying and its relation to quality control. 5 hrs (2 class, 3 lab). PR. COI. (1)

**AENG 233. Agricultural Process Engineering (3).** Design and operations of systems for drying and storage, material handling and refrigeration; other unit operations in the processing of agricultural products. 5 hrs (2 class, 3 lab). PR. COI. (2)

**AENG 235. Agricultural Process Systems Analysis and Design (3).** Modeling agricultural process equipment; systems simulation; economic analysis of process systems. 3 hrs (class). PR. AENG 233. (1)

**AENG 236. Physical Properties of Agricultural Materials (3).** Measurement and application of mechanical, rheological, thermal and electrical properties of agricultural materials. 5 hrs (2 class, 3 lab). PR. AENG 233 or COI. (2)

**AENG 237. Process Control in Agricultural Process Engineering (3).** Control systems analysis and design; simulation for process control. 3 hrs (class). PR. AENG 270 or COI. (2)

**AENG 238. Drying and Dehydration of Agricultural Crops (3).** Principles of drying and dehydration, drying methods; design and

operation of drying systems. 3 hrs (class). PR. AENG 232 or COI. (1)

**AENG 240. Advanced Water Resources Planning (3).** Factors and issues in water resource planning; application of systems methodologies. 3 hrs (class). PR. COI. (1)

**AENG 241. Research Methods in Land and Water Resources Engineering (3).** Quantitative and qualitative research methods; validity and reliability considerations in research design; analytical tools and techniques; computer-oriented approaches; application to land and water resources engineering problems. 3 hrs (class). PR. COI. (1)

**AENG 242. Water Management (3).** Irrigation practices as affected by soil properties and topography; interrelations of irrigation with tillage, fertility and fertilizer applications; moisture control during germination and harvest; irrigation for water conservation; influences of salinity and drainage on water management. 3 hrs (class). PR. COI. (1)

**AENG 243. Soil and Water Conservation (3).** Agricultural hydrology; flood control and structures; diversion and waterways; relationship between water management and soil-water conservation; land clearing, development, and formation. 3 hrs (class). PR. COI. (2)

**AENG 244. Groundwater Hydrology (3).** Groundwater as a source of water supply, occurrence and distribution, flow hydraulics, aquifer and well characteristics, well drilling, discharge, development, maintenance, and recharge. Pumps and pumping test analysis. 3 hrs (class). PR. ABE 71 and MATH 26 or 36. (2)

**AENG 245. Drainage Engineering (3).** Dynamics of soil water; rainfall-runoff relations; seepage analysis; soil permeability measurements; generalized flow equations; design criteria; quantitative determination of drainage spacing and depth; subsurface and open ditch drainage design. 3 hrs (class). PR. ABE 73 and MATH 151. (1)

**AENG 247. Water Quality Control Engineering (3).** Water and waste water characteristics; design and operation of water and waste water treatment systems; water reclamation and reuse. 3 hrs (class). PR. ABE 177 or ChE 180 or COI. (2)

**AENG 248. Erosion and Sediment Transport (3).** Theories and models of erosion and sediment transport; control measures; soil and water conservation planning. 3 hrs (class). PR. COI. (1)

**AENG 249. Statistical Hydrology (3).** Frequency analysis of hydrologic events; hydrologic models; single and multisite generation of synthetic sequences; data augmentation; flood estimation; application studies. 3 hrs (class). PR. ABE 71 or COI. (2)

**AENG 260. Experimental Stress Analysis (3).** Elasticity, brittle-coating methods, photoelastic methods, strain measurement methods and related instrumentation; principles of testing and inspection of engineering materials. 5 hrs (2 class, 3 lab). PR. ENSC 13 or its equivalent. (1)

**AENG 261. Agricultural Machinery Design (4).** Design and testing of agricultural machinery to meet their functional and economic requirements. 8 hrs (2 class, 6 lab). PR. COI. (2)

**AENG 262. Advanced Soil Mechanics of Tillage and Traction (3).** Soil failure theories, traction, compaction and flotation on agricultural soils; tillage tool design. 5 hrs (2 class, 3 lab). PR. ABE 145 or ABE 180 or COI. (1)

**AENG 263. Crop Establishment Engineering (3).** Dynamics of seeding and transplanting; soils seed and seedling-machine interactions. 5 hrs (2 class, 3 lab). PR. ABE 145 or ABE 180 or SOIL 1. (1,2)

**AENG 264. Pesticide Application Equipment (3).** Design, operation and the efficient and safe use of pesticide application equipment for crops. 5 hrs (2 class, 3 lab). PR. ABE 42. (1)

**AENG 265. Design of Harvesting and Threshing Machinery (3).** Theory of operation of and design of harvesters and threshers 3 hrs (class). PR. ABE 42 or COI. (2)

**AENG 266. Advanced Agricultural Energy and Power Engineering (3).** Conventional and non-conventional energy sources; engine test on dynamometers; design of alternative power sources. 5 hrs (2 class, 3 lab). PR. ABE 41 or COI. (2)

**AENG 270. Instrumentation for Engineering Research (4).** Instruments and principles of measurement and control of temperature, humidity, strain, moisture content, and pressure and fluid flow in engineering process; principles of digital measurements. 6 hrs (3 class, 3 lab). PR. EE 1 or its equivalent. (2)

**AENG 290. Special Problems (1-3).** May be taken twice provided that total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2)

**AENG 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. (2)

**AENG 296. Special Problems in Agricultural Engineering (2).** May be taken twice for additional credits not to exceed a total of 6 units. PR. COI

**AENG 299. Graduate Seminar in Agricultural Engineering (1).** May be taken twice.

**AENG 300. Master's Thesis (6).** (1,2,M)

**AENG 400. Doctoral Dissertation (12).**

#### AGROMETEOROLOGY (AGMET)

*Agrometeorology and Farm Structures Division, Institute of Agricultural Engineering, College of Engineering and Agro-Industrial Technology*

**Degree offered:** Master of Science

**Foundation courses:** ABE 110, AGME 110

To qualify for the MS AGMET degree, a student must complete 18 units of core and major courses (ABE 114, AGME 250, AGME 260, AGME 290, AGME 291, AENG 270, STAT 241); 9 units of minor courses; 6 units of thesis and 1 units of Graduate Seminar.

For students with agrometeorology as minor/cognate field AGME 250 and AGME 260 is required.

#### Agrometeorology

**AGME 250. Micrometeorology (3).** Radiation, energy and water balances over land surfaces, radiation, temperature, humidity and wind profiles in the atmospheric boundary; microclimate modifications; and instrumentation. 3 hrs (class). PR. PHYS 13 or its equivalent. (1)

**AGME 260. Tropical Agrometeorology (3).** Climatic controls; agrometeorological observation network and practices; crop and animal weather-relations; research methods in agrometeorology; agrometeorological forecasts and advisories. 5 hrs (2 class, 3 lab). PR. AGME 250. (2)

**AGME 290. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2)

**AGME 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2)

**AGME 300. Master's Thesis (6).** (1,2,M).

#### AGRONOMY (AGR)

*Institute of Crop Science, College of Agriculture and Food Science*

**Degrees offered:** Master of Agriculture, Master of Science and Doctor of Philosophy

**Areas of specialization:** MAgr: Crop Production and Management/ MS: Crop Physiology, Crop Production and Management, Seed Science and Technology, Weed Science / PhD: Crop Production and Management, Crop Physiology, Weed Science

**Foundation courses:** For MAgr and MS students - HORT 132/BOT 132, CHEM 40 and SOIL 150 / For PhD students - BOT 132/HORT 132, CHEM 40, SOIL 150, and CHEM 160

Students who have not taken the foundation or core courses should include them in the plans of course work in addition to the requirements for the degree. A foundation or core course need not be included in the program of the student if the course has been taken by the student. If an equivalent course was taken outside UPLB, the student must pass a validating examination. Determination of equivalence shall be the prerogative of the academic department offering the course.

The minimum number of units required for graduation in the MAgr AGR program is 36 units. At least 24 units of course work shall be in the major field, and at least 12 units in the minor field.

The MS AGR program requires a minimum of 32 units, these are 15 units of major courses, 9 units of minor courses, 2 units of seminar and 6 units of thesis. The major courses are composed of core courses AGR 112, AGR 241, CHEM 160 and other major courses to satisfy the minimum number of units.

The PhD AGR program requires a minimum of 38 units, these are 15 units of major courses, 9 units of cognate courses, 2 units of seminar and 12 units of dissertation. The major courses are composed of core courses AGR 112, AGR 240, AGR 241 and other major courses to satisfy the minimum number of units.

For MS and PhD students with Agronomy as minor/cognate field at least 9 units of course work in Agronomy is required. AGR 241 or AGR 240 or both may be taken plus 6 or 3 units of other Agronomy courses depending on area of specialization. Students with weed science as a minor/cognate may opt not to include AGR 241/240.

PhD students are required to pass a departmental written comprehensive examination in their area of specialization to be administered by a department committee. This examination is given once in a semester.

### Agronomy

**AGR 235. Physiology of Herbicides (3).** Absorption translocation, mechanism of action, and selectivity of herbicides. 3 hrs (class). PR. BOT 20 and CHEM 40 (2)

**AGR 235.1. Laboratory on Mode of Action of Herbicides (2).** Laboratory phase of Agronomy 235, 6 hrs (lab). (2)

**AGR 236. Herbicide-Soil Interactions (3).** Herbicide adsorption, leaching, volatilization, degradation, and persistence in soils. 3 hrs (class). PR. SOIL 1 or COI. (1)

**AGR240. Environmental Physiology (3).** Characterization of climatic environment and elucidation of varied response of plants to its environment with emphasis on economically important crops. 3 hrs (class). PR. BOT 20 or COI. (1,2)

**AGR 241. Advanced Field Crop Physiology and Ecology (3).** Management and evaluation of the effects of climatic and edaphic factors on crop growth. 3 hrs (class). PR. BOT 20 or COI. (1,2)

**AGR 250. Advanced Plant Breeding I (3).** Types, uses, and induction of genetic variation; systems of pollen control; selection concepts and general breeding procedures for crops in each mode of pollination; approaches in breeding for specific characters. 3 hrs (class). PR. AGR 150 (2)

**AGR 251. Advanced Plant Breeding II (3).** Advanced concepts and methods in population breeding and cultivar development. 3 hrs (class). PR. BIO 130b and AGR 250.(1)

**AGR 254. Crop Evolution (3).** Origin and evolution of crop plants and dynamics of plant domestication. 3 hrs (class). PR. AGR 50 or COI. (1)

**AGR 255/BIO 255. Population Genetics (3).** Genetics of population undergoing random mating and inbreeding; effects of selection, mutation, migration and other forces on the genetic composition of natural and artificial biological population. 3 hrs (class). PR. BIO 130b and MATH 26. (1)

**AGR 256. Quantitative Genetics (3).** Genetics of quantitative characters in random and nonrandom mating population. Application of quantitative genetic theories in breeding work. 3 hrs (class). PR.

AGR 255. (2)

**AGR 258. Molecular Plant Breeding (3).** Molecular markers, recombinant DNA technology, and cell and tissue culture technology in crop improvement. 3 hrs (class). PR. AGR 150 and BIO 101 or COI. (1)

**AGR 270. Seed Science, Technology and Program Development (3).** Advanced concepts in the science and technology of seed production, post production, genetic conservation, testing and quality control; policies and management of seed and related programs. 3 hrs (class). PR. AGR 170 or COI. (1)

**AGR 290. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2,M)

**AGR 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2,M)

**AGR 299. Graduate Seminar in Agronomy (1).** May be taken twice for a maximum of 2 units. 1 hr (class). PR. Graduate standing. (1,2)

**AGR 300. Master's Thesis (6).** (1,2,M)

**AGR 400. Doctoral Dissertation (12).** (1,2,M)

### Agriculture

**AGRI 211. Design and Assessment of Farming Systems (3).** Critical analysis, designing and evaluating farming systems. 3 hrs (class). PR. AGRI III or COI. (2)

**AGRI 221. Advanced Ecological Agriculture (3).** Dynamics of agroecosystem in relation to ecological agriculture practices, issues and concerns. 3 hrs (class). PR. AGRI 121 or COI. (2)

### Crop Science

**CRSC 245. Stress Physiology of Plants (3).** Response of plants to various environmental stresses; morphophysiological, biochemical and genotypic variation as bases for adaptation to stress. 3 hrs (class). PR. BOT 20. (1,2)

### ANIMAL SCIENCE (ANSC)

*Institute of Animal Science, College of Agriculture and Food Science*

**Degrees offered:** *Master of Science, Doctor of Philosophy, and Master in Animal Nutrition*

**Areas of specialization:** MS: Animal Breeding, Animal Nutrition, Animal Physiology, Animal Production, Meats/ PhD: Animal Breeding, Animal Nutrition, Animal Physiology, Animal Production

**Foundation courses:** CHEM 160 and STAT 162 for both MS and PhD students:

The Master in Animal Nutrition (MAN) requires 31 units composed of 19 units of core courses and 12 units of qualified elective courses either under Agribusiness Management and Entrepreneurship/



Agricultural Economics or under Business Management.

The MS ANSC program requires a minimum of 31 units composed of 15 units of major courses, 9 units of minor courses, 1 unit of seminar and 6 units of thesis.

The PhD ANSC program requires a minimum of 37 units, composed of 15 units of major courses, 9 units of cognate courses, 1 unit of seminar and 12 units of dissertation.

## Animal Science

**ANSC 202. Animal Production Technologies (3).** Technologies for efficient and profitable animal production. 3 hrs (class). (1,2)

**ANSC 210. Advances in Swine Production (3).** Modern concepts and practices in swine production. 3 hrs (class). PR. ANSC 111 or COI. (1,2)

**ANSC 220. Advanced Course in Cattle and Carabao Production (3).** Cattle, carabao, and draft animal production with emphasis on smallholder systems; integration with crops and farm activities. 5 hrs (2 class, 3 lab). PR. ANSC 121 or COI. (1)

**ANSC 225. Conservation of Grass and Forage Crops (3).** Principles and methods of preserving grasses, legumes, and farm by-products; their nutritive value, utilization and cost of production. 5 hrs (2 class, 3 lab). PR. AGR 118 or COI. (2)

**ANSC 240. Advanced Poultry Production (3).** Modern practices and new concepts in commercial poultry production. 3 hrs (class). PR. ANSC 116 or COI. (2)

**ANSC 241. Feed Nutrient Utilization (3).** Nutrient digestion, absorption, and metabolism in monogastrics and ruminants and their requirements at different stages of production. 3 hrs (class). (1,2)

**ANSC 242. Feed Science and Industry (3).** Advances in feed production and processing technologies in relation to animal production. 3 hrs (class). PR. ANSC 241. (1,2).

**ANSC 243. Feed Additives (3).** Classification, mode of action, and use of non-nutritive substances in animal nutrition and health. 3 hrs (class). PR. ANSC 241. (1,2)

**ANSC 250. Advanced Course in Meats (3).** Physical and chemical characterization of meats and determination of meat quality. 5 hrs (2 class, 3 lab). PR. ANSC 131 or COI. (1)

**ANSC 260. Artificial Breeding of Farm Animals (3).** Techniques in the artificial breeding of farm animals. 7 hrs (1 class, 6 lab). PR. COI. (1)

**ANSC 261/ZOO 261. Livestock Endocrinology (3).** Anatomy and functional interrelationships of the endocrine gland in vertebrates. 3 hrs (class). PR. ANSC 101 or COI. (2)

**ANSC 262. Physiology of Reproduction (3).** Comparative physiology of reproduction in higher animals; factors involved in fertility; genetic and environmental variations in fertility mechanisms. 5 hrs (2 class, 3 lab). PR. ANSC 171 or COI. (2)

**ANSC 263. Mammalian Anatomy (3).** Anatomical dissection of mammals with emphasis on the horse, ox, and pig. 7 hrs (1 class, 6 lab). PR. COI. (1)

**ANSC 264. Mammalian Physiology (3).** General mammalian physiology with emphasis on circulation, respiration, digestion, metabolism, renal function, endocrinology, and nervous system. 3 hrs (class). PR. ANSC 101 or COI. (1)

**ANSC 265. Advanced Animal Breeding (3).** Population genetics; estimation and interpretation of genetic parameters in experimental population; selection index theory and application; breeding plans for maximum rate of improvement. 3 hrs (class). PR. ANSC 161 or COI. (1)

**ANSC 266. Poultry Breeding (3).** Breeding for the improvement of the economically important traits of poultry. 3 hrs (class). PR. ANSC 161 or COI. (2)

**ANSC 267/MBB 267. Animal Productive Biotechnology (3).** Biotechnological concepts and techniques in animal reproduction. 3 hrs (class). PR. ANSC 260 or COI. (2)

**ANSC 270. Research Techniques in Animal Nutrition (3).** Feeding experiments; metabolism and laboratory studies. 7 hrs (1 class, 6 lab). PR. COI. (2)

**ANSC 271. Feed Formulation and Quality Control (3).** Microscopic, chemical, and other tests for identification of feedstuffs additives and adulterants, advances in feed formulation for different classes of farm animals and for different nutritive purposes. 7 hrs (1 class, 6 lab). PR. COI. (1)

**ANSC 272. Advanced Animal Nutrition (3).** Advances in animal nutrition research and in industry practices. 3 hrs (class). PR. COI. (2)

**ANSC 285. Environmental Physiology of Domestic Animals (3).** Physiological mechanisms of animal adaptation, body temperature regulation, and related nutritional, metabolic and hormonal functions affecting animal production. 5 hrs (2 class, 3 lab). PR. ANSC 172 or COI. (2)

**ANSC 290. Special Problems in Animal Science (1-3).** May be taken twice provided that total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2)

**ANSC 291. Special Topics in Animal Science (1-3).** May be taken twice provided that total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2)

**ANSC 299. Graduate Seminar in Animal Science (1).** May be repeated once for a maximum of 2 units. PR. Graduate standing. (1,2)

**ANSC 300. Master's Thesis (6).** (1,2,M)

**ANSC 400. Doctoral Dissertation (12).** (1,2,M)

## Dairy Science

**DSC 230. Advances in Dairy Production (3).** Recent advances

in feeding, breeding, type, classification and other management practices in dairy production. 3 hrs (class). PR. ANSC 122 or COI. (2)

**DSC 235. Dairy Products Processing I (3).** Handling and processing of liquid milk cream and butter. 5 hrs (2 class, 3 lab). PR. ANSC 135 or COI. (1)

**DSC 236. Dairy Products Processing II (3).** Handling and processing of concentrated, dried, and fermented milk and frozen dairy products. 5 hrs (2 class, 3 lab). PR. ANSC 135 or COI. (2)

**DSC 240. Quality Control of Milk Products (3).** The physical, chemical and microbiological quality control testing of milk and milk products, dairy water supplies, detergents, and sanitizers. 7 hrs (1 class, 6 lab.) PR. CHEM 32 and ANSC 135 or COI. (2)

**DSC 268. Physiology of Lactation (3).** Anatomy and physiology of the mammary gland; theories of milk secretion affecting lactation. 5 hrs (2 class, 3 lab). PR. ANSC 101 and CHEM 160 or COI. (1,2)

**DSC 290. Special Problems (1-3).** May be taken twice provided that total numbers of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2)

### APPLIED MATHEMATICS (AMAT)

*Institute of Mathematical Sciences and Physics, College of Arts and Sciences*

**Degree offered:** Doctor of Philosophy

The Doctor of Philosophy in Applied Mathematics contains a total of 40 units broken down into 6 units of core courses (AMAT 310 and AMAT 350), 6 units of major courses, 3 units of research and development internship, elective courses, 12 units of elective courses, 1 unit of graduate seminar, and 12 units of dissertation (AMAT 400).

#### Applied Mathematics

**AMAT 310. Dynamic Systems Modeling (3).** Deterministic and stochastic modeling of temporal and spatial evolution of dynamic systems. 3 hrs (class). PR. COI. (1,2)

**AMAT 350. Advanced Numerical Analysis (3).** Theory and applications of numerical analysis. 3 hrs (class). PR. COI. (1,2)

**AMAT 398. Research and Development Internship (3).** Student should have passed the 12 units of core and major courses. Minimum of 200 hrs. (1,2,M)

**AMAT 399. Graduate Seminar (1).** PR. COI. (1,2,M)

**AMAT 400. PhD Dissertation (12).** PR. COI. (1,2,M)

Please refer to Mathematics for other courses.

### APPLIED NUTRITION (ApN)

*Institute of Human Nutrition and Food, College of Human Ecology*

**Degree offered:** Master of Science

**Foundation courses:** STAT 1, CHEM 160, HNF 11, HNF 121, HFDS 12

The MS ApN program requires a minimum of 31 units, these are 15 units of major courses, 9 units of minor courses, 1 unit of seminar and 6 units of thesis. The major courses are composed of core courses HNF 223, HNF 251, HNF 222, HUME 290 or HUME 291 and other major courses\* to satisfy the minimum number of units.

\*Major courses could be chosen from any of the following: HNF 221, HNF 224, HNF 225, HNF 252, HNF 253, HNF 254, HNF 298

Graduate students may choose to minor in any of the following areas/disciplines: Agricultural Education, Community Development, Extension Education, Rural Sociology, Development Communication, Food Science, Agronomy, Animal Science, Horticulture, Agricultural Economics, Development Management, Agricultural Chemistry, Chemistry, and Statistics.

Please refer to Human Nutrition for the list of courses.

### BIOCHEMISTRY (BCHM)

*Institute of Chemistry, College of Arts and Sciences*

**Degrees offered:** Master of Science and Doctor of Philosophy

The MS BCHM program requires a minimum of 31 units, these are 15 units of major courses, 9 units of minor courses\*, 1 unit of seminar and 6 units of thesis. The major courses are composed of 9 units of core courses (CHEM 260, CHEM 261, CHEM 263) and 6 units of biochemistry Courses.

The PhD BCHM program has a total of 38 units, these are 15 units of major courses, 9 units of cognate\*; 12 units of dissertation units and 2 units of seminar. The major courses are composed of 12 units of core courses units of core courses CHEM 262, CHEM 263\*\*, CHEM 266, CHEM 268, CHEM 269 and 3 units of other biochemistry courses.

\*Minor/cognate fields are Agricultural biotechnology, agricultural chemistry, agronomy, animal science, applied nutrition, botany, chemistry, computational science, entomology, food science, forestry, genetics, horticulture, microbiology, molecular biology, plant pathology, veterinary medicine

\*\*CHEM 263 is required in place of one of the indicated core courses if it has not been taken yet in the masters degree program.

Thesis/Dissertation should involve the application of biochemical principles and techniques.

Please refer to Chemistry for the list of courses.

**BOTANY (BOT)***Institute of Biological Sciences, College of Arts and Sciences***Degrees offered:** Master of Science and Doctor of Philosophy

**Areas of specialization:** MS: Economic Botany, Mycology, Palynology, Phycology, Plant Anatomy and Morphology, Plant Ecology, Plant Physiology (Plant Growth, Plant Nutrition, Salt Tolerance, Water Relations), Plant Systematics. / PhD: Mycology, Palynology, Phycology, Plant Physiology (Plant Growth, Plant Nutrition, Salt Tolerance, Water Relations).

**Foundation courses:** BOT 20; BOT 110; BOT 140; other related basic courses as may be deemed necessary by the Graduate Program Coordinating Committee.

The MS BOT program requires a minimum of 31 units, these are 15 units of major courses, 9 units of minor courses, 1 unit of seminar and 6 units of thesis.

The PhD BOT program requires a minimum of 37 units, these are 15 units of major courses, 9 units of cognate courses, 1 unit of seminar and 12 units of dissertation.

**Botany**

**BOT 201. Cell Ultrastructure (3).** Ultrastructure, molecular organization, origin and function of cellular organelles. 5 hrs (2 class, 3 lab). PR. COI. (1)

**BOT 202. Advances in Phycology (3).** Selected topics on the biology of algae with emphasis on recent ecological, physiological, and ultrastructural studies. 5 hrs (2 class, 3 lab). PR. COI. (1)

**BOT 210. Developmental Plant Anatomy (3).** Analytical study and interpretation of the initiation, differentiation, and organization of tissues and organs with emphasis on vascular plants. A term report on the development of specific tissues or organs is required. 5 hrs (2 class, 3 lab). PR. COI. (2)

**BOT 220. Plant Photophysiology (3).** Photosynthesis, photo respiration, photo morphogenesis, and other related processes in photophysiology of the plants. 3 hrs (class). PR. BOT 20 and CHEM 160 or CHEM 161. (1)

**BOT 221. Water Economy and Related Process in Plants (3).** Water relations, energy exchange, ion uptake, and ionic relations in plants. 3 hrs (class). PR. COI. (2)

**BOT 225/MBB 225. Biotechnology of Plant Secondary Metabolites (3).** Physiological bases of secondary plant metabolites production in vitro. 5 hrs (2 class, 3 lab). PR. BOT 20 and CHEM 160 or COI. (2)

**BOT 232/HORT 232. Physiology and Biochemistry of Endogenous Growth Regulators (3).** Physiology, biochemistry, transport, mode of action, assay and application of endogenous growth regulators. 5 hrs (2 class, 3 lab). PR. COI. (2)

**BOT 240. Problems and Methods in Plant Systematics (3).** A consideration of recent developments in plant taxonomy. 5 hrs (2

class, 3 lab). PR. BOT 140 or its equivalent. (1,2)

**BOT 245. Weed Systematics (3).** Identification and ecology of major tropical weeds. 5 hrs (2 class, 3 lab). PR. BOT 140 or its equivalent. (2)

**BOT 250. Advanced Plant Ecology. (3).** Physical, chemical, and biological processes which underlie ecosystem structure and function including plant competition, plant succession, material, and energy cycling. 3 hrs (class). PR. BOT 150 or its equivalent. (1)

**BOT 261. Pollination Biology (3).** Pollination processes, relationships of plants and pollinating agents, population dynamics of pollinators, and techniques in pollination biology. 5 hrs (2 class, 3 lab). PR. BIO 150 or COI. (1)

**BOT 290. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2)

**BOT 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units.

**BOT 299. Graduate Seminar in Botany (1).** May be repeated once for a maximum of 2 units. PR. COI. (1, 2, M)

**BOT 300. Master's Thesis (6).** (1, 2, M)

**BOT 400. Doctoral Dissertation (12).** (1, 2, M).

**BUSINESS MANAGEMENT (BM)***Department of Agribusiness Management, College of Economics and Management***Degree offered:** Master of Management

The Master of Management in Business Management is a non-thesis program. Prior to regular admission to the program, prospective students will be required to attend a summer workshop on the problems and prospects of agribusiness today, fundamentals of accounting and financial statement analysis, quantitative management, and microcomputer applications. The 5-week workshop will serve both as post-screening procedure and refresher course to prospective students.

The BM curriculum has 39 academic units, these are, 9 units of core courses (MGT 201, MGT 213 and MGT 231); 27 units of major courses (MGT 203, MGT 209, MGT 215, MGT 221, MGT 251, MGT 281, BM 240, BM 255, BM 280), and 3 units of electives (MGT 117, MGT 207, MGT 273, BM 261, STAT 250 or any graduate course approved by the student's guidance committee.)

**Business Management**

**BM 240. Production and Operations Management (3).** Production, principles, procedures and techniques for efficient utilizations of production resources. 3 hrs (class). PR. MGT 221. (2)

**BM 255. International Marketing (3).** Export-import trade with emphasis on analyzing the commercial feasibility of export products.

3 hrs (class). PR. MGT 251. (1)

**BM 261. Law in Business Transaction (3).** Laws affecting the various aspects of business operations, particularly those affecting the production, financing, marketing and distribution of goods and services. 3 hrs (class). PR. MGT 201 (1)

**BM 280. Research Methods in Business Management (3).** Statistical description, estimation and inference; statistical decision theory; survey of research methods and analytical procedures in the social sciences and their application in business management. 3 hrs (class). PR. COI. (1, 2)

### Management

**MGT 201. Organization and Management (3).** Organization and management theories, concepts and processes; organization changes and managerial systems. 3 hrs (class). (1,2)

**MGT 203. Environment of Management (3).** Survey of socio-cultural, economic, politico-legal, technological and natural forces in local and international environment, their interactions/interrelationships, and their influence and effects on management of public and private organizations. 3 hrs (class). PR. COI. (2,M)

**MGT 207. Managerial Problem Solving and Decision Making (3).** Quantitative and non-quantitative concepts, tools, and dynamics in problem solving and decision making processes at the national, firm, and individual levels. 3 hrs (class). PR. COI. (1,2)

**MGT 209. Economic Analysis (3).** Economic theory and policy with reference to the Philippine development program. 3 hrs (class). (2)

**MGT 213. Management Accounting and Control I (3).** Financial accounting policy in private and public organizations within the framework of accounting conventions. 3 hrs (class). (1)

**MGT 215. Financial Management (3).** Short and long range financial planning. Management of working capital and long-term financial position of a business organization. 3 hrs (class). (2)

**MGT 221. Quantitative Methods in Administration (3).** Various techniques of determining optimization involving univariate and multivariate functions. Includes differential and integral calculus, linear systems, and matrices and an introduction to linear programming. 3 hrs (class). PR. COI. (1)

**MGT 231. Human Behavior in Organization (3).** Individual and group behavior as these are influenced by cultural and technological factors: organizational change. 3 hrs (class). (1,2)

**MGT 251. Marketing Management (3).** The nature and dynamics of demand, the major marketing problems confronting the management in adapting to demand conditions; the development of pricing strategies for new and existing products. The types of distribution patterns and promotional programs employed to obtain sales and profits under a variety of operating conditions; the management of existing product lines, the development, testing, and introduction of new products; and the dynamics of export markets. 3 hrs (class).(2)

**MGT 273. Management of Small Business (3).** Characteristics, opportunities and hazards of small business; entrepreneurship and

the formation of small business; problems of survival; problems created by growth and ways to deal with them. 3 hrs (class). (1)

**MGT 281. Strategic Management (3).** Strategy formulation, implementation, evaluation and control; integration of the functional areas of business for a better strategy-environmental alignment. 3 hrs (class). PR. MGT 215, MGT 251 and BM 240 or ABME 240. (1, 2)

## CHEMICAL ENGINEERING (ChE)

*Department of Chemical Engineering, College of Engineering and Agro-Industrial Technology*

**Degree offered:** Master of Science

**Area of Specialization:** Pollution Engineering

The MS ChE program requires a minimum of 34 units, these are 18 units of major courses, 9 units of minor courses\*, 1 unit of seminar and 6 units of thesis. The major courses are composed of 12 units of core courses ChE 204, ChE 242, ChE 243, ChE 245 and 6 units of major courses from ChE 240, ChE 272, ChE 290, ChE 291.

The MS ChE with Pollution Engineering as specialization requires 37 units, these are: 12 units of core courses (ChE 204, ChE 242, ChE 243, ChE 245), 18 units of specialization courses (ChE 282, ChE 283, ChE 284, ChE 286, ChE 288, ChE 291), 1 unit of seminar; and 6 units of thesis.

\*Partial list of cognate/minor courses for MS ChE Program  
 Animal Science (Dairy Science): DSC 230, DSC 235, DSC 236  
 Food Science (Food Science and Engineering): FST 219, FST 235, FST 236, FST 240, FST 241, AENG 232, AENG 233  
 Chemistry: ACHM 235, CHEM 214, CHEM 205, CHEM 216, CHEM 230, CHEM 265, CHEM 267, CHEM 275  
 Computer Science: CMSC 215, CMSC 250, CMSC 280  
 Environmental Science: ChE 291, AENG 247, ENS 275, ENS 201, ENS 203, ENS 242, ENS 296, CHEM 273  
 Mathematics: MATH 213, AMAT 266, AMAT 267  
 Statistics: STAT 235, STAT 251, STAT 252  
 Management: MGT 207, MGT 251, DM 204, DM 210  
 Economics/Agricultural Economics: AECO 240, AECO 241, AECO 248  
 Agricultural Engineering: AENG 201, AENG 202, AENG 204, AENG 225, AENG 231, AENG 232, AENG 233, AENG 240, AENG 247  
 Forestry (Pulp and Paper Technology): WST 203, WST 204, WST 205  
 Forestry (Forest Products Engineering): WST 212, WST 225, WST 260, WST 262

### Chemical Engineering

**ChE 204. Mathematical Methods for Chemical Engineering Analysis (3).** Numerical and analytical methods of solutions to systems of linear equations, ordinary and partial differential equations; and their applications in chemical engineering analyses. PR. ENSC 26 and ENSC 21. (1,2)

**ChE 240. Advanced Control Theory (3).** Theories for analysis and design of advanced control systems. PR. EE 130 or COI. (2)



**ChE 242. Advanced Chemical Engineering Thermodynamics (3).** Estimation of the thermophysical properties of substances and modeling of phase equilibrium. PR. ChE 143 and ENSC 21 or COI. (2)

**ChE 243. Advanced Transport Phenomena (3).** Heat, mass and momentum transport analysis in chemical and biochemical engineering systems. 3 hrs (class). PR. ChE 149 or COI. (1)

**ChE 245. Advanced Chemical Reaction Engineering (3).** Kinetics of heterogeneous catalytic and non-catalytic reactions; analysis and design of multiphase, non-ideal and non-isothermal reactors. PR. ChE 145 and ENSC 21 or COI. (1)

**ChE 272. Advances in Biochemical Engineering (3).** Engineering developments in bioprocesses, nonconventional biological systems; recent developments in biochemical engineering. PR. CHEM 177 or COI. (1)

**ChE 282. Physical and Chemical Wastewater Treatment Design (3).** Applications of the physical and chemical principles in the design of wastewater treatment facilities. 3 hrs (class). PR. ChE 180 or COI. (1)

**ChE 283. Biological Wastewater Treatment Design (3).** Wastewater treatment design of bioreaction systems for suspended and immobilized aerobic and anaerobic digestion processes. 3 hrs (class). PR. ChE 180 and MCB 1 or COI. (1)

**ChE 284. Solid Waste Management (3).** Technical aspects of solid waste minimization, treatment and disposal. 3 hrs (class). PR. ChE 180 or COI. (2)

**ChE 286. Air Quality and Pollution Control Engineering (3).** Air quality; elements, sources, and effects of air pollution; measurement, monitoring, and engineering control. 3 hrs (class). PR. ChE 180 or COI. (1)

**ChE 288. Hazardous Waste Management (3).** Minimization, treatment, and disposal of hazardous wastes; integrated management of hazardous wastes. 3 hrs (class). PR. ChE 180 or CE 52 or CHEM 180 or COI. (2)

**ChE 290. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2)

**ChE 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2)

**ChE 299. Graduate Seminar (1).** May be taken twice for a maximum of 2 units. PR. COI. (1,2)

**ChE 300. Master's Thesis (6).** (1,2,M)

## CHEMISTRY (CHEM)

*Institute of Chemistry, College of Arts and Sciences*

**Degree offered:** *Master of Science*

The MS CHEM program requires a minimum of 31 units, these are 15 units of major courses, 9 units of minor courses\*, 1 unit of seminar and 6 units of thesis. The major courses are composed of 12 units of core courses CHEM 205, CHEM 220, CHEM 230, CHEM 242 and 3 units of chemistry courses.

\*Minor field options are agricultural chemistry, biochemistry, computer science, environmental science, mathematics and physics.

## Chemistry

**CHEM 205. Intermediate Physical Chemistry (3).** Principles and calculations in intermediate physical chemistry, with emphasis on quantum chemistry, molecular thermodynamics, and chemical kinetics. 3 hrs (class). PR. CHEM 115 or COI. (1)

**CHEM 211. Quantum Chemistry (3).** Fundamental principles, computational methods, and chemical applications of quantum mechanics. 3 hrs (class). PR. CHEM 115 or COI. (1)

**CHEM 214. Molecular Thermodynamics (3).** Principles of statistical thermodynamics and its applications to molecular systems. 3 hrs (class). PR. CHEM 205 or COI. (2)

**CHEM 215. Advanced Physical Chemistry (3).** Classical and quantum mechanics; statistical thermodynamics. 3 hrs (class). PR. CHEM 111 or COI

**CHEM 216. Chemical Kinetics (3).** Empirical and theoretical treatments of rates of simple gas phase reactions, reactions in solutions, complex reactions; catalysis. 3 hrs (class). PR. CHEM 205 or COI. (2)

**CHEM 220. Advanced Inorganic Chemistry (3).** Structure, bonding, stereochemistry and reactivity of inorganic compounds; recent advances in the field. 3 hrs (class). PR. CHEM 120 or COI. (1)

**CHEM 225. Organometallic Chemistry (3).** Principles and applications of organotransition metal chemistry. 3 hrs (class). PR. CHEM 120 and CHEM 140 or COI. (1)

**CHEM 227. Bioinorganic Chemistry (3).** Role of metals in biological systems. 3 hrs (class). PR. CHEM 120 and CHEM 161 (or 160) or COI. (2)

**CHEM 230. Research Techniques in Chemistry (3).** Theories and principles of analytical techniques important to agricultural research. 7 hrs (1 class, 6 lab). PR. CHEM 112.1 or COI. (1)

**CHEM 231. Chromatography (3).** Principles and applications of chromatographic separations. 3 hrs (class). PR. CHEM 112 and CHEM 137 or COI. (2)

**CHEM 232. Spectrochemical Methods of Analysis (3).** Theories and principles of modern spectrometric techniques used for chemical analysis; their instrumentation and applications. 3 hrs (class). PR. CHEM 112 and CHEM 137 or COI. (2)

**CHEM 233. Electroanalytical Chemistry (3).** Principles, methodology and applications of electroanalytical chemistry. 3 hrs (class). PR. CHEM 112 and CHEM 137 or COI. (1)

**CHEM 242. Organic Reaction Mechanism (3).** Advanced study of the structure and reactivity of organic compounds; stereochemistry. 3 hrs (class). PR. CHEM 44 or COI. (2)

**CHEM 244. Organic Synthesis (3).** Principles and applications of organic synthesis. 3 hrs (class). PR. CHEM 242 or COI. (2)

**CHEM 246. Heterocyclic Compounds (3).** Structure and chemical behavior of heterocyclic systems, with emphasis on naturally occurring types. 3 hrs (class). PR. CHEM 44 or COI. (1)

**CHEM 252. Chemistry of Natural Products (3).** Isolation and identification of chemical compounds obtained from natural sources. 7 hrs (1 class, 6 lab). PR. COI. (2)

**CHEM 254. Physical Biochemistry (3).** Applications of thermodynamics and kinetics in biological systems. 3 hrs a week (class). PR. CHEM 160 or CHEM 161 and CHEM 102 or CHEM 112. (1)

**CHEM 260. Intermediary Metabolism I (3).** Metabolism of carbohydrates and lipids. 3 hrs (class). PR. CHEM 160 or CHEM 161 or COI. (1)

**CHEM 261. Intermediary Metabolism II (3).** Metabolism of proteins, nucleic acids, and biologically-active nitrogen containing compounds. 3 hrs (class). PR. CHEM 160 or CHEM 161 or COI. (2)

**CHEM 262. Lipid Chemistry (3).** Structure and biological functions, properties and applications of lipids. 3 hrs a week (class). PR. CHEM 160 or CHEM 161. (1)

**CHEM 263. Analytical Biochemistry (3).** Isolation, purification, and characterization of biomolecules. 7 hrs (1 class, 6 lab). PR. CHEM 32 and CHEM 160.1 or COI. (1,2)

**CHEM 265. Enzyme Chemistry (3).** Equilibrium and kinetic aspects of enzyme reactions; enzyme structure and function; allosterism. 3 hrs (class). PR. CHEM 111 and CHEM 160 or CHEM 161 or COI. (2)

**CHEM 266. Chemistry of Nucleic Acids (3).** Structure, chemical properties, metabolism and biological functions of nucleic acids. 3 hrs (class). PR. CHEM 160 or CHEM 161. (2)

**CHEM 267. Advanced Biochemistry (3).** Special topics in advanced biochemistry. 3 hrs (class). PR. CHEM 160 or CHEM 161 or COI. (1,2)

**CHEM 268. Carbohydrate Chemistry (3).** Occurrence, structure and properties, isolation and purification, characterization, synthesis, biosynthesis and application of carbohydrates. 3 hrs (class). PR. CHEM 160 or CHEM 161. (1)

**CHEM 269. Protein Chemistry (3).** Structure, function, interrelationships and applications of protein. 3 hrs (class). PR. CHEM 160 or CHEM 161. (2)

**CHEM 273. Chemical Toxicology (3).** Toxicological concepts, reaction mechanisms and regulatory policies involved in the use of and exposure to chemicals in environment. 3 hrs (class). PR. CHEM 160 or CHEM 161 or COI. (1,2)

**CHEM 275. Enzyme Technology (3).** Large-scale enzyme extraction and purification; immobilized enzyme technology; functional characteristics of enzyme reactors; recent advances in enzyme technology. 3 hrs (class). PR. CHEM 178 and CHEM 265 or COI. (1)

**CHEM 290. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2)

**CHEM 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2)

**CHEM 299. Graduate Seminar (1).** May be repeated for a maximum of 2 units. (1,2,M)

**CHEM 300. Master's Thesis (6).** (1,2,M)

**CHEM 400. Doctoral Dissertation (12).** (1,2,M)

## COMMUNICATION ARTS (COMA)

*Department of Humanities, College of Arts and Sciences*

**Degrees offered:** *Master of Arts and Master in Communication Arts*

The MCA program is a non-thesis program, it consists of 37 units, these are 24 units of major courses, 12 units of minor and 1 unit of seminar. The major courses includes 6 units of core courses COMA 201 and COMA 202; 3 units of Special Problem (COMA 290); and other major courses (COMA 211, COMA 212, COMA 213, COMA 214, COMA 215, COMA 220, COMA 224, and COMA 226) to satisfy the units required.

The MA CA program requires a minimum of 31 units, these are 15 units of major courses, 9 units of minor courses\*, 1 unit of seminar and 6 units of thesis. The major courses includes core courses (COMA 201, COMA 202) and 9 units of other major courses from COMA 211, COMA 212, COMA 213, COMA 214, COMA 215, COMA 220, COMA 224 and COMA 226.

\*can be taken from any of the disciplines of social sciences, human ecology, management, linguistics, philosophy, literature, mass communication, development communication, and other related areas.

## Communication Arts

**COMA 201. Critical Approaches to Communication Studies (3).** A survey of critical theories and their application to analysis of texts and to communication research. 3 hrs (class). PR. COMA 192 or COI.

**COMA 202. Discourse Analysis in Communication (3).** The study of language and its extension through communication technology using discourse analysis. 3 hrs (class). PR. COMA 104 or COI. (1)

**COMA 211\*. Rhetoric (3).** Theories of rhetoric from ancient to modern times. (1)

**COMA 212. Phonology (3).** Theories and principles of speech

communication, the physiology of speech production, and transcriptions of sounds in the International Phonetic Alphabet (IPA). 3 hrs (class). PR. COI.

**COMA 213. Advanced Oral Interpretation (3).** Principles, concepts and techniques of oral interpretation applied to a variety of literary genres. 3 hrs (class). PR. COMA 212.

**COMA 214. Varieties of Public Speaking (3).** The preparation, presentation, and critical evaluation of different kinds of individual and group-speaking performances in professional and off-the-job situations. 3 hrs (class). PR. COMA 212 or COI.

**COMA 215. Speech Communication Strategies for Instruction (3).** Preparation, design and application of speech communication tools and strategies for effective teaching. 3 hrs (class). PR. COI.

**COMA 220. Grammar and Stylistics (3).** Interactive relationship between grammar, semantics, and style. 3 hrs (class). PR. COI.

**COMA 224. Writing for Corporate Communication (3).** Strategies in the design and preparation of communication forms to meet corporate objectives. 3 hrs (class). PR. ENG 102 or COI.

**COMA 226. Writing Children's Literature (3).** Writing in context, fiction, and nonfiction for children. 3 hrs (class). PR. ENG 106 or COI.

**COMA 290. Special Problems (3).**

**COMA 299. Graduate Seminar (1).**

**COMA 300. Master's Thesis (6).**

### COMMUNITY DEVELOPMENT (CD)

*Institute of Governance and Rural Development, College of Public Affairs and Development*

**Degrees offered:** *Master of Science and Doctor of Philosophy*

The MS CD program requires a minimum of 37-38 units, these are 21-22 units of major courses, 9 units of minor courses, 1 unit of graduate seminar and 6 units of thesis. The major courses are composed of core courses (CED 232, AERS 265, AERS 282, STAT 166 or CED 291); 6 units of specialization courses (CED 250, CED 252); and 3 units of electives (CED 246, CED 253, AERS 261).

The PhD CD program requires a minimum of 45-48 units, these are 23 units of major courses, 9 or 12 units of cognate courses, 1 unit of graduate seminar and 12 units of dissertation. The major courses are composed of core courses (CED 227, CED 301, CED 365, AERS 281, AERS 282\*, CED 291\*\*); 6 units of specialization courses (CED 250\*, CED 252\*, CED 251, AERS 267) and 3 units of electives (DM 220, SOC 292, CED 246, CED 253).

\*Required if not taken in the MS program

\*\*If CED 291 has been taken, additional social science statistics or qualitative research methods may be required.

### Community Education

**CED 201. Philosophy of Education (3).** Significant theories and principles of education and their implications for development education in the Philippines. 3 hrs (class). PR. COI. (1,2)

**CED 202. Theory and Practice of Community Education (3).** Theoretical underpinnings and strategies in community education. 3 hrs (class). PR. COI. (1,2)

**CED 210. Managing Education for Community Welfare (3).** Management principles and tools for productivity and quality improvement in education within the community. 3 hrs (class). PR. COI. (1,2)

**CED 211. Advanced Educational Psychology (3).** Psychological theories and principles underlying the learning processes. 3 hrs (class). PR. COI. (1)

**CED 213. Instructional Systems Design and Management (3).** Principles, approaches, and processes in designing and managing instructional systems. 3 hrs (class). PR. COI. (2)

**CED 215. Leadership for Educational and Community Productivity (3).** Leadership behavior, theories, qualities, approaches, skills and techniques. 3 hrs (class). PR. COI. (2)

**CED 217. Educational Planning (3).** Concepts, procedures and tools in developing plans at various levels and types of educational systems. 3 hrs (class). PR. COI. (2)

**CED 220. Sociology of Education (3).** Analysis of education as a factor in social change; the sociological significance of schools and other social institutions in rural development; social factors in the learning process. 3 hrs (class). PR. COI. (2)

**CED 224. Economics of Education (3).** Application of the economics in the analysis of problems and issues in financing education, both formal and nonformal, particularly in low-income countries. 3 hrs (class). PR. COI. (1)

**CED 226. Educational Evaluation (3).** Measurement approaches, evaluation techniques, models and processes in determining the effectiveness of formal education training programs. 3 hrs (class). PR. COI. (1)

**CED 227. Administrative Theory (3).** Management theories and concepts as they relate to organizations with emphasis on educational institutions; forces in the organization and the external environment and their influence on managerial roles, functions, and management policies. 3 hrs (class). PR. COI. (2)

**CED 231. Vocational Education in Agriculture (3).** Concepts of vocational education in agriculture; current trends and issues as they relate to the development process. 3 hrs (class). PR. COI. (1)

**CED 232/SOC 232. Advanced Social Psychology (3).** Issues in social perception, cognition, social influence and social relationships. 3 hrs (class). PR. COI. (2)

**CED 233. Experiential Learning Programs in Agriculture (3).** Identification and analysis of contemporary issues and problems

in conducting experiential learning programs in agriculture. 3 hrs (class). PR. COI. (1)

**CED 240. Extension Science (3).** The theory and practice of extension. 3 hrs (class). PR. COI. (1)

**CED 242. Adult Education in Agriculture (3).** A course to acquaint prospective teachers, agricultural leaders, and community workers regarding ways of developing programs for young and adult farmers, and effective methods of teaching adults. 3 hrs (class). PR. COI. (1)

**CED 244. Comparative Analysis of Extension Approaches (3).** Analysis of different extension approaches and their application under varied socioeconomic and physical milieus. 3 hrs (class). PR. COI. (2)

**CED 246. Evaluation in Rural Development (3).** The nature, principles, and role of evaluation in vocational agriculture education; extension education, and community development; selection, construction, and use of evaluation devices. 3 hrs (class). PR. COI. (1,2)

**CED 248. Participatory Extension (3).** Concepts and practice in community-based participatory extension and action research planning and development. 3 hrs (class). PR. COI. (2)

**CED 250. Community Development (3).** Philosophy, principles, and problems of community development in the Philippines. 3 hrs (class). PR. COI. (1)

**CED 251. Comparative Community Development (3).** Analysis of the characteristics of national community development programs in selected countries, with emphasis on their comparative merits and demerits and on the extraction of elements that may have universal application. 3 hrs (class). PR. COI. (2)

**CED 252. Planning and Administration of Community Development (3).** Features of community development programs in the Philippines, their organization, administrative planning, interrelationship with local government units, financing, personnel administration, field execution, and evaluation. 3 hrs (class). PR. COI. (1,2)

**CED 253. Comparative Local Government (3).** Organization, management, and finance of local rural government in selected high-income and low-income countries, including the relationship between level of government and the alternative to local autonomy. 3 hrs (class). PR. COI. (1)

**CED 290. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. (1,2)

**CED 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. (1,2)

**CED 298. Field Studies (3).** PR. COI. (1,2,M)

**CED 299. Graduate Seminar (1).** (1,2)

**CED 300. Master's Thesis (6).** (1,2,M)

**CED 301. Philosophical Ideas in Development (3).** Philosophical traditions in development and conceptual frameworks for analyzing contemporary development programs. 3 hrs (class). PR. COI. (1)

**CED 365. Rural Institutions (3).** Identification, description, and analysis of changes taking place in rural institutions, which relate to the economic, social, political, and cultural life of the rural population. 3 hrs (class). PR. AERS 265 or AERS 261 or COI. (1,2)

**CED 400. Doctoral Dissertation (12).** (1,2,M)

## COMPUTER SCIENCE (CMSC)

*Institute of Computer Science, College of Arts and Sciences*

Degrees offered: *Master of Science and Doctor of Philosophy*

Applicants will be admitted as a regular student if they have a BS in Computer Science degree in any accredited institution and has an average of 2.0 or better in all their computer science courses. Foundation courses are: CMSC 123, CMSC 124, CMSC 125, CMSC 127, CMSC 131, CMSC 141, CMSC 142. Applicants who have not taken these courses may do so as non degree students. Once a student obtains an average of 2.0 or better in these seven courses, they may be admitted as a regular student.

The MS CMSC consists of a minimum of 34 units, these are 18 units of major courses, 9 units of minor courses\*, 1 unit of seminar and 6 units of thesis\*\*. The major courses are composed of core courses (CMSC 214, CMSC 215, CMSC 244, CMSC 245); and other 200 level CMSC courses to satisfy the number of units.

The core courses of the MS program serves as the foundation courses for the PhD program. Students must have passed these courses otherwise they are to be taken in addition to the courses required in the PhD program.

The PhD CMSC consists of a minimum of 38 units, these are: 15 units of major courses; 9 units of cognate courses; 2 units of seminar; and 12 units of dissertation\*\*. The major courses are composed of core courses (CMSC 241, CMSC 341, CMSC 342); and other 200 level CMSC courses to satisfy the number of units.

\*The minor/cognate courses may be taken from another field like Mathematics, Statistics, Management, Economics, Forestry, and other fields in UPLB with an MS program.

\*\*Graduate students may do their thesis on any of the following areas of strength of the Institute: Algorithm (Serial, Distributed, and Parallel), Computer Performance Evaluation, Computer-Assisted Instruction, Expert Systems, Information and Database Systems, Networking, Software Engineering.

## Computer Science

**CMSC 214. Programming Language Design Concepts (3).** Formal language theory, principles, and techniques of compiler construction, programming language, design concepts; parallelism and formal semantics. 3 hrs (class). PR. CMSC 124 and CMSC 141 or COI. (2)

**CMSC 215. Advanced Computer Systems (3).** Recent developments in computer architecture and computer systems. 3 hrs



(class). PR. CMSC 125 and CMSC 131 or COI. (1)

**CMSC 227. Advanced Database Systems (3).** Conceptual design of a database; models for conceptual design; database management, security and recovery; database languages. 3 hrs (class). PR. CMSC 127 or COI. (1)

**CMSC 241. Formal Languages, Automata Theory and Computations (3).** Finite automata and regular expression; context-free languages; Turing Machines, undecidability. 3 hrs (class). PR. CMSC 141 or COI. (1)

**CMSC 244. Algorithms and Advanced Data Structures I (3).** Design, analysis, and implementation of algorithms; use of advanced data structure in algorithm design. 3 hrs (class). PR. CMSC 142 or COI. (1)

**CMSC 245. Algorithms and Advanced Data Structures II (3).** Advanced topics in algorithmic graph theory, efficient polynomial and matrix algorithms; number theoretic algorithms, string processing and computational geometry; design and analysis of parallel algorithms; the theory of NP completeness and approximation algorithms. 3 hrs (class). PR. CMSC 244. (2)

**CMSC 250. Scientific Computing (3).** Principles, methodology, and tools of scientific computing. 3 hrs (class). PR. MATH 28 or 38 or COI. (1)

**CMSC 271. Management Information Systems (3).** Computer-based methodologies for the design and development of management information systems. 3 hrs (class). PR. CMSC 127 or COI. (1)

**CMSC 272. Strategic Information Systems Development (3).** Information engineering concepts and tools for strategic systems planning and development. 3 hrs (class). PR. CMSC 127 or COI. (2)

**CMSC 280. Parallel Processing (3).** Parallel machine models; design, analysis, and implementation of parallel algorithms. 3 hrs (class). PR. CMSC 132 or COI. (2)

**CMSC 290. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units.

**CMSC 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. (1,2)

**CMSC 299. Graduate Seminar (1).** May be taken twice. (1,2)

**CMSC 300. Master's Thesis (6).** PR. COI.

**CMSC 341. Advanced Theory of Computation (3).** Recursive function theory, computability and decidability. 3 hrs (class). PR. CMSC 241. (1)

**CMSC 342. Computational Complexity Theory (3).** Time and space complexities of algorithms. 3 hrs (class). PR. CMSC 245. (2)

**CMSC 391. Special Topics (1-3).** PR. COI. (1,2)

**CMSC 399. Graduate Seminar (1).** PR. COI. (1,2)

**CMSC 400. Doctoral Dissertation (12).** (1,2,M)

## COOPERATIVE MANAGEMENT (CM)

*Institute of Cooperatives and Bio-Enterprise Development (ICOPED), College of Economics and Management*

**Degree offered:** *Master of Management*

The MM CM program consists of 36 units, these are: 9 units of core courses (MGT 201, MGT 213, MGT 231); 24 units of major courses (MGT 207, MGT 215, MGT 251, ENTR 201, COST 201, COST 204, COST 291, COST 298) and 3 units of electives chosen from AEEO, ABM or courses from other units relevant to student's plan of study.

## Cooperative Studies

**COST 201. Theory and Comparative Development of Cooperatives (3).** Concepts, philosophy, history, and nature of cooperatives; comparative study of cooperatives development in different societies. 3 hrs (class). PR. COI. (1)

**COST 202. Organization and Management of Cooperatives (3).** Nature, types of operations of cooperatives as business enterprises; problems and prospects in organizing and managing cooperatives. 3 hrs (class). PR. AEEO 136 or COI. (1,2)

**COST 203. Cooperatives Legislation (3).** The Philippine cooperatives movement and laws on cooperatives; analysis of legislative measures from the perspective of social and economic development in line with current national developmental goals and strategies. 3 hrs (class). PR. COI. (1)

**COST 204. Cooperative Enterprise Development (3).** Analysis and planning of cooperative enterprise development. 3 hrs (class). PR. COI. (2)

**COST 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. 2 hrs (class). PR. COI.

**COST 298. Field Studies (3).** PR. COI.(1,2,M)

**COST 299. Graduate Seminar (1).** May be taken twice. 1 hr (class). PR. COI.

*For other courses please see Business Management and Agribusiness Management & Entrepreneurship*

## DEVELOPMENT COMMUNICATION (DEVCO)

*College of Development Communication*

**Degrees offered:** *Master of Science and Doctor of Philosophy*

## Master of Science in Development Communication

The Master of Science in Development Communication program responds to the evolving development paradigms and communication perspectives. It is designed to produce graduates who are able to:

1. Compare and contrast theories, schools of thought,

principles, and strategies of communication in the context of developments;

2. Analyze issues and challenges in development that may be addressed by education and training in development communication;
3. Conduct research and evaluation in development communication; and
4. Apply development communication concepts and skills in the design and management of systems, programs, and projects in development.

### Doctor of Philosophy in Development Communication

The program prepares graduates to assume leadership roles in development communication education and practice. The PhD in Development Communication is designed to produce graduates who are able to:

1. Explain the process of theory construction and critiquing towards theory formulation in development communication;
2. Analyze the research and research management process in development communication programs;
3. Conduct development communication research;
4. Examine issues and challenges towards setting directions in development communication education and practice; and
5. Formulate development communication policies for development programs.

The MS DEVC program has a minimum of 33 units, these are: 11-13 units of core courses (DEVC 202, DEVC 205, DEVC 290, DEVC 291, DEVC 295, DEVC 299); 6 units of electives; 9 units of cognate courses; and 6 units of thesis.

The PHD DEVC program has a minimum of 42 units, these are: 20-22 units of core courses (DEVC 310, DEVC 311, DEVC 320, DEVC 363, AERS 281, DEVC 391, DEVC 393, DEVC 399); 1-3 units electives; 9-12 units cognate courses; and 12 units dissertation.

For students with DEVC as a minor or cognate field DEVC 202 and 6 units (3 units for PhD students with two cognates) of DEVC courses are required.

### Development Communication

**DEVC 202. Communication Theory in Development Communication (3).** Communication theories and their applications to development communication study and practice. 3 hrs (class). PR. None. (1,2)

**DEVC 205. Communication and Development (3).** Perspectives, theories, principles, and strategies of communication and development. 3 hrs (class). PR. COI. (1,2)

**DEVC 208. Communication Approaches in Development Programs (3).** Application of communication concepts, principles, strategies, and practices in promoting social ideas towards behavior change and mobilizing people in developmental programs. 3 hrs (class). PR. DEVC 202 or COI. (1,2)

**DEVC 212. Environmental Communication (3).** Application of environmental communication principles, strategies, and techniques to address risks, controversies, and crises associated with the

environment. 3 hrs (class). PR. COI. (2)

**DEVC 215. Communication and Culture (3).** Nature and interrelationships of communication and culture, and their applications to development communication. 3 hrs (class). PR. COI. (1)

**DEVC 230. Educational Communication Systems (3).** Learning theories and approaches in educational communication systems and their application to learning. 5 hrs (2 class, 3 lab). PR. COI. (1)

**DEVC 231. Educational Communication Systems Management (3).** Theories, principles, approaches, and tools in managing an educational communication unit. 3 hrs (class). PR. COI. (2)

**DEVC 234. Information and Communication Technologies for Development (3).** Theoretical perspectives, systems and structures, uses, and ethics in using information and communication technologies as tools in development. 3 hrs (class). PR. COI. (1)

**DEVC 290. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI.

**DEVC 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. (1,2)

**DEVC 295. Development Communication Research (3).** Quantitative and qualitative research methods in development communication. 3 hrs (class). PR. DEVC 202. (1,2)

**DEVC 299. Graduate Seminar in Development Communication (1).** May be taken for one or two semesters. (2)

**DEVC 300. Master's Thesis (6).** (1,2,M)

**DEVC 310. Theorizing in Development Communication (3).** History, philosophical assumptions, communication theory traditions and praxis, and critique towards theorizing in development communication. 3 hrs (class). PR. DEVC 202 or COI. (1,2)

**DEVC 311. Organizational Communication and Leadership in Development (3).** Theories, perspectives, processes, and applications of organizational communication and leadership in development practice. 3 hrs (class). PR. None. (1,2)

**DEVC 320. Communication Systems Policies and Planning (3).** Concepts, theories, and approaches in communication systems policy formulation and planning in support of a development program. 3 hrs (class). PR. DEVC 311. (1,2)

**DEVC 363. Public Communication of Science (3).** Concepts, models, approaches, and issues in public communication of science in the context of development. 3 hrs (class). PR. COI. (1,2)

**DEVC 390. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI.

**DEVC 391. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI.

**DEVC 393. Qualitative Approaches to Communication (3).** Perspectives, approaches, concepts, and methods in qualitative communication research. 3 hrs (class). PR. DEVC 310. (2)

**DEVC 399. Graduate Seminar (1).** May be taken for one or two semesters.

**DEVC 400. Doctoral Dissertation (12).** (1,2,M)

## **DEVELOPMENT MANAGEMENT AND GOVERNANCE (DMG)**

*Institute of Governance and Rural Development, College of Public Affairs and Development*

**Degrees offered:** *Master of Science; Master of Development Management and Governance*

**Areas of Specializations:** Organizational and Institutional Development, Program Management, Governance of Microfinance and Microinsurance Institutions, and Local Governance and Development

MDMG is a non thesis program it has a total of 31 units that includes 15 units of core courses (DM 201, DM 204, DM 241, LGD 210, AERS 282); 9 units of specialization courses; 3 units of elective; 3 units of field study (DM 298); and 1 unit of seminar (DM 299)

MS DMG has a total of 38 units that includes 19 units of core courses (DM 201, DM 204, DM 241, LGD 210, AERS 282, PAF 203); 9 units of specialization courses; 3 units of elective; 6 units of thesis (DMG 300); and 1 unit of seminar (DM 299)

Specialization courses

- a. Organizational and Institutional Development: DM 230, LGD 215, LGD 216, DM 210
- b. Program Management: DM 220, DM 221, DM 223, DMG 224, DMG 225
- c. Local Governance and Development DM 224, DMG 224, DMG 244, DMG 245, DMG 246, LGD 211, LGD 213, LGD 216
- d. Governance of Microfinance and Microinsurance Institutions DMG 230, DMG 231, DMG 232

## **Development Management**

**DM 201. Development Perspective (3).** Systems theory and concepts and their application to the analysis of the national development process; comparison of development patterns; and Philippine historical realities and current national development goals and strategies. 3 hrs (class). PR. COI. (1,2)

**DM 204. Management Dimensions of Development Organizations (3).** History, environment, and dynamics of development organizations; application of management principles in the analysis of development organization. 3 hrs (class). PR. COI. (1,2)

**DM 210. Research Management (3).** Principles, practices, and dynamics of research management. 3 hrs (class). (1,2)

**DM 220. Public Policy and Program Administration for Development (3).** (1,2). Policy formulation, analysis, and

implementation; program administration and project management for development. 3 hrs (class). PR. COI. (1,2)

**DM 221. Fiscal Administration in Development (3).** Theories and methods of fiscal administration and their application in the financial planning and analysis of development programs. 3 hrs (class). PR. COI. (1,2)

**DM 223. Project Development and Management (3).** Design, implementation, and evaluation of development projects. 3 hrs(class). PR. COI. (1,2)

**DM 224. Public Affairs Management in Development I (3).** Political and administrative structures and processes in national development with emphasis on rural development. 3 hrs (class). PR. COI. (1,2)

**DM 225. Public Affairs Management in Development II (3).** Concepts, scope, and components of rural development management. Analysis of management environment and behavior in the implementation of rural development programs. 3 hrs (class). PR. DM 224 or COI. (2)

**DM 230. Planned Change in Development (3).** Concepts, models, and strategies of planned transformation. 3 hrs (class). PR. COI. (1,2)

**DM 241. Managerial Leadership (3).** Leadership theories, roles, styles, and skills in various management levels. 3 hrs (class). PR. MGT. 101 or COI. (1,2)

**DM 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited in the student's program will not exceed 4 units. (1)

**DM 298. Field Studies in Development Management (3).** PR. COI. (1,2,M)

**DM 299 . Graduate Seminar in Development Management (1).** May be taken twice. PR. COI. (1,2)

## **Development Management and Governance**

**DMG 224. Governance Framework for Disaster Risk Reduction and Climate Change Adaptation (3).** Governance theories, concepts and issues, and their application in disaster risk reduction and climate change adaptation policy, plans and projects. 3 hrs (3 class). PR. COI. (1,2)

**DMG 225. Governance of Food Systems (3).** Theories, perspectives and approaches to governance of food systems for food and nutrition security. 3 hrs (class). PR. COI. (1,2)

**DMG 230. Microfinance, Microinsurance and Development (3).** Concepts, models, and management of microfinance and microinsurance institutions and their role in development. 3 hrs (class). PR. COI. (1,2)

**DMG 231. Governance of Microfinance Institutions (3).** Concepts, approaches, and tools in the governance of microfinance institutions. 3 hrs (class). PR. DM 230 or COI. (1,2)

**DMG 232. Governance of Microinsurance Institutions (3).** Concepts, approaches, and tools in the governance of microinsurance institutions. 3 hrs (class). PR. DMG 230 or COI. (1,2)

**DMG 244. Local Government Entrepreneurship (3).** Concepts, principles, practices and tools in local government entrepreneurship. 3 hrs (class). PR. COI. (1,2)

**DMG 245. Local Development Planning (3).** Theories, processes and tools for local development planning. 3 hrs. (class). PR. COI. (1,2)

**DMG 246 . Public Integrity and Social Accountability (3).** Anti corruption, public integrity mechanisms and social accountability strategies. 3 hrs (class). PR. COI. (1,2)

**DMG 300. Master's Thesis (6).** (1,2)

### DEVELOPMENT STUDIES (DVST)

*Graduate School, UPLB*

**Degree offered:** *Doctor of Philosophy*

The PhD DVST program combines the analytical rigor required of social science and technical fields to be able to address development issues such as food security, natural resource management, population, gender and development, and agrarian and rural development. Study of these development issues can be properly understood in an interdisciplinary perspective. The program has as its loci of disciplines the applied social sciences to be combined with the technical courses to address a development issue.

The program requires the applicants to have a Master's degree or a Master of Science degree in the Social Sciences or related fields; a development practitioner, with at least two years experience in development work or development research; and to submit a development research problem proposal upon application

The program has a total of 49 units, these are: 12 units of core courses (DVST 301, DVST 302, DVST 303, SPPS 272); 12 units of specialization courses, 12 units for cognate courses, 12 units dissertation (DVST 400) and 1 unit of seminar (DVST 399).

#### Areas of specialization

##### I. Agriculture, Food and Nutrition Security

- A. Molecular Biology and Biotechnology (MBB 292, MBB 295, MBB 224)
- B. Food Safety (VPH 228, VPH 220, DSC 240)
- C. Food and Nutrition Planning (HNF 251, HNF 252, HNF 223, HNF 254, AECO 261)
- D. Production System and the Supply Chain Analysis (ABM 241, ABM 205, MGT 251, AECO 220, AECO 320, DMG 225)

##### II. Natural Resources Management

- A. Plant Genetic Management and Conservation (PGR 261, PGR 262, PGR 263)
- B. Forest Management (SFFG 201, SFFG 212, SFFG 229, SFFG 287)
- C. Soil Management (SOIL 260, AENG 243, AGRI 211, AGRI 221)
- D. Water Management (AENG 240, AENG 242, AENG 243,

AENG 244)

E. Watershed Management (ENS 202, FRM 252, AENG 240, ENS 270, ENS 236\*)

F. Climate Risk Management (DMG 224, AGME 260, AECO 210, AECO 211)

##### III. Agrarian and Rural Development Studies

A. Agrarian Studies (AECO 250, AECO 251, AGRS 211, AGRS 221, AECO 250, COST 202, COST 203, AECO 230)

B. Rural Studies (CED 244, CED 246, CED 248, CED 365, DM 223, DM 230, ENS 220, AERS 261, SOC 205)

##### IV. Population, Gender and Development Studies

A. Women and Development (SOC 265, SOC 201)

B. Population and Development (SOC 240, SOC 245, SOC 260, ENS 270, ENS 220)

#### Cognate Fields

A student will choose at least two cognate fields with at least two courses from each field.

1. Strategic Planning and Policy Studies (DM 220, SPPS 202, SPPS 232, SPPS 221, SFFG 229, SFFG 212, ENS 221, SFFG 224, DEVC 220, SPPS 201, DMG 245, PLAN 201, PLAN 214)

2. Economics (AECO 220, AECO 241, AECO 240, AECO 250, AECO 251, ECON 275, ECON 271, ECON 241, ECON 285, ECON 251, ECON 202, ECON 201, CED 224, FRM 227)

3. Development Communication (DEVC 205, DEVC 262, DEVC 215)

4. Development Management and Governance (LGD 210, LGD 213, AERS 265)

5. Political Science (POLSCI 260, PAF 201)

6. Sociology (SOC 212, SOC 240)

7. Community Education (CED 202, CED 224, Comparative and International)

#### Development Studies

**DVST 301. Development Theories and Frameworks (3).** Theories, paradigm shifts and frameworks from colonial era to contemporary times. 3 hrs. (class). PR. COI. (1)

**DVST 302. Development Practice. (3).** Multidisciplinary frameworks in the analysis of development practice. 3 hrs (class). PR. DVST 301. (2)

**DVST 303. Mixed Methods Research for Development Studies (3).** Concepts, processes and applications of mixed methods research to development studies. 3 hrs (class). PR. COI. (1)

**DVST 399. Graduate Seminar (1).** (1, 2)

**DVST 400. Doctoral Dissertation (12).** (1, 2, M)



**ECONOMICS (ECON)**

*Department of Economics, College of Economics and Management*

Degree offered: *Master of Science*

**Areas of specialization:** Economics of Growth and Development and Quantitative Methods in Economics

The MS ECON program requires students to earn at least 32 units of graduate work. This consists of 15 units of core courses (ECON 201, ECON 202, ECON 230, ECON 237, ECON 203 or ECON 204); 9 units of specialization courses; 2 units of seminar (ECON 299) 6 units of master's thesis (ECON 300).

All applicants will be given a validation examination in undergraduate level macroeconomic theory, microeconomic theory, mathematical economics, and econometrics. Applicants who pass this examination will not be required to undergo the Summer Program in Economics.

The Summer Program in Economics (SPE) is a two month program offered regularly from June to July of each year. For the prospective applicant to proceed to the regular graduate program, they must obtain a weighted average grade of 2.00 or better in four modules in the SPE.

**Economics**

**ECON 201. Macroeconomic Theory I (3).** Theories of income and employment determination and the business cycle; theories of inflation and unemployment; the macroeconomy and the fiscal, monetary, and external sectors; open economy macroeconomics; stabilization policies. 3 hrs (class). PR. ECON 101 or COI. (1)

**ECON 202. Microeconomic Theory I (3).** Preference and choice; consumer choice and demand; production costs, profits, and supply; competitive markets; market structure; externalities, public goods, and market failure; general equilibrium and welfare. 3 hrs (class). PR. ECON 102 or COI. (1)

**ECON 231. Economic Dynamics (3).** Dynamic analysis and dynamic optimization with applications in economics. 3 hrs (class). PR. ECON 230. (2)

**ECON 237. Econometrics (3).** Single equation and simultaneous equation problems; techniques of estimation, specification, and identification problems in economic analysis. 3 hrs (class). PR. AEEO 103, ECON 137, or COI. (1)

**ECON 238. Econometric Time-series Analysis. (3).** Theory of difference equations, stationary time-series models, unit root processes, multi-equation time-series models, cointegration and error-correction models. 3 hrs (class). PR. ECON 237. (2)

**ECON 239. Economy-Wide Modeling (3).** Macroeconomic models and applied general equilibrium models. 3 hrs (class). PR. ECON 201, ECON 202, ECON 230 and ECON 237. (2)

**ECON 241. International Trade and Commercial Policy (3).** Causes of trade and effects on resource allocation, economic growth, and income distribution. Selected issues in international commercial trade policies particularly those relating to agricultural commodity

trade. 3 hrs (class). PR. ECON 201 and ECON 202. (2)

**ECON 271. Advanced Resource Economics (3).** Applications of economic concepts such as social welfare, externalities, social cost and gains to decision-making associated with optimizing use of natural resources. 3 hrs (class). PR. AEEO 240 or COI. (2)

**ECON 275. Economic Valuation of Environmental and Natural Resource System (3).** Approaches and techniques for economic measurements and valuation of natural resources and environmental impacts of development. 3 hrs (class). PR. COI. (2)

**ECON 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI.

**ECON 299. Graduate Seminar in Economics (1).** PR. COI. (1,2). May be taken twice for a maximum of 2 units.

**ECON 300. Master's Thesis (6).** (1,2,M)

**Adopted Courses from UP Diliman**

**ECON 203. Macroeconomic Theory II (3).** Theories of consumption, saving and investment; theories of growth, theories of economic development and accumulation. 3 hrs (class). PR. ECON 201. (2)

**ECON 204. Microeconomic Theory II (3).** Information asymmetry; hidden action; equilibrium under uncertainty and over time; social choice; axiomatic bargaining; incentive and mechanism design. 3 hrs (class). PR. ECON 202 or COI. (2)

**ECON 230. Mathematical Economics (3).** Applications of linear algebra, theory of functions, linear and nonlinear optimization in economic theory. 3 hrs (class). PR. COI. (1)

**ECON 251. Public Economics (3).** Market failures; theory of public goods; public choice and incentive mechanisms for good allocation; public sector pricing; incentive effects of taxation; optimal taxation and redistribution. 3 hrs (class). PR. ECON 202 or COI. (2)

**ECON 285. Development Economics I (3).** Theories of economic growth and development; background and comparative analyses of growth in developed and developing countries. 3 hrs (class). PR. ECON 201 or COI. (2)

**EDUCATION MANAGEMENT (EDM)**

*Institute of Governance and Rural Development, College of Public Affairs and Development*

Degree offered: *Master in Public Affairs*

The MPAf EDM program consist of 31 units, these are 13 units of core courses, 12 units of specialization courses and 6 units of electives. The core courses are PAF 201, PAF 203, PAF 204 and DM 224. The specialization courses are CED 201, CED 215, CED 291, CED 298 and CED 299. The 3 unit elective course can be selected from the following: CED 213, CED 217, CED 226, CED 242, CED 246.

*Please refer to Public Affairs and Community Development for the list of courses.*

**ENTOMOLOGY (ENT)**

*Institute of Weed Science, Entomology, and Plant Pathology, College of Agriculture and Food Science*

**Degrees offered:** *Master of Science and Doctor of Philosophy*

The Master of Science program has the following specific objectives: (1) to develop in the student the capacity to sort out and critically analyze the facts and train them in the process of scientific thinking and (2) to provide them with a broad basic background for independent scientific experimentation. The Doctor of Philosophy program, on the other hand, has the following additional objectives: (1) to develop in the student a keen perception for and sensitivity to diverse entomological problems and the ability to formulate and implement their solutions independently, (2) to enable the student to analyze, synthesize, and integrate seemingly unrelated and discordant facts into a meaningful, unified body of knowledge from which they can draw intelligent responses to specific situations, and (3) to develop in the student a sense of moral commitment and conviction towards the solution of entomological problems affecting the nation.

Applicants should have an academic background in general entomology, genetics, biology, microbiology, and chemistry, furthermore, students should have already taken the foundation courses ( ENT 101, ENT 110, ENT 120, ENT 140, ENT 151 and ENT 209 for PhD) to ensure background adequacy, otherwise, these courses need to be included in the student's coursework.

The MS ENT program requires a minimum total number of 31 units including 15 units of major courses, 9 units of minor courses, 1 unit of seminar and 6 units of thesis. Eighteen units of coursework should be beyond the 200 level.

PhD ENT is being offered in three modes namely: (a) Regular PhD, (b) PhD by Research, and (c) Straight PhD. The regular PhD program requires a minimum of 37 units, these are 15 units of major courses\*, 9 units of cognate courses\*, 1 unit of seminar and 12 units of dissertation. Graduate School and CPC's policy shall be followed for Straight and PhD by Research.

\*For students with double cognates, major and minor courses should have at least 12 units, 6 units of courses from each cognate field is required.

**Entomology**

**ENT 209. History of Entomology (3).** Historical perspective in the development of world entomology. 3 hrs (class). PR. ENT 101 or COI. (2)

**ENT 220. Advanced Insect Physiology (3).** Biochemical bases of life processes in insects. 5 hrs (2 class 3 lab). PR. CHEM 160, ENT 120 or COI. (2)

**ENT 225. Advanced Insecticide Toxicology (3).** Physiochemical concepts of the action or toxic agents in biochemical systems; mechanism of action or anticholinesterase inhibitors; insecticide resistance and synergism; selective toxicity. 5 hrs (2 class 3 lab). PR. CHEM 160 or ENT 125 or COI. (1)

**ENT 240. Advance Insect Taxonomy (3).** Recent concepts in systematics; original research on taxonomic group of student's interest. 5 hrs (2 class, 3 lab). PR. ENT 140 or COI. (1)

**ENT 246. Taxonomy of Immature Insects (3).** Identification, classification, and behavior of immature forms of insects, with emphasis on the endopterygote orders. 7 hrs (1 class, 3 lab). PR. ENT 140 or COI. (2)

**ENT 247. Aphidology (3).** Systematics, ecology, behavior, and economic significance of the Aphidoidea. 7 hrs (1 class, 6 lab). PR. ENT 140 or COI. (2)

**ENT 251. Advanced Insect Ecology (3).** Contemporary ecological concepts and methods as they related to insect populations. 3 hrs (class). PR. ENT 151 or COI. (1)

**ENT 271. Insect Transmission of Plant Pathogens (3).** Insect vectors of plant pathogens, techniques of plant pathogen transmission, interrelationships of plants, insects and pathogens; physiology of insects in relation to transmission of plant pathogens. 5 hrs (2 class, 3 lab). PR. ENT 101 and PPTH 101 or COI. (2)

**ENT 272. Biology of Entomophagous Insects (3).** Lifehistory, habits, host relationship, and other biological peculiarities of selected groups of entomophagous insects. 5 hrs (2 class, 3 lab). PR. ENT 140 or COI. (1)

**ENT 275. Insect Pathology (3).** Insect pathology and microbiology, including biological relationship between microorganisms and insects. 5 hrs (2 class, 3 lab). PR. ENT 101 and MCB or COI. (2)

**ENT 277. Economic Acarology (3).** Taxonomy and biology of mites associated with crop plants, stored products, leaf litter and soil; control of injurious species; laboratory rearing techniques. 7 hrs (1 class, 6 lab). PR. ENT 146 or COI. (1)

**ENT 279. Insect Resistance in Plants (3).** Pest control through resistant plants, methods of selection, analysis of the components of resistance interactions between resistant plants and insects. 5 hrs (2 class, 3 lab). PR. ENT 120 and BOT 20 or COI. (1)

**ENT 290. Special Problems (1-3).** May be taken twice provided that total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2,M)

**ENT 291. Special Topics (1-3).** May be taken twice provided that total number of units to be credited to the student's program will not exceed 4 units. (1,2,M)

**ENT 295. Pesticide Residues (3).** Analysis of pesticide residues; their fate in the environment; and their ecological significance; pesticide legislation. 5 hrs (2 class, 3 lab). PR. ENT 125 or COI. (1)

**ENT 299. Graduate Seminar in Entomology (2).** May be taken for additional credit not exceeding 2 units. PR. Graduate standing. (1,2,M)

**ENT 300. Master's Thesis (6).** (1,2,M)

**ENT 400. Doctoral Dissertation (12).** (1,2,M)

**ENVIRONMENTAL SCIENCE (ENS)***School of Environmental Science and Management***Degrees offered:** *Master of Science and Doctor of Philosophy***Areas of specialization:**

MS: Environmental Planning and Management, Environmental Restoration, Community-based Resource Management, Protected Area Management, Environmental Chemistry and Toxicology, Environmental Biology

PhD: Environmental Security and Management, Protected Areas Planning, Development and Management, Social Theory and Environment

**Core courses:**

MS: ENS 201, ENS 211, ENS 275, ENS 296, ENS 299

PhD: ENS 242, ENS 270, ENS 299 if graduates of MS in Environmental Science. If non-MS in Environmental Science, foundation courses such as ENS 201 plus any other two courses from ENS 211, ENS 275, and ENS 296 are required. Core courses are ENS 242, ENS 270 and ENS 299.

**Environmental Science**

**ENS 201. Ecosystem Structure and Dynamics (3).** Ecosystem structure, function, energetics, nutrient cycles, population dynamics, ecosystem models. 3 hrs (class). PR. BOT 150 or BIO 150 or COI. (1,2)

**ENS 202. Landscape Ecology (3).** Principles, theories, research methods and application of landscape ecology in environmental and natural resource management. 3 hrs (class). PR. ENS 201, BIO 150 or COI. (2)

**ENS 203. Advanced Aquatic Ecology (3).** Recent studies in aquatic environment-organism interactions; adaptive mechanisms; species displacement and extinction; modern approaches in the evaluation of production rates. 3 hrs (class). PR. COI. (1)

**ENS 204. Issues in Aquatic Resources Management (3).** Problems and issues in the use of aquatic resources with emphasis on the Philippines situation. 3 hrs (class). (2)

**ENS 211. Systems Analysis and Quantitative Methods in Natural Resources Management (3).** Statistical concepts and data analysis; optimization techniques; stochastic modeling; application of the systems approach to resource-based problems. 3 hrs (class). PR. MGT 211 or COI. (1)

**ENS 220. Institution and the Environment (3).** Social science approaches to the study of man-environment interactions; analysis of the interrelationships between culture, population, and the natural environment, and human responses to changing habitats. 3 hrs (class). PR. COI. (2)

**ENS 221/SFFG 221. Environmental and Natural Resource Policy Formulation (3).** Theories, concepts, and issues in environmental and natural resource policy formulation, case studies with special reference to developing countries. 3 hrs (class). PR. COI.

**ENS 230. Industrial Ecology (3).** Ecological principles and their applications in the organization and management of industrial systems. 3 hrs (class). PR. ENS 201 or COI. (1)

**ENS 242/ECO 275 . Economic Valuation of Environmental and Natural Resource System (3).** Approaches and techniques for economic measurements and valuation of natural resources and environmental impacts of development. 3 hrs (class). PR. COI. (1,2)

**ENS 255/PSY 255. Environmental Psychology (3).** Analysis of the confluence of psychological processes and environmental context from a transactional perspective. 3 hrs (class). PR. COI. (2)

**ENS 265/SOC 265. Gender and Environments (3).** Theories, research, and issues relevant to the analysis of gender relations in the home and work environments. 3 hrs (class). PR. COI. (1)

**ENS 270. Dynamics of Population, Resources and Environment (3).** Interactions of human populations with resources and environment in different ecosystems; local, national, and global in scope. 3 hrs (class). PR. HUME 2 or COI. (1)

**ENS 275. Contemporary Issues in Environment and Development (3).** Environmental issues, concerns and opportunities; environment economy interactions; environmental administration; sustainable development policies and issues; resource-use conflict and resolution. 3 hrs (class). PR. COI. (1,2)

**ENS 290. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI.

**ENS 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI.

**ENS 296. Environmental Impact Assessment: Perspectives from the Natural and Social Sciences (4).** Framework and methodology for environmental impact assessment of the biophysical and socioeconomic systems; ecological, social and ethical bases of EIA; risk assessment and management; mitigation of negative impacts and enhancement of positive impacts; case studies. 6 hrs (3 class, 3 lab). PR. COI. (2,M)

**ENS 299. Graduate Seminar (1).** May be taken twice.

**ENS 300. Master's Thesis (6).** (1,2,M)

**ENS 400. Doctoral Dissertation (12).** (1,2,M)

**EXTENSION EDUCATION (EXTE)**

*Institute of Governance and Rural Development, College of Public Affairs and Development*

**Degrees offered:** *Master of Science and Doctor of Philosophy*

The MS program consists of a minimum of 37-38 units these are: 21-22 units of major courses; 9 units of minor courses; 1 unit of seminar; 6 units of thesis. The major courses are composed of 12-13 units of core courses (CED 232, AERS 265, AERS 282, STAT 166 or CED 291); 6 units of specialization courses (CED 240, CED 242);

and 3 units of electives (CED 246, CED 252, AERS 261).

The PhD program requires a minimum of 45-48 units, these are 23 units of major courses, 9 or 12 units of cognate courses, 1 unit of graduate seminar (CED 299) and 12 units of dissertation (CED 400). The major courses are composed of core courses (CED 227, CED 301, CED 365, AERS 281, AERS 282\*. CED 291\*\*); 6 units of specialization courses (CED 240\*, CED 242\*, CED 244, CED 248); and 3 units of electives (CED 220, AERS 267, SOC 292)

\*Required if not taken in the MS program

\*\*If CED 291 has been taken, additional social science statistics or qualitative research methods may be required.

*Please refer to Community Development for the list of courses.*

### **FAMILY RESOURCE MANAGEMENT (FaRM)**

*Department of Human and Family Development Studies, College of Human Ecology*

**Degree offered:** *Master of Science*

The MS FaRM program requires 31 units in the curriculum distributed as follows: 9 units of Core courses (HFDS 221, HFDS 231, HFDS 232); 6 units of major courses; 9 units of minor courses, 1 unit of seminar (HUME 299) and 6 units of thesis (HUME 300).

#### **Human and Family Development Studies**

**HFDS 221. Family Behavior (3).** Analysis of family behavioral pattern as affected by ecological factors. 3 hrs (class). PR. COI. (1)

**HFDS 222. Problems in Family Relations (3).** Approaches and strategies in handling problems of families. 3 hrs (class). PR. HFDS 112 or COI. (2)

**HFDS 231. Family Management (3).** Current concepts and issues in family management. 3 hrs (class). PR. COI. (1)

**HFDS 232. Consumer Behavior (3).** Consumer motivation and behavior in relation to various factors. 3 hrs (class). PR. COI. (2)

**HFDS 243. Experimental Craft Design (3).** Advanced experimental craftwork and design development. 5 hrs (2 class, 3 lab). PR. COI.

**HFDS 256. Consumer Textiles (3).** Problems related to new developments in textiles and market conditions. 5 hrs (2 class, 3 lab). PR. COI. (1)

#### **Human Ecology**

**HUME 290. Special Problem (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. (2,M)

**HUME 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. (1,2)

**HUME 299. Graduate Seminar. (1).** May be taken twice.

**HUME 300. Master's Thesis (6).** (1,2,M).

### **FOOD AND NUTRITION PLANNING (FNP)**

*Institute of Human Nutrition and Food, College of Human Ecology*

**Degree offered:** *Master of Professional Studies*

The Regional Training Program is an interdisciplinary course of advanced training which leads to the degree of Master of Professional Studies in Food and Nutrition Planning (MPS-FNP). FNP utilizes a multisectoral approach to food and nutrition planning. Such an approach integrates nutrition into the overall development process as a necessary factor in policy-making and as an indicator of development.

Currently, the FNP Program is under the Institute of Human Nutrition and Food. The core and teaching staff, however, come from the three units of the university:

College of Agriculture and Food Science (CAFS)  
Agricultural Systems Institute  
Institute of Food Science  
College of Development Communication (CDC)  
College of Economics and Management (CEM)  
Department of Agricultural Economics  
College of Human Ecology (CHE)  
Institute of Human Nutrition and Food

The regular course covers three semesters and a summer totaling 17 months with an academic load of 41 units. The course consists of a set of interdisciplinary lectures, seminar-workshops and field work in micro planning. The 41 units consists of 20 units of core courses (HNF 251, HNF 252, HNF 298, HUME 291, AECO 241, AECO 261); 15 units of major courses (DEV 201, AERS 291, HNF 253, HUME 299, FST 290); and 6 units of electives.

The student may choose courses from any of the following fields, subject to the approval of her/his guidance committee: Agrarian and Rurban Development Studies, Rural Sociology, Community Development, Development Communication, Agricultural Economics, Development Management and Governance, Agricultural Chemistry, Human Nutrition and Food, Food Science, Animal Science, Horticulture, Agronomy

*Please refer to Human Nutrition for the list of courses.*

### **FOOD SCIENCE AND TECHNOLOGY (FST)**

*Institute of Food Science, College of Agriculture and Food Science*

**Degrees offered:** *Master of Science and Doctor of Philosophy*

**Areas of specialization:** Food Chemistry, Food Engineering, Food Microbiology, Food Processing

The MS FST program requires a minimum of 31 units, these are 15 units of major courses, 9 units of minor courses, 1 unit of seminar and 6 units of thesis. The major courses are composed of core courses FST 202, FST 210, FST 221, FST 235 and other major courses to satisfy the required number of units.



The PhD FST program requires a minimum of 37 units, these are: 15 units of major courses; 9 units of cognate courses; 1 unit of seminar; and 12 units of dissertation.

### Food Science and Technology

**FST 202. Food Analysis (3).** Physical and chemical methods in the analysis of foods. 7 hrs (1 class, 6 lab). PR. CHEM 32 or COI. (2)

**FST 210. Food Biochemistry (3).** Biochemical and physicochemical changes in foods such as meat, fish, fruits, vegetables, cereals, and root crops. 3 hrs (class). PR. CHEM 160 or COI. (1)

**FST 219. Postharvest Biochemistry of Fruits and Vegetables (3).** Biosynthetic and degradative changes occurring in fruits and vegetables after harvest. 3 hrs (class). PR. COI. (2)

**FST 220. Microbiological Aspects of Food Processing (3).** Introduction to the microbiological problems in food preservation. 5 hrs (2 class, 3 lab). PR. COI. (1)

**FST 221. Advanced Food Microbiology (3).** Important groups of food microorganisms, their isolation and characterization in relation to food processing. 7 hrs (1 class, 6 lab). PR. MCB 180 or COI. (2)

**FST 235. Thermal Processing (3).** Determination of thermal death times of spoilage microorganisms; heat penetration studies; computation of processing periods. 7 hrs (1 class, 6 lab). PR. COI. (1).

**FST 236. Dehydration and Freezing (3).** Effects of newer processing techniques on cellular structure, biochemical composition and quality of food. 7 hrs (1 class, 6 lab). PR. COI. (2)

**FST 240. Tropical Food Processing (3).** Theoretical and experimental consideration in the processing of selected tropical foods. 7 hrs (1 class, 6 lab). PR. FST 210 and FST 220 or COI.

**FST 241. Tropical Fruits and Vegetables Processing (3).** Principles underlying newer techniques of processing tropical fruits and vegetables. 7 hrs (1 class, 6 lab). PR. FST 210 and FST 220 or COI.

**FST 290. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. 12 units of graduate credit. (1,2)

**FST 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. (1,2)

**FST 299. Graduate Seminar in Food Science and Technology (1).** May be taken twice. PR. 12 units of graduate credit. (1,2)

**FST 300. Master's Thesis (6).** (1,2,M)

**FST 400. Doctoral Dissertation (12).** (1,2,M)

### FORESTRY: FOREST BIOLOGICAL SCIENCES (FOR: FBS)

*Department of Forest Biological Sciences, College of Forestry and Natural Resources*

**Degrees offered:** *Master of Forestry, Master of Science, and Doctor of Philosophy*

### Areas of specialization:

*MF and MS:* Forest Botany, Forest Ecology, Forest Entomology, Forest Genetics, Forest Pathology, Forest Physiology

*PhD:* Forest Ecology, Forest Entomology, Forest Pathology, Forest Physiology

### Foundation courses:

FBS 161, FBS 136, BIO 30, STAT 164 or FRM 167 for PhD.

All graduate students in the department are required to register FBS 299 (Graduate Seminar) after 1 year of residence and should present a seminar paper on a topic related to the proposed thesis/dissertation.

### Forest Biological Sciences

**FBS 204. Architecture of Tropical Trees (3).** Analysis of tropical trees; architectural models and ecological strategies; and applications of tree architecture. 5 hrs (2 class, 3 lab). PR. FBS 4 and FBS 36 or COI. (1)

**FBS 228. Insects in Relation to Plant Diseases (3).** Insect transmission and dissemination of plant pathogens; insect-pathogen-plant relationships. 5 hrs (2 class, 3 lab). PR. 6 units in ENT and 6 units in PPTH or equivalent. (1)

**FBS 229. Principles of Forest Entomology (3).** Principles involved in forest and forest products protection, survey methods, analysis and identification of causal agents, evaluation of hazards and losses. 5 hrs (2 class, 3 lab). PR. FBS 127. (2)

**FBS 230. Advanced Forest Tree Physiology (3).** The physical and mineral requirements of forest trees. 5 hrs (2 class, 3 lab). PR. FBS 31 or BOT 20. (1,2)

**FBS 240. Phytopathological Methods (3).** Laboratory techniques used in growing fungi, studying their physiology, and principles of bioassay. Field techniques used in the study of tree diseases. 7 hrs (1 class, 6 lab). PR. FBS 41 or FBS 42. (1)

**FBS 241. Advance Forest Pathology (3).** Advanced studies in forest pathology and forest products pathology. 5 hrs (2 class, 3 lab). PR. FBS 41 or FBS 42. (1)

**FBS 242. Control of Forest Tree Diseases (3).** Theories and practices in the control of pathogens affecting forest trees. 5 hrs (2 class, 3 lab). PR. FBS 41 and Organic Chemistry. (2)

**FBS 244. Advanced Forest Mycology I (3).** Mycomycetes, Phycomycetes, Fungi Imperfecti: Review of selected literature and laboratory training in identification. 7 hrs (1 class, 6 lab). PR. FBS 140. (2)

**FBS 245. Advanced Forest Mycology II (3).** Ascomycetes and basidiomycetes. Review of selected literature and laboratory training in identification. 7 hrs (1 class, 6 lab). PR. FBS 140. (1)

**FBS 256. Photomicrography (3).** Chemistry of photography. Techniques of making photomicrographs of biological materials.

7 hrs (1 class, 6 lab). PR. Organic Chemistry and FBS 151 or its equivalent. (2)

**FBS 268/MBB 268. Molecular Phylogenetics (3).** Applications of molecular biological techniques and molecular data to inferences of phylogenetics patterns and evolutionary processes, and to analysis of toponomic groups of organisms. 3 hrs (class). PR. BIO 101 and any basic course in systematics (BOT 140, ZOO 140, ENT 140 or FBS 167). (2)

**FBS 290. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. (1,2)

**FBS 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2)

**FBS 299. Graduate Seminar (1).** (1,2)

## Forestry

**FOR 300. Master's Thesis (6).** (1,2,M)

**FOR 400. Doctoral Dissertation (12).** (1,2,M)

## FORESTRY: FOREST RESOURCES MANAGEMENT (FOR: FRM)

*Institute of Renewable Natural Resources, College of Forestry and Natural Resources*

**Degrees offered:** *Master of Forestry, Master of Science, and Doctor of Philosophy*

Areas of specialization:

**MF and MS:** Environmental Forest Management, Forest Policy and Administration, Forest Resource Economics, Forest Biometry, Nontimber Resources Management, Watershed Management

**PhD:** Forest Policy and Administration, Forest Resource Economics, Forest Biometry, Nontimber Resource Management, Timber Resource Management, Watershed Management

Applicants of FOR: FRM must have already taken the foundation courses (FRM 100, FRM 167, FRM 184, FRM 65 or FOR 150 (for audit) or their equivalents, if not, these courses may be required to be taken.

The MFor: FRM is a non-thesis program, it requires a minimum of 31 units, these are: 18-21 units of major courses including core courses FRM 214, FRM 286, SFI 223 and specialization courses; 1 unit of seminar; and 9-12 units of minor courses.

The MS FOR:FRM program requires a minimum of 31 units, these are: 15 units of major courses; 9 units of minor courses; 1 unit of seminar; and 6 units of thesis. The major courses are composed of 9 units of core courses (FRM 214, FRM 286, SFI 223) and 6 units of specialization courses.

The PhD FOR:FRM program requires a minimum of 37 units, these are: 12 units of major courses; 6 units in each cognate field; 1 unit of seminar; and 12 units of dissertation. For students with only 1

cognate field, 15 units are required for major courses and 9 units of courses under the cognate field.

## Courses for each Area of Specialization:

Environmental Forest Management: FRM 110, SFFG 120, FRM 253, SFI 261, ENS 201, ENS 296

Forest Policy and Administration: SFFG 120, SFFG 125, FRM 201, SFFG/ENS 221, SFFG 224, SFFG 229, FRM 227

Forest Resource Economics: FRM 217, FRM 227, FRM 287, ECON 237, ECON 271, ENS 242 or ECON 275

Forest Biometry: FRM 164, FRM 167, FRM 261, FRM 262, FRM 264, FRM 294

Nontimber Resources Management: FRM 130, FRM 153, FRM 167, FRM 287, SFI 123, WLDL 105

Timber Resources Management: FRM 167, FRM 287, FRM 292, FRM 293, FRM 294, SFI 221, SFI 223

Watershed Management: FRM 153, FRM 167, FRM 253, FRM 294, SFI 261, AENG 243

## Forest Resources Management

**FRM 201. Planning and Evaluation of Forestry Research (3).** Research program, project, and study planning; analysis and interpretation; critical reviews. 3 hrs (class). PR. COI. (1)

**FRM 204. Geospatial Methods in Natural Resources Management (3).** Application of geographic information systems (GIS) technology in natural resources management; GIS operations and spatial analysis. 5 hrs (2 class, 3 lab). PR. FRM 104 or COI. (1)

**FRM 214. Introduction to Operations Research (3).** Linear transformations, vector spaces, matrix; survey of operations research and mathematical decision models; fundamentals of systems modeling. 3 hrs (class). PR. MATH 27 or COI. (1)

**FRM 217. Advanced Forestry Economics (3).** Microeconomic analysis of forestry. 3 hrs (lect). PR. FRM 117. (1)

**FRM 227. Economic Analysis of Forest Policy (3).** Economic aspects and significance of major forest policies with particular emphasis on Philippine forestry. 3 hrs (class). PR. FRM 217. (1,2)

**FRM 253. Advanced Watershed Management (3).** Interception, transpiration, evaporation, and sedimentation related to the quantity, quality, and distribution of water as affected by forestry practices. 3 hrs (lect). PR. FRM 153. (1,2)

**FRM 261. Aerial Photo Mensuration (3).** Advanced methods in the use of aerial photographs in forest inventory; photo mensurational techniques in the preparation of tree and stand volume tables; planning large-scale photo mensurational projects. 5 hrs (2 class, 3 lab). PR. FRM 161. (1)

**FRM 264. Advanced Forest Mensuration (3).** Analysis of forest measurements; evaluation of growth prediction methods; recent

developments in forest mensuration and statistics. 5 hrs (2 class, 3 lab). PR. FRM 164 or COI. (1,2)

**FRM 286. Advanced Forest Management (3).** Social, economic, and technical aspects of the organization of a forest for continuous (or managed) yield; forest regulation; forest management planning. 5 hrs (2 class, 3 lab). PR. COI. (1)

**FRM 287. Economic Analysis in Forest Management (3).** Forest management unit as a bioeconomic system, decision-making in timber management; economic sustained yield theory; current forest management practices. 5 hrs (2 class, 3 lab). PR. COI. (2)

**FRM 289. Multiple-Use Forestry (3).** Problems related to the concept and practice of multiple-use forestry; the economics of multiple-use forestry. 3 hrs (class). PR. FRM 189 or COI. (2)

**FRM 290. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. (1,2)

**FRM 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. (1,2)

**FRM 292. Log Transportation Systems (3).** Technical and economic aspects of the design and selection of log transportation systems. 5 hrs (2 class, 3 lab). PR. FRM 192. (1,2)

**FRM 294. Optimization Models in Forestry (3).** Deterministic and probabilities mathematical decision models applied to forestry with special emphasis on forest management harvesting and wood resource allocation problems. 3 hrs (class). PR. FRM 214 or COI. (2)

**FRM 299. Graduate Seminar (1).** May be taken twice. (1,2)

## Forestry

**FOR 300. Master's Thesis (6).** (1, 2, M)

**FOR 400. Doctoral Dissertation (12).** (1, 2, M)

## FORESTRY: SILVICULTURE AND FOREST INFLUENCES (FOR: SFI)

*Institute of Renewable Natural Resources, College of Forestry and Natural Resources*

**Degrees offered:** *Master of Forestry, Master of Science, and Doctor of Philosophy*

### Areas of specialization:

Silviculture, Agroforestry, Tree Improvement

### Foundation courses for MF, MS and PhD students:

SFI 101, FBS 130, SFI 221, SFI 223, SFI 271

The MFor: SFI is a non-thesis program, it requires a minimum of 31 units, these are: 18-21 units of major courses including core courses SFI 221, SFI 223, SFI 271 and specialization courses; 1 unit of seminar; and 9-12 units of minor courses.

The MS FOR: SFI program requires a minimum of 31 units, these are: 15 units major courses; 9 units of minor courses; 1 unit of seminar; and 6 units of thesis. The major courses consists of core courses SFI 221, SFI 223, SFI 271 and specialization courses to satisfy the minimum units required.

The PhD FOR: SFI program requires a minimum of 37 units, these are: 12 units of major courses; 6 units in each cognate field; 1 unit of seminar; and 12 units of dissertation. For students with only 1 cognate field, 15 units are required for major courses and 9 units of courses under the cognate field.

Additional courses which may be required for MF/MS students specializing in Silviculture: FBS 161, FBS 172, FRM 167 or STAT 162, SFI 261

For those specializing in Tree Improvement: FBS 161, FBS 172, SFI 141, SFI 241, FRM 167 or STAT 162

For those specializing in Agroforestry: SFI 122, SFI 123, SFI 261, FRM 167 or STAT 162

Additional courses which may be required for PhD students specializing in Silviculture: SFI 141, SFI 201, FBS 172, FBS 230, CHEM 160, FRM 167 or STAT 162

For those specializing in Tree Improvement: SFI 201, SFI 241, FBS 230, CHEM 160, FPPS 111, WST 201, FRM 167 or STAT 162

For those specializing in Agroforestry: SFFG 133, SFFG 233, SFI 291, FBS 291, SOIL 170, FRM 167 or STAT 162

## Silviculture and Forest Influences

**SFI 201. Advanced Forest Soils (3).** Physical and chemical properties of soils; soil microbiology; soil as related to the growth and development of timber stands. 5 hrs (2 class, 3 lab). PR. SFI 101.

**SFI 221. Advanced Nursery and Plantation Techniques (3).** Recent developments in nursery and forest planting techniques. 5 hrs (2 class, 3 lab). PR. SFI 121 or COI. (1)

**SFI 223. Advanced Silviculture (3).** Stand improvements and regeneration methods in tropical forests. (Field trip required). 5 hrs (2 class, 3 lab). PR. SFI 121 or COI. (1,2)

**SFI 241. Advanced Forest Tree Improvement (3).** Approaches to forest tree improvement, selection, species introduction, seed orchards, hybridization, mutation, and progeny testing. 3 hrs (class). PR. SFI 141 and FRM 167. (2)

**SFI 261. Forest Influences (3).** The influence of forests on local and microclimate, stream flow, and soil productivity. 5 hrs (2 class, 3 lab). PR. FRM 153 or COI. (2)

**SFI 271. Advanced Silvics (3).** Analysis of the interrelation of site factors. 5 hrs (2 class, 3 lab). PR. SFI 101 and FBS 36 or COI. (1,2)

**SFI 290. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2,M)

**SFI 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2)

**SFI 299. Graduate Seminar (1).** May be taken twice. 1 hr (class). PR. COI. (1,2)

## Forestry

**FOR 300. Master's Thesis (6).** (1, 2, M)

**FOR 400. Doctoral Dissertation (12).** (1,2,M)

## FORESTRY: SOCIAL FORESTRY AND FOREST GOVERNANCE (FOR: SFFG)

*Department of Social Forestry and Forest Governance, College of Forestry and Natural Resources*

**Degrees offered:** *Master of Forestry and Master of Science*

The MFor: SFFG is a non-thesis program, it requires a minimum of 31 units, these are 18-21 units of major courses including core courses SFFG 201, SFFG 212, SFFG 233, SFFG 263, SFFG 290 and other major courses SFFG 280, SFFG 287, SFFG 291, SFI 123; 1 unit of seminar; and 9-12 units of minor courses.

The MS FOR: SFFG program requires a minimum of 34 units, these are: 12 units of core (SFFG 201, SFFG 212, SFFG 263, AERS 282) and 6 units of major courses (SFFG 233, SFFG 280, SFFG 287, SFFG 291); 9 units of minor courses; 1 unit of seminar (SFFG 299); and 6 units of thesis (FOR 300)

Suggested fields of cognate for MF and MS programs:

Agronomy, Horticulture, Animal Science, Economics, Food Science, Human Ecology, Agricultural Education, Extension Education, Community Development, Forest Management, Silviculture and Forest Influences, Development Communication.

## Social Forestry and Forest Governance

**SFFG 201. Comparative Social Forestry (3).** Perspectives in social forestry; analysis of social forestry programs. 3 hrs (class). PR. SFFG 101 or COI. (1)

**SFFG 212. Program Development and Evaluation in Social Forestry (3).** Theories, principles, and processes of program development and evaluation; their application to social forestry. 3 hrs (class). PR. SFFG 201 or COI. (2)

**SFFG 221/ENS 221. Environmental and Natural Resource Policy Formulation (3).** Theories, concepts and issues in environmental and natural resource policy formulation; case studies with special reference to developing countries. 3 hrs (class). PR. COI. (1,2)

**SFFG 224. Alternative Theories and Methods of Policy Analysis in Natural Resources (3).** Survey, critique and applications of alternative theories and methods in the analysis of natural resource policies. 3 hrs (class). PR. FRM 124 or COI. (2)

**SFFG 229. Public Administration of Forest Resources (3).** Execution of forest resources programs, especially administered by

the forestry agencies in the Philippines. 3 hrs (lect.). PR. FRM 124 or COI. (1)

**SFFG 233. Agroforestry Management Practice (3).** Microanalysis and application of management principles on agroforestry farms. 7 hrs (1 class, 6 practicum). PR. SFFG 133 or COI. (2, M)

**SFFG 263. Cultures and Societies in Tropical Forest Ecosystems (3).** Community and forest interactions in the tropics, with special reference to Southeast Asia. 3 hrs (class). PR. SFFG 163 or COI. (1)

**SFFG 280. Swidden Farming Systems (3).** Social, economic, and cultural factors underlying the practice of swidden farming; technologies, practices, and policies involved in its management. 3 hrs (class). PR. COI. (2)

**SFFG 287. Conflict Management in Forestry (3).** Analysis and management of conflicts to promote forest resources development and conservation. 3 hrs (class). PR. SFFG 201 or COI.

**SFFG 290. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units.

**SFFG 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units.

**SFFG 299. Graduate Seminar (1).** May be taken twice.

## Forestry

**FOR 300. Master's Thesis (6).** (1,2,M)

## FORESTRY: WOOD SCIENCE AND TECHNOLOGY (FOR: WST)

*Department of Forest Products and Paper Science, College of Forestry and Natural Resources*

**Degrees offered:** *Master of Forestry, Master of Science, and Doctor of Philosophy*

**Areas of specialization:** Forest products, wood science, industrial management.

PhD by Research is offered in the following areas: Pulp and Paper Technology, Timber Mechanics, Wood Adhesion, Wood Anatomy, Wood Chemistry

**Foundation courses for MF and MS students:**  
BOT 1, CHEM 40, PHYSICS 13, MATH 26

**Foundation courses for PhD students:**  
FPPS 111, FPPS 121, FPPS 131, MGT 101 (for those who will specialize in Industrial Management)

**Core courses for MF/MS students:**  
FPPS 111, FPPS 121, FPPS 131, WST 299, MGT 101 (for those specializing in Industrial Management)

**Core courses for PhD students:**  
WST 201, WST 203, WST 221, WST 299



**Wood Science and Technology**

**WST 201. Tree Growth and Wood Quality (3).** Developmental morphology of trees; internal and external control of wood formation; wood quality and variability. 5 hrs (2 class, 3 lab). PR. FPPS 111 and FBS 31. (2)

**WST 202. Wood Quality Evaluation (3).** Patterns of variation of wood quality indicators; sampling strategies and biomathematical methods of wood quality assessment. 5 hrs (2 class, 3 lab). PR. COI.(1)

**WST 203. Wood Chemistry II (3).** Chemistry and physics of cellulose and other components of the cell wall. 5 hrs (2 class, 3 lab). PR. FPPS 131. (2)

**WST 204. Wood and Bark Extractives (3).** Chemistry of extraneous components of wood and bark. 5 hrs (2 class, 3 lab). PR. FPPS 131. (2)

**WST 205. Paper Properties (3).** Evaluation of chemical, physical, and optical properties of paper and their significance to the end use of paper. 5 hrs (2 class, 3 lab). PR. FPPS 132. (1)

**WST 211. Instrumentation for Research (3).** Design and operation of instrumentation systems in wood science research. 5 hrs (2 class, 3 lab). PR. COI.

**WST 212. Advanced Quality Control in Wood Processing (3).** Sampling plans for acceptance inspection and for the control of wood production processes. Introduction to the application of reliability techniques and life testing. 5 hrs (2 class, 3 lab). PR. FPPS 181. (1)

**WST 221. Wood Physics II (3).** The physics of wood and wood-based materials. Practical considerations with respect to moisture and heat movement and their application to wood drying processes. 5 hrs (2 class, 3 lab). PR. FPPS 121. (2)

**WST 222. Elasticity of Wood and Wood-Based Materials (3).** Theory of elasticity as applied to wooden structural members and other wood-based materials. 5 hrs (2 class, 3 lab). PR. MATH 27 or its equivalent. (2)

**WST 223. Strength Properties of Timber and Glued Wood Products (3).** Test methods and specimen geometry; effects of defects, basic stresses, grading and working stresses. 5 hrs (2 class, 3 lab). PR. FPPS 124. (1)

**WST 225. Wood Moisture Relations (3).** Theories and thermodynamics of water absorption by wood; mechanisms of moisture movement through wood below and above the fiber saturation point. 5 hrs (2 class, 3 lab). PR. WST 221. (1,2)

**WST 241. Wood Machining II (3).** Industrial woodworking machines and processes. Selection and maintenance of cutting tools. 5 hrs (2 class, 3 lab). PR. FPPS 144.

**WST 260. Wood Resins Relations (3).** Physical and physicochemical aspects of wood adhesion. 5 hrs (2 class, 3 lab). PR. FPPS 171. (2)

**WST 262. Advanced Wood Preservation (3).** Theories of fluid penetration in wood and design of wood treating plant. 5 hrs (2 class,

3 lab). PR. FPPS 161. (1)

**WST 270. Advanced Kiln Drying (3).** Design of lumber kilns, moisture control, seasoning and dry kiln problems of wood-using industries. 5 hrs (2 class, 3 lab). PR. FPPS 151. (2)

**WST 282. Analysis of Decision Alternatives (3).** Application of linear programming to management problems in the wood industry. 5 hrs (2 class, 3 lab). PR. FRM 214. (2)

**WST 290. Special Problems (1-3).** May be taken twice provided that total number of units to be credited to the student's program will not exceed 4 units. (1, 2)

**WST 299. Graduate Seminar (1).** May be taken twice. (1,2,M)

**Forestry**

**FOR 300. Master's Thesis (6).** (1, 2, M)

**FOR 400. Doctoral Dissertation (12).** (1, 2, M)

**GENETICS (GEN)**

**Lead unit:** *Institute of Biological Sciences, College of Arts and Sciences*

The MS and PhD degree programs in Genetics are offered by the Genetics and Molecular Biology Division of the Institute of Biological Sciences, together with other units in UPLB. The programs are managed by an interdepartmental Program Management Committee created by the dean of the Graduate School. An Admissions Committee screens applicants to the programs.

The two graduate programs aim to furnish the student with a firm background in Biology with specialization in Genetics; and prepare the student for competence in instruction, research, and extension.

The MS GEN program requires a minimum of 31 units, these are: 15 units of major courses including core courses (BIO 130a, BIO 130b, BIO 201, AGR 255); 9 units of minor courses; 1 unit of seminar (BIO 299); and 6 units of thesis (BIO 300)

A written examination is to be taken after the student has passed the core courses. This is scheduled regularly at the beginning of each semester. The student must pass this examination before they can be allowed to take the general examination.

The PhD GEN program requires applicants to have already taken BIO 130a, BIO 130b, CHEM 160 and STAT 162 or their equivalents, if not, these courses may be required to be taken. The program requires a minimum of 37 units, these are: 15 units of major courses including core courses AGR 255 and BIO 231; 9 units of cognate courses; 1 unit of seminar (BIO 299); and 12 units of dissertation (BIO 400). BIO 130a and BIO 130b is required for MS and PhD students who have Genetics as minor/cognate field.

**Biology**

**BIO 201/MBB 201. Advanced Molecular Biology (3).** Advances in molecular biology with emphasis on the structures, properties, functions, and interactions of biomolecules in basic cellular

processes and manipulation of DNA. 3 hrs (class). PR. BIO 101 (2)

**BIO 206/MBB 206. Research Techniques in Molecular Biology I (3).** Experiments in molecular biology with emphasis on recombinant DNA techniques. 7 hrs (1 class, 6 lab). PR. BIO 201. (2)

**BIO 231. Advanced Cytogenetics (3).** Recent advances on the role of chromosomes in heredity, development, differentiation, and evolution. 5 hrs (2 class, 3 lab). PR. BIO 131. (1)

**BIO 235. Evolutionary Genetics (3).** Analysis of genetic mechanisms affecting evolutionary change. 3 hrs (class). PR. BIO 30 or its equivalent (1)

**BIO 236. Developmental Genetics. (3).** Genetic control of development in plants and animals. 3 hrs (class). PR. BIO 130a. (2)

**BIO 241. Biogeography (3).** The geographical distribution of plants and animals; mechanisms and modes of dispersal; dynamic changes of floral and faunal distribution patterns; continental and island biogeography; current theories on the origin of existing distribution patterns. 3 hrs (class). PR. BIO 142 or COI.

**BIO 242. Biosystematics (3).** Discussions on the species concept and specialization problems; variation; modes and measures of selection; and evolutionary mechanisms using the results on the studies of genetics, ecology, systematics, psychology, biogeography, and historical geology. 3 hrs (class). PR. BIO 142 or COI.

**BIO 290. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (2)

**BIO 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. (1)

**BIO 299. Graduate Seminar in Biology (1).** May be repeated once for a maximum of 2 units. PR. COI. (1,2)

**BIO 300. Master's Thesis (6).** (1,2)

**BIO 400. Doctoral Dissertation (12).** (1,2)

### HORTICULTURE (HORT)

*Institute of Crop Science, College of Agriculture and Food Science*

**Degrees offered:** *Master of Agriculture, Master of Science, and Doctor of Philosophy*

#### Areas of specialization:

MAgr: Crop Production and Management

MS: Crop Breeding, Crop Processing and Handling, Embryology and Tissue Culture, Ornamental Horticulture, Plant Propagation and Nursery Management, Postharvest Physiology, Seed Technology

PhD: Crop Breeding, Crop Physiology, Crop Production and Management, Embryology and Tissue Culture, Postharvest Physiology

Foundation courses: HORT 132, STAT 162 or AGR 112, BIO 30 and CHEM 40.

The MAgr HORT is a non-thesis program, it requires a minimum of 36 units, these are 24 units of major courses and 12 units of minor courses.

The MS HORT program requires a minimum of 31 units, these are: 15 units of major courses\*, 9 units of minor courses, 1 unit of seminar (HORT 299) and 6 units of thesis (HORT 300).

The PhD HORT program requires a minimum of 37 units, these are: 15 units of major courses\*, 9 units of cognate courses, 1 unit of seminar (HORT 299) and 12 units of dissertation (HORT 400).

\*Major courses vary depending on the field of specialization

Courses for MS students specializing in Propagation and Nursery Management and Embryology and Tissue Culture: CHEM 160, HORT 220 or HORT 230 and HORT 232.

For Crop Production and Management: CHEM 160, HORT 220 or HORT 230 and SOIL 260

For Crop Physiology: CHEM 160, CHEM 160.1, HORT 220 or HORT 230 and HORT 232

For Postharvest Physiology: CHEM 160, CHEM 160.1, HORT 209 and FST 219

For Seed Technology: CHEM 160, CHEM 160.1, HORT 220 or HORT 230 and HORT 234

Courses for PhD students specializing in crop production and management: DM 210, PPTH 202, ENT 170 and HORT 231

For Propagation and Nursery Management: DM 210, PPTH 202, BOT 210, and HORT 231

For Embryology and Tissue Culture: DM 210, PPTH 202, ENT 170 and HORT 231

For Crop Physiology: DM 210, BOT 220, HORT 220 or HORT 230 or HORT 231

For Postharvest: DM 210, CHEM 102, CHEM 260 and BOT 210

#### Some guidelines

A foundation or core course need not be included in the program of study if the course has been taken by the student at UPLB. If an equivalent course was taken outside UPLB, the student must pass a validating examination. Determination of equivalence shall be the prerogative of the academic department offering the course.

A student entering the PhD program in Horticulture must have taken the prescribed core course for MS in Horticulture or their equivalent, otherwise, they should register the courses but cannot be considered as core or major courses for PhD.

To satisfy the minimum number of units required for the major field, the student with the guidance of the adviser, may choose from the

several related course offered by UPLB.

## Horticulture

**HORT 209. Postharvest Physiology of Perishable Crops (3).** Physical and physiochemical changes in perishable crops after harvest; mechanisms and control of deterioration. 5 hrs (2 class, 3 lab). PR. HORT 109.1. (2)

**HORT 220. Applied Vegetable Crop Physiology (3).** Effects of different environmental factors on the growth and development of various vegetable crops. 5 hrs (2 class, 3 lab). PR. HORT 132/BOT 132 or COI. (2)

**HORT 230. Applied Fruit Crops Physiology (3).** Environmental factors, cultural treatments, and growth regulators that modify basic processes controlling flowering and fruiting of fruit crops. 5 hrs (2 class, 3 lab). PR. HORT 130 and HORT 132/BOT 132 or COI. (2)

**HORT 231. Reproductive Crop Physiology (3).** The flowering process and its associated phenomena of photoperiodism, vernalization, thermoperiodism, and endogenous rhythm, sex expression, fruit-set and development and their control mechanism. 5 hrs (2 class, 3 lab). PR. HORT 132/BOT 132. (1)

**HORT 232/BOT 232. Physiology and Biochemistry of Endogenous Growth Regulators (3).** Physiology, biochemistry, transport, mode of action, assay and applications of endogenous growth regulators in agriculture. 5 hrs (2 class, 3 lab). (jointly offered with Botany of the College of Arts and Sciences). PR. COI.

**HORT 234. Crop Seed Physiology (3).** Seed development, dormancy, germination, and other physiological processes associated with seed production and storage of economically important crop plants. 5 hrs (2 class, 3 lab). PR. COI. (1)

**HORT 241. Plant Morphogenesis (3).** Processes involved, categories of the factors affecting morphogenetic phenomena and their implications on plant development and propagation. 5 hrs (2 class, 3 lab). PR. HORT 132/ BOT 132. (1)

**HORT 290. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2,M)

**HORT 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2,M)

**HORT 299. Graduate Seminar (1).** May be taken twice.

**HORT 300. Master's Thesis (6).** (1,2,M)

**HORT 400. Doctoral Dissertation (12).** (1,2,M)

## HUMAN NUTRITION (HN)

*Institute of Human Nutrition and Food, College of Human Ecology*

**Degree offered:** *Doctor of Philosophy*

The PhD HN program requires a minimum of 42 units, these are:

12 units of core courses (HNF 211, HNF 221, HNF 224, ENS 270), 9 units of major courses (HNF 222, HNF 223, HNF 251, HNF 252, HNF 254, HNF 255, HUME 290, HUME 291, AECO 261); 9 units of cognate courses; and 12 units of dissertation (HORT 400).

Cognate courses may be chosen from any of the following areas: agriculture, agronomy, horticulture, animal and veterinary sciences, genetics, environmental sciences, food science, extension education, communication, statistics, economics, sociology, anthropology, and community development.

The following background courses may be required for students with deficiencies: HUME 101, AERS 265 or DM 201, CHEM 260, CHEM 261, AERS 282, STAT 101, STAT 166, and HNF 121

## Human Nutrition and Food

**HNF 211. Food and Culture (3).** Human food behavior and food ways as influenced by various factors; related relationships to dietary patterns and application to nutrition development programs. 3 hrs (class). PR. COI. (2)

**HNF 221. Biochemical Aspects of Human Nutrition (3).** Analysis of biochemical processes and regulations, and their interrelationships in the metabolism of nutrients. 3 hrs (class). PR. CHEM 160 or 161 or COI. (1)

**HNF 222. Nutrition in Health and Disease (3).** Nutrition in relation to physiological and biochemical changes during special health and disease conditions. 3 hrs (class). PR. COI. (2)

**HNF 223. Evaluation of Nutritional Status (3).** Principles, methods, and techniques used in the evaluation of nutritional status of population groups. 5 hrs (2 class, 3 lab). PR. COI. (1)

**HNF 224. Nutritional Epidemiology (3).** Epidemiologic principles and methods and their application to the promotion of nutrition and health; and control of nutrition oriented diseases in human population. 5 hrs (2 class, 3 lab). PR. STAT 101 or COI. (1)

**HNF 225. Nutritional Physiology (3).** Analysis of physiological principles and processes as applied to human nutrition in health and disease. 3 hrs (class). PR. COI. (1)

**HNF 251. Ecology of Food and Nutrition (3).** Ecological, sociocultural, economic, and demographic factors affecting food consumption and nutritional status of a region and population. 3 hrs (class). PR. COI. (1)

**HNF 252. Food and Nutrition Planning (3).** Identification and analysis of problems, resources, and processes involved in the formulation of policies and planning of food and nutrition programs. 3 hrs (class). PR. COI. (2)

**HNF 253. Workshop in Food and Nutrition Planning (3).** Formulation of policies and plans for food and nutrition programs on the national and sectoral levels. 3 hrs (class). PR. HNF 252 or COI. (2)

**HNF 254. Nutrition Programs (3).** Activities involved in food and nutrition programs at local, national, and international levels;

planning and evaluation of applied nutrition programs. 3 hrs (class). PR. COI. (1)

**HNF 298. Field Studies (6).** PR. COI. (M)

### Human Ecology

**HUME 290. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. (2,M)

**HUME 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. (1,2)

**HUME 299. Graduate Seminar (1).** May be taken twice. (1,2)

**HUME 300. Master's Thesis (6).** (1,2,M)

**HUME 400. Doctoral Dissertation (12).** (1,2,M)

### INFORMATION TECHNOLOGY (IT)

*Institute of Computer Science, College of Arts and Sciences*

**Degree offered:** *Master of Information Technology*

The Master of Information Technology (MIT) program is designed to further train IT practitioners by providing them with advanced knowledge in IT for them to be able to design and implement IT solutions in their workplace. Graduates of the Master of Information Technology program are expected to be able to: 1) demonstrate indepth understanding of technical concepts pertaining to information technology; 2) apply the latest advances in information technology in their field of work; and 3) undertake the proper design, implementation and maintenance of a production-grade IT-based solutions.

The curriculum consists of 28 units of core courses (IT 210, IT 226, IT 227, IT 238, IT 280, IT 299, IT 295, CMSC 215, CMSC 272); and 9 units of elective courses (CMSC 214, CMSC 220, CMSC 224, CMSC 225, CMSC 227, CMSC 228, CMSC 229, CMSC 231, CMSC 250, CMSC 271, CMSC 280, CMSC 291) for a total of 37 academic units.

The Master of Information Technology is awarded if the student obtains a weighted general average of 2.00 or better in the course work, satisfies the seminar requirement, passes a general examination, and successfully implements an IT-based application project.

### Information Technology

**IT 210. Web Application Development (3).** WWW programming, Internet and Intranet applications development, designing and building active server pages and other integrated web-based solutions. 5 hrs (2 class, 3 lab). PR. CMSC 100 or COI. (1)

**IT 226. Enterprise Information Systems (3).** Framework of information systems in organizations, enterprise process modeling and development of collaborative enterprise systems using IT-tools and other enabling technologies. 3 hrs (class). PR. COI. (1)

**IT 227. E-Commerce Technologies (3).** Fundamental concepts and applications of e-commerce technologies. 5 hrs (2 class, 3 lab). PR. IT 210 and IT 226 or COI. (2)

**IT 238. Networking and Client/Server Computing (3).** Client/Server computing techniques, system design, software and applications. 5 hrs (2 class, 3 lab). PR. CMSC 137 or COI. (1)

**IT 280. Internet Security (3).** Algorithms, IT-solutions and security issues associated with developing applications for the Internet. 5 hrs (2 class, 3 lab). PR. IT 238 or COI. (2)

**IT 295. IT-Based Application Project (6).** PR. COI. (1,2,M)

**IT 299. Graduate Seminar (1).** PR. COI. (1,2,M)

*Please refer to Computer Science for other courses.*

### LOCAL GOVERNANCE AND DEVELOPMENT (LGD)

*Institute of Governance and Rural Development, College of Public Affairs and Development*

### Local Governance and Development

**LGD 210. Governance and Development (3).** Concepts, models, principles, tools, indicators, practices, issues, trends, and prospects in governance and development. 3 hrs (class). PR. None. (2)

**LGD 211. Delivery Systems for Public Services (3).** Theory and practice of public service delivery with focus on local government units. 3 hrs (class). PR. None. (2)

**LGD 213. Local Fiscal Management (3).** Concepts, principles, processes and practices in local fiscal management, local revenue generation, allocation, utilization and accountability. 3 hrs (class). PR. None. (2)

**LGD 215. Human Resource Management in Local Government Units (3).** Principles, practices, trends, and issues in human resource management in local government units 3 hrs (class). R. None. (2)

**LGD 216. Organizational Development in Local Government Units (3).** Theories, concepts, and processes in organizational development and improvement of local government units. 3 hrs (class). PR. None. (2)

**LGD 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited in the student's program will not exceed 4 units. (1,2,M)

**LGD 298. Field Studies (3).** PR. COI. (1,2,M)

**LGD 299. Graduate Seminar (1).** May be taken twice. PR. COI. (1,2,M)

### MATHEMATICS (MATH)

*Institute of Mathematical Sciences and Physics, College of Arts and Sciences*

**Degree offered:** *Master of Science*



The Master of Science in Mathematics contains a total of 31 units broken down into 9 units of core courses (MATH 213, MATH 225 and MATH 230), 9 units of track courses, 6 units of elective courses, 6 units of thesis (MATH 300); and 1 unit of seminar (MATH 299).

A student can choose from three tracks and should take the required courses in each track: for Pure Mathematics Track, MATH 213, MATH 225, MATH 230; for Applied Mathematics Track, AMAT 250, AMAT 255, AMAT 266; and for Mathematics Education Track, MAED 201, MAED 202, MAED 203.

The six (6) units of elective courses should be 200-level courses. These can be chosen from one program, such as statistics, economics, computer science, engineering, education management or systems biology; or all can be mathematics or applied mathematics courses such as algebra, analysis, geometry, combinatorics, coding theory or mathematical programming. The electives can also be any combination of courses from various programs.

### Applied Mathematics

**AMAT 215. Mathematical Theory of Choice and Games (3).** Mathematical modeling and analysis of games and rational choice. 3 hrs (class). PR. AMAT 105 or MATH 120. (2)

**AMAT 250. Numerical Simulation (3).** Computational techniques for the simulation of a large variety of systems and processes. 3 hrs (class). PR. COI. (2)

**AMAT 255. Mathematical Data Science (3).** Deterministic, fuzzy, and probabilistic algorithms for discovering patterns in data sets. 3 hrs (class). PR. COI. (2)

**AMAT 266. Deterministic Mathematical Decision Models (3).** Linear models; inventory models; integer programming and combinatorial models; elementary dynamic programming models; introduction to nonlinear programming. 3 hrs (class). PR. AMAT 160 or COI. (1)

**AMAT 267. Probabilistic Mathematical Decision Models (3).** Basic concepts and application of probabilistic mathematical decision models such as queuing, inventory, dynamic programming and simulation, inventory, dynamic programming and simulation models. 3 hrs (class). PR. AMAT 160 or COI. (2)

**AMAT 277. Mathematical Finance (3).** Mathematical concepts and techniques used in the pricing of financial derivatives. 3 hrs (class). PR. AMAT 160 or COI. (1)

**AMAT 280. Biomathematics (3).** Mathematical modeling of biological systems. 3 hrs (class). (1)

### Mathematics

**MATH 211. Abstract Algebra (3).** Binary operations, algebraic systems such as semigroups, rings integral domains, field, extensions. 3 hrs (class). PR. MATH 111. (1)

**MATH 213. Theory of Matrices (3).** Operations on matrices; canonical forms, determinants; characteristic equations; eigenvalues. 3 hrs (class). PR. MATH 120. (1)

**MATH 215. Coding Theory and Cryptography (3).** Concepts and mathematical theory of error-correcting codes, encryption and decryption schemes. 3 hrs (class). PR. MATH 111. (1)

**MATH 217. Algebraic Combinatorics (3).** Discrete structures from an algebraic perspective. 3 hrs (class). PR. MATH 211. (2)

**MATH 220. Algebraic Geometry (3).** Concepts and theorems of algebraic geometry. 3 hrs (class). PR. MATH 211. (1)

**MATH 222. Finite Geometries (3).** The finite plane, projective plane, affine plane, hyperbolic plane; Galois geometries; combinatorial applications of finite geometries; finite inverse geometry and block design. 3 hrs (class). PR. MATH 211. (2)

**MATH 225. Topology (3).** Topological spaces; bases and subbases; continuity; metric spaces; separation axioms; compactness; product spaces; connectedness. 3 hrs (class). PR. MATH 101 or its equivalent. (2)

**MATH 230. Real Analysis (3).** The real number system; Lebesgue measures; Riemann and Lebesgue integrals; differentiation and integration. 3 hrs (class). PR. MATH 155. (1)

**MATH 231. Functions of a Complex Variable (3).** Complex differentiation and integration; analytic continuation; residue theorem; conformal mapping; and some special functions. 3 hrs (class). PR. MATH 155. (2)

**MATH 235. Functional Analysis (3).** Concepts, principles, methods, and applications of functional analysis; normed and Banach spaces; Hilbert space theory. 3 hrs (class). PR. MATH 213. (2)

**MATH 243. Graph Theory and Applications (3).** Concepts and theorems involving graphs and networks and their applications. 3 hrs (class). (2)

**MATH 252. Theory of Partial Differential Equations (3).** Concepts and advanced techniques in solving partial differential equations arising from applications. 3 hrs (class). PR. MATH 151 or COI. (2)

**MATH 281. Measure-theoretic Probability and Stochastic Processes (3).** Theories and techniques in probability and stochastic processes. 3 hrs (class). PR. MATH 182 or COI. (2)

**MATH 291. Special Topics (1-3).** May be taken twice provided that total number of units to be credited to the student's program will not exceed 4 units. May be taken twice. PR. COI.

**MATH 299. Graduate Seminar (1).** May be taken twice. (2)

**MATH 300. Master's Thesis (6).** (1,2,M)

### Mathematics Education

**MAED 201. Mathematics Education (3).** Mathematical thoughts and ideas as bases of school mathematics. 3 hrs (class). PR. None. (1)

**MAED 202. Mathematical Didactics (3).** Pedagogical philosophies, principles, and praxis in mathematics education. 3 hrs (class). PR. None. (1)

**MAED 203. Mathematics Curriculum (3).** Analysis, design, and evaluation of school mathematics curriculum. 3 hrs (class). PR. MAED 202. (2)

### MICROBIOLOGY (MCB)

Lead unit: *Institute of Biological Sciences, College of Arts and Sciences*

**Degrees offered:** *Master of Science and Doctor of Philosophy*

The microbiology program is offered jointly by the Agricultural Systems Institute (CAFS), Institute of Crop Science (CAFS), Institute of Food Science (CAFS), Department of Forest Biological Sciences (CFNR) and the Institute of Biological Sciences (CAS). The lead unit is the Institute of Biological Sciences.

The foundation courses are MCB 101 for MS and MCB 201 and MCB 220 for PhD.

The MS MCB program requires a minimum of 32 units, these are: 15 units of major courses including core courses MCB 130, MCB 201 and MCB 220; 2 units of seminar (MCB 299); 9 units of minor courses; and 6 units of thesis (MCB 300).

The PhD MCB program requires a minimum of 38 units, these are: 15 units of major courses including core courses MCB 230 and MCB 241; 9 units of cognate courses; 2 units of seminar (MCB 299) and 12 units of dissertation (MCB 400).

For MS and PhD students with MCB as minor/cognate field at least 9 units of course work in Microbiology is required.

#### Microbiology

**MCB 201. Advances in Microbiology (3).** Current research and development in microbiology. 3 hrs (class). PR. COI. (1)

**MCB 220. Physiology of Bacteria (3).** Physiological processes in bacteria including study of bacterial variation and population dynamics. 5 hrs (2 class, 3 lab). PR. MCB 101 and MCB 120. (2)

**MCB 221. Physiology and Molecular Biology of Extremophiles (3).** Life processes, molecular basis of adaptation to harsh environments, and biotechnological and industrial applications of the extremophiles. 3 hrs (class). PR. MCB 120 and BIO 101, or COI. (1)

**MCB 230. Advanced Microbial Genetics (3).** Molecular genetics of microbial systems. 3 hrs (class). PR. MCB 130 or COI. (1)

**MCB 240. Determinative Bacteriology (3).** Bacterial identification, cultivation of representative groups of bacteria from their natural habitats. 7 hrs (1 class, 6 lab). PR. MCB 101. (1)

**MCB 241. Polyphasic Approach in Microbial Taxonomy (3).** Phenotypic and genotypic methods in microbial classification, nomenclature and identification. 5 hrs (2 class, 3 lab). PR. MCB 101 and BIO 101, or COI. (2)

**MCB 260. Advanced Industrial Microbiology (3).** Microbiological and physiological aspects of fermentation processes. 3 hrs (class).

PR. MCB 160. (2)

**MCB 270. Microbial Toxins (3).** Nature, activity, and toxigenicity of bacterial and fungal toxins affecting man and other animals; methods of isolation, detection, and quantification. 5 hrs (2 class, 3 lab). PR. MCB 101 and CHEM 160.1 or COI. (2)

**MCB 285. Predictive Microbiology and Modeling Applications in Food Safety (4).** Assessment and control of microbiological risks in foods, process calculations on growth, survival, and inactivation of microorganisms in foods. 8 hrs (2 class, 6 lab). PR. MCB 180 and MATH 26 or COI. (1)

**MCB 290. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. (1,2)

**MCB 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. (1)

**MCB 299. Graduate Seminar (1).** May be taken twice. (1,2)

**MCB 300. Master's Thesis (6).** (1,2)

**MCB 400. Doctoral Dissertation (12).** (1,2)

### MOLECULAR BIOLOGY AND BIOTECHNOLOGY (MBB)

**Degree offered:** *Master of Science and Doctor of Philosophy*

The MS program in Molecular Biology and Biotechnology is an interdisciplinary program which involves the following UPLB units: College of Agriculture, College of Arts and Sciences, College of Forestry and Natural Resources, College of Veterinary Medicine, College of Engineering and Agro-Industrial Technology, College of Human Ecology, College of Economics and Management, School of Environmental Science and Management, College of Public Affairs and the National Institutes of Molecular Biology and Biotechnology.

The Graduate School supervises the implementation of the program through a Management Committee composed of chairs of the clusters committees for each of the four clusters in the Basic Sciences, Plant Sciences, Animal Sciences and Physical and Engineering Sciences and Environmental Biotechnology. The members of these committees constitute the Graduate Faculty in Molecular Biology and Biotechnology (GFMBB). The GFMBB is directly under the Graduate School. The members of the GFMBB nominate and elect two members at large to the Management Committee. The Graduate School provides administrative support to the Management Committee.

#### Areas of specialization

Basic Sciences: Genetics, Microbiology, Biochemistry, Chemistry. Plant Sciences: Agronomy, Horticulture, Plant Breeding, Plant Physiology, Plant Pathology, Forestry. Animal Sciences: Animal Breeding, Animal Physiology, Veterinary Medicine, Zoology, Entomology. In Physical and Engineering Sciences and Environmental Biotechnology: Microbiology, Bioengineering, Food Science and Technology, Chemistry, Environmental Sciences

**Foundation courses**

CHEM 160, MATH 26, BIO 101, MCB 101 are the foundation courses for the MS program while CHEM 261, MBB 201/BIO 201, MBB 206/BIO 206, MBB 211, MBB 240 are for PhD.

The MS MBB program requires a minimum of 37 units, these are 21 units of major courses, 9 units of minor courses, 1 unit of seminar and 6 units of thesis. The major courses are composed of core courses (MBB 201/BIO 201, CHEM 261, MBB 206/BIO 206, MBB 211, MBB 240, MBB 292) and other major courses to satisfy the required number of units.

The PhD MBB program requires a minimum of 41 units, these are 18 units of major courses, 9 units of cognate courses, 2 units of seminar and 12 units of dissertation. The major courses are composed of core courses (MBB 207/BIO 207, MBB 295/ENS 295, MBB 250, MBB 292) and other major courses to satisfy the required number of units.

**Molecular Biology and Biotechnology**

**MBB 201/BIO 201. Advanced Molecular Biology (3).** Advances in molecular biology with emphasis on the structures, properties, functions, and interactions of biomolecules in basic cellular processes and manipulation of DNA. 3 hrs (class). PR. BIO 101. (2)

**MBB 206/BIO 206. Research Techniques in Molecular Biology I (3).** Experiments in molecular biology with emphasis on recombinant DNA techniques. 7 hrs (1 class, 6 lab). PR. BIO 201 (2)

**MBB 207/BIO 207. Research Techniques in Molecular Biology II (3).** Advanced experimental techniques in molecular biology. 7 hrs (1 class, 6 lab). PR. MBB 206/BIO 206 and MBB 211 (1)

**MBB 211. Biocomputing in Molecular Biology and Biotechnology (2).** Principles and applications of computational sciences in molecular biology and biotechnology. 4 hrs (1 class, 3 lab). PR. COI. (1)

**MBB 224/SOIL 224. Biotechnology of Soil-Microbe-Plant Interactions (3).** Biotechnological approaches in study of beneficial soil-microbe-plant interactions and related principles, processes and applications. 5 hrs (2 class, 3 lab). PR. SOIL 120 or MCB 150, and BIO 101, or COI. (2)

**MBB 225/BOT 225. Biotechnology of Plant Secondary Metabolites (3).** Physiological bases of secondary plant metabolites production in vitro. 5 hrs (2 class, 3 lab). PR. BOT 20 and CHEM 160 or COI. (2)

**MBB 229/VMCB 229. Biotechnology in Immunoprophylaxis and Diagnostics of Animal Diseases (2).** Principles and applications of biotechnological advances in vaccine design and development and veterinary diagnostics. 4 hrs (1 class, 3 lab). PR. VMCB 221 or VPAR 234 or COI. (1)

**MBB 235/FPPS 235. Forest Products Biotechnology (3).** Application of biotechnology to improve the quality and utilization of wood; bio-processing operations in forest-based and related industries. 3 hrs (class). PR. FPPS 131 or COI. (2)

**MBB 240. Industrial Biotechnology (3).** Principles of bioprocess

and bioseparation technologies with emphasis on physico-chemical and engineering aspects. 5 hrs (2 class, 3 lab). PR. MATH 26, CHEM 160 and MCB 1. (1)

**MBB 250. Advances in Transformation Biotechnology (3).** Advances and applications of transformation of microorganisms, plants and animals using recombinant DNA techniques. 3 hrs (class). PR. MBB 201/BIO 201. (1)

**MBB 251/PPTH 251. Molecular Plant-Pathogen Interactions (3).** Molecular mechanisms of plant pathogen interactions and application of molecular diagnostics and markers in plant pathology. 3 hrs (class). PR. PPTH 101 and BIO 101. (2)

**MBB 267/ANSC 267. Animal Reproductive Biotechnology (3).** Biotechnological concepts and techniques in animal reproduction. 3 hrs (class). PR. ANSC 260 or COI.

**MBB 268/FBS 268. Molecular Phylogenetics (3).** Applications of molecular biological techniques and molecular data to inferences of phylogenetic patterns and evolutionary processes, and to analyses of taxonomic groups of organisms. 3 hrs (class). PR. BIO 101 and any basic course in systematics (BOT 140, ZOO 140, ENT 140 or FBS 167). (2)

**MBB 273/ENT 273. Insect Molecular Biology (3).** Molecular aspects of insect biology and the use of biotechnology in entomological research and integrated pest management. 3 hrs (class). PR. ENT 120 and BIO 101 or COI. (2)

**MBB 290. Special Problems (1-3).**

**MBB 291. Special Topics (1-3).**

**MBB 292. Biotechnology and Society (3).** Implications of biotechnological research and products on society and the economy. 3 hrs (class). (2)

**MBB 295/ENS 295. Environmental Biotechnology (3).** Biological and biochemical aspects of environmental biotechnology. 3 hrs (class). PR. MCB 1 and CHEM 160, or COI. (1)

**MBB 299. Graduate Seminar (1).** (1,2)

**MBB 300. Master's Thesis (6).** (1,2,M)

**MBB 390. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2,M)

**MBB 391. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2)

**MBB 399. Graduate Seminar (1).** May be taken twice. PR. Graduate Standing. (1,2)

**MBB 400. Doctoral Dissertation. (12).** (1, 2, M)

**NATURAL RESOURCES CONSERVATION (NRC)**

*Institute of Renewable Natural Resources, College of Forestry and Natural Resources*

**Degree offered:** *Master of Science*

**Areas of specialization:** Biodiversity Conservation, Parks and Outdoor Recreation Management, Coastal Resources Management

The MS NRC program is coordinated by a Graduate Program Management Committee under the Graduate School. It is composed of representatives of concerned academic units with offerings in natural resources conservation. Using Graduate School requirements, all applicants will be evaluated by the Management Committee in consultation with the appropriate academic departments. An applicant for admission to the MS NRC program should be a holder of baccalaureate degree in forestry, agriculture, biology, environmental science, and other allied fields.

The program requires a minimum of 34 units, these are 15 units of core courses (AECO 240, FRM 204, NRC 201, NRC 282, SFFG 221/ENS 221), 12 units of specialization courses\*, 1 unit of seminar (NRC 299), and 6 units of thesis (NRC 300) which should be a substantial contribution to the development of concepts, principles, and practices in natural resources conservation.

**\*Specialization courses are as follows:**

Biodiversity Conservation: BIO 241, FBS 101, MBB 268, PGR 262, WLDL 101, WLDL 105, WLDL 205

Parks and Outdoor Recreation Management: FRM 140, NRC 185, NRC 231, NRC 232, NRC 233

Coastal Resources Management: ENS 203, ENS 204, NRC 241, NRC 242, MS 254 (for cross enrollment at the Marine Science Institute, UP Diliman).

**Natural Resources Conservation**

**NRC 201. Perspectives and Approaches to Natural Resources Conservation (3).** Biological, geological and social dimensions of natural resources conservation. 3 hrs (class). PR. COI. (1)

**NRC 231. Protected Areas Management (3).** Issues, practices and strategies in managing national parks and other protected areas. 3 hrs (class). PR. FRM 140 or COI. (1)

**NRC 232. Ecotourism (3).** Planning and implementation of ecotourism programs and projects. 3 hrs (class). PR. FRM 140 or COI. (1)

**NRC 233. Buffer Zone Management (3).** Land use and management planning, monitoring and evaluation, and strategies to promote social and site development activities in the buffer zone area. 5 hrs (2 class, 3 lab). PR. COI. (2)

**NRC 241. Coastal Ecosystem Dynamics (3).** Structures, functions, processes and interactions in coastal ecosystems. 3 hrs (class). PR. FBS 36 or BIO 150 or COI. (2)

**NRC 242. Coastal Ecosystem Management (3).** Theories, issues and approaches in managing coastal ecosystems. 3 hrs (class). PR. NRC 241 or COI. (1)

**NRC 282. Conservation Planning (3).** Perspectives and methods in planning for biodiversity and natural resource conservation. 5 hrs (2 class, 3 lab). PR. NRC 201 or COI. (1)

**NRC 299. Graduate Seminar (1).** (1,2)

**NRC 300. Master's Thesis (6).** (1,2,M)

**PLANT BREEDING (PB)**

*Institute of Crop Science, College of Agriculture and Food Science*

The MS/ PhD in Plant Breeding program is a common degree program for master's and doctoral students of the Institute of Crop Science and Institute of Renewable and Natural Resources (CFNR) who are specializing in plant breeding. The student's department affiliation is generally determined by their crop of interest.

An applicant for admission to the MS program must be a holder of the degree of Bachelor of Science in Agriculture. Where the BS degree is not in agriculture, the applicant must have had at least six (6) units of crop science courses.

A student who is admitted to the MS program is expected to have taken the following foundation courses or their equivalent: AGR 150. Methods in Plant Breeding and STAT 162. Experimental Designs I. Course equivalence shall be determined by the department offering the course. Foundation courses that have not been taken previously by the student shall be included in the program of study but units earned in these courses cannot be used to satisfy the unit requirements for the degree.

The program requires a minimum of 32 units, these are 15 units of major courses, 9 units of minor courses, 2 units of seminar (AGR 299 and 6 units of thesis (AGR 300). The major courses are composed of core courses (BIO 130a, BIO 130b, CHEM 160, AGR 250, AGR 255 and other major courses to satisfy the required number of units if the under have already been taken.

A core course need not be included in the program of study if the course or its equivalent has been taken by the student. Determination of equivalence shall be the prerogative of the academic department offering the course. If an equivalent course was taken outside UPLB, the student must pass a validating examination, which shall be given by the department offering the course.

An MS student majoring in another field who would like to minor in plant breeding must take at least 6 units of plant breeding courses with graduate credit including at least 3 units in the above 200 level.

An applicant for admission to the PhD program must be a holder of an MS degree in a biological field. An applicant with an MS degree in a non biological field must apply for admission to the MS program. Where the BS degree is not in agriculture, the applicant must have had at least 6 units of crop science courses. An applicant is also expected to have had in their previous degrees the following courses or their equivalents:

AGR 150. Methods in Plant Breeding



BIO 130a. Advanced Genetics I  
 BIO 130b. Advanced Genetics II  
 CHEM 160. Introductory Biochemistry  
 STAT 162. Experimental Designs I

The department offering the course shall determine course equivalence. Foundation courses that have not been taken previously by the student shall be included in the program of study, but units earned in these courses cannot be used to satisfy the unit requirements for the degree.

The PhD PB requires a minimum of 38 units, these are 15 units of major courses, 9 units of cognate courses, 2 units of seminar and 12 units of dissertation (AGR 400). The major courses are composed of core courses (AGR 250, AGR 251, AGR 255, AGR 256) and other major courses to satisfy the required number of units for the major field. The student may choose from several plant breeding courses offered by the three participating departments as well as from courses in allied disciplines like genetics, plant pathology, entomology, statistics, plant/crop physiology, and biochemistry.

The student may also minor in one of such related fields. PhD core course need not be included in the program if the course or its equivalent has been taken by the student. If an equivalent course was taken outside UPLB, the student must pass a validating examination for the course which shall be given by the department offering it. Equivalence shall be determined by the department concerned.

A PhD student with plant breeding as one of two cognates must take AGR 250. Advanced Plant Breeding and at least 3 units of plant breeding courses with graduate credit while a PhD student with plant breeding as the only cognate field must take Agronomy 250 and at least 6 units of plant breeding courses with graduate credit.

The UPLB Graduate School rules and requirements for the comprehensive and final examination shall be followed. However, the written comprehensive examination for the major field (plant breeding) is common for the most part to all students in the program and is given by an interdepartmental committee once in a semester. The written comprehensive examination for the minor field(s) is given by the faculty member(s) representing the minor field in the student's advisory committee.

### **Agronomy**

**AGR 250. Advanced Plant Breeding I (3).** Types, uses, and induction of genetic variation; systems of pollen control; selection concepts and general breeding procedures for crops in each mode of pollination; approaches in breeding for specific characters. 3 hrs (class). PR. AGR 150. (2)

**AGR 251. Advanced Plant Breeding II (3).** Advanced concepts and methods in population breeding and cultivar development. 3 hrs (class). PR. BIO 130b and AGR 250. (1)

**AGR 254. Crop Evolution (3).** Origin and evolution of crop plants and dynamics of plant domestication. 3 hrs (class). PR. BIO 130b and AGR 250. (1)

**AGR 255. Population Genetics (3).** Genetics of population undergoing random mating and inbreeding; effects of selection, mutation, migration, and other forces on the genetic composition

of natural and artificial biological population. 3 hrs (class). PR. BIO 130b and MATH 26. (1)

**AGR 256. Quantitative Genetics (3).** Genetics of quantitative characters in random and nonrandom mating population. Application of quantitative genetic theories in breeding work. 3 hrs (class). PR. AGR 255. (2)

**AGR 258. Molecular Plant Breeding (3).** Molecular markers, recombinant DNA technology, and cell and tissue culture technology in crop improvement. 3 hrs (class). PR. AGR 150 and BIO 101 or COI. (1)

**AGR 290. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2,M)

**AGR 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2,M)

**AGR 299. Graduate Seminar in Agronomy (1).** May be taken twice for a maximum of 2 units. 1 hr (class). PR. Graduate standing. (1,2)

**AGR 300. Master's Thesis (6).** (1,2,M)

**AGR 400. Doctoral Dissertation (12).** (1,2,M)

### **PHYSICS (PHYS)**

*Institute of Mathematical Sciences and Physics, College of Arts and Sciences*

**Degree offered:** *Master of Science*

### **Physics**

**PHYS 221. Classical Mechanics I (3).** Classical dynamics of particles and systems of particles in translational, rotational, and oscillatory motion in the Lagrangian and Hamiltonian formalisms. 3 hrs (class). PR. PHYS 121 or COI. (1,2)

**PHYS 225. General Relativity (3).** Einstein field equations and their vacuum solutions for isotropic homogeneous systems. 3 hrs (class). PR. PHYS 221. (2)

**PHYS 231. Classical Electrodynamics I (3).** Electrostatics and magnetostatics and their unification through Maxwell's equations. 3 hrs (class). PR. PHYS 131 or COI. (1,2)

**PHYS 232. Classical Electrodynamics II (3).** Nature and propagation of electromagnetic fields. 3 hrs (class). PR. PHYS 231. (1,2)

**PHYS 241. Quantum Mechanics I (3).** Analytical techniques in quantum mechanics. 3 hrs (class). PR. PHYS 141 or COI. (1,2)

**PHYS 242. Quantum Mechanics II (3).** Approximation techniques in quantum mechanics. 3 hrs (class). PR. PHYS 241. (1,2)

**PHYS 251. Statistical Mechanics I (3).** Thermodynamics ensembles and quantum statistics. 3 hrs (class). PR. PHYS 151 or

COI. (1,2)

**PHYS 252. Statistical Mechanics II (3).** Statistical mechanics of ideal Bose and Fermi systems, phase transitions, and nonequilibrium thermodynamic systems. 3 hrs (class). PR. PHYS 251. (2)

**PHYS 275. Electrons and Phonons in Solids (3).** The properties of solids emerging from the band structure and the interactions of constituent electrons, phonons, and their collective excitations. 3 hrs (class). PR. COI. (1)

**PHYS 299. Graduate Seminar (1).** May be taken twice. PR. COI. (1,2,M)

**PHYS 300. Master's Thesis (6).** (1,2,M)

### PLANT GENETIC RESOURCES CONSERVATION AND MANAGEMENT (PGRCM)

**Degree offered:** *Master of Science*

The MS PGRCM interdepartmental program is administered by the Graduate School. The participating colleges in the program are the Colleges of Agriculture, Arts and Sciences, and Forestry. The student's college affiliation is generally determined by their crop/field of interest.

The program aims to equip the student with a comprehensive understanding of the PGR concepts, principles and strategies for formal and informal PGR conservation development and management; the capacity to manage genebanks, living botanical collections, natural reserves and in situ conservation areas; and a broad knowledge and understanding of policy issues relating to PGR conservation and use.

The program is managed by an interdepartmental committee (Program Management and Admissions Committee) created by the dean of the Graduate School. This committee is also in charge of prescreening applicants for admission to the program.

A student entering the MS PGRCM program is expected to have taken the following foundation courses or their equivalent at UPLB or elsewhere: BOT 140 - Systematics of the Spermatophytes, AGR 152. Plant Genetic Resources Conservation and Management, and AGR 170. Fundamentals of Seed Technology

The department(s) offering the course(s) shall determine whether the course(s) taken may be considered as equivalent(s) of the required one(s).

The program requires a minimum of 31 units, these are 15 units of major courses, 9 units of minor courses, 1 unit of seminar and 6 units of thesis. The major courses are composed of core courses PGR 261, PGR 262, PGR 263 and other suggested major courses (AGR 254, AGR 270, HORT 234, STAT 250) to satisfy the minimum number of units. The program of study must include any foundation courses that have not been taken by the student previously but units earned in these courses cannot be used to satisfy the unit requirements for the degree.

A core course need not be included in the program if the course or its equivalent has been taken by the student at UPLB or elsewhere.

However, if the course or its equivalent was taken outside UPLB, the student must pass a validating examination for the course which will be given by the department offering it. The department shall also determine if the course previously taken may be considered as the equivalent of the required one.

To satisfy the minimum number of units required for the minor field, the student may choose from several courses in any of the following disciplines offered by the three participating colleges such as: Agronomy, Horticulture, Plant Breeding, Genetics, Sociology, Anthropology, Entomology, Plant Pathology, Seed Science, Forestry, Botany, Plant Physiology, Statistics, Biochemistry, Environmental Science, and other areas depending on the interest of the student.

### Plant Genetic Resources

**PGR 261. Assessment of Genetic Diversity in Plants. (3).** Biochemical, molecular, and cytogenetic methods of plant genetic resources characterization and evaluation; utilization and classification of plant genetic resources. 5 hrs (2 class 3 lab). PR. AGR 152 or COI. (1)

**PGR 262. Plant Genetic Resources Conservation Methods and Management (3).** Strategies in plant genetic resources conservation and genebank management. 5 hrs (2 class 3 lab). PR. AGR 152 or COI. (2)

**PGR 263. Plant Genetic Resources Documentation and Information Management (3).** Management of passport, characterization, evaluation and inventory information in genebanks. 5 hrs (2 class 3 lab). PR. AGR 152 or COI. (1)

**PGR 299. Graduate Seminar (1).** 1 hr (class).

**PGR 300. Master's Thesis (6).**

### PLANT PATHOLOGY (PPTH)

*Institute of Weed Science, Entomology, and Plant Pathology, College of Agriculture and Food Science*

**Degrees offered:** *Master of Science and Doctor of Philosophy*

**Areas of specialization:** Phyto bacteriology, Mycology, Nematology, Plant Virology, Epidemiology, Disease Resistance, Postharvest Pathology, Biological Control, Fungal Physiology, Seed Pathology, Extension Plant Pathology

A student entering the MS PPTH program is expected to have taken the foundation courses PPTH 101, PPTH 103, PPTH 106, PPTH 114 or PPTH 104, PPTH 115 or their equivalent. If the student has not taken these courses, the student shall be required to take or validate them in addition to the course requirements.

The program requires a minimum of 31 units, these are 15 units of major courses, 9 units of minor courses, 1 unit of seminar and 6 units of thesis. The major courses are composed of core courses PPTH 201, STAT 162 and other major courses to satisfy the minimum number of units. The core courses of the MS program PPTH 201 and STAT 162 serves as the foundation course for PhD.

For the PhD program, there are three options: the first is the regular PhD program which can be pursued by qualified MS graduates. The regular PhD program requires a minimum of 37 units, these are 15 units of major courses, 9 units of cognate courses, 1 unit of seminar (PPTH 299) and 12 units of dissertation (PPTH 400). The major courses are composed of a core course PPTH 241 and other major courses to satisfy the minimum number of units.

The second option is the Straight PhD program, it is open to MS students who meet the Graduate School's requirements of a GPA of 1.25 or better for 18 units of 200-level courses taken during the first year of graduate study. If found to qualify by the Department's Graduate Studies Committee through a qualifying examination, the student is allowed to shift to the straight PhD program.

The third option is the PhD by Research program. This allows the candidate to earn the PhD degree through the submission of, and the successful defense of a dissertation, without the usual academic coursework requirement. It requires the candidate to devote almost her/his entire residency to research.

### Plant Pathology

**PPTH 201. Pathogenesis (3).** Pathogenesis as it applies to bacterial and fungal diseases of plants. 5 hrs (2 class, 3 lab). PR. COI. (1)

**PPTH 202. Advanced Course in Plant Disease Control (3).** Exclusion and eradication of plant diseases; protection and immunization of plants; recent advances in plant disease control. 5 hrs (2 class, 3 lab). PR. PPTH 102 or COI. (2)

**PPTH 204. Advanced Mycology I (3).** Mycomycetes and phycomycetes. A comprehensive survey; field collections, identification; preservation; readings and special topics. 7 hrs (1 class, 6 lab). PR. PPTH 104 or COI. (1 every odd year)

**PPTH 206. Advanced Phytonematology (3).** Advances in phytonematological research with emphasis on nematode density/plant yield relationships, host-parasite relations, population dynamics, cytology, physiology, and recent developments in nematode control. 5 hrs (2 class, 3 lab). PR. PPTH 106 or COI. (1)

**PPTH 212. Disease Resistance in Plants (3).** Manifestations and genetics of disease resistance in plants, nature and causes of variation in plant pathogens, breeding for disease resistance, and utilization of resistant genes. 5 hrs (2 class, 3 lab). PR. PPTH 101 or COI. (2)

**PPTH 214. Advanced Mycology II (3).** Ascomycetes, Basidiomycetes, and Fungi Imperfecti. Comprehensive survey; field collection; identification; preservation; and mycological literature. 7 hrs (1 class, 6 lab). PR. PPTH 104 or COI. (1 every even year).

**PPTH 215. Advance Plant Virology (3).** Classification infection, reproduction, movement, and control of plant viruses. 5 hrs (2 class, 3 lab). PR. PPTH 115 or COI. (1)

**PPTH 216. Taxonomy of Plant Parasitic Nematodes (3).** Systematics, identification, classification, and nomenclature of plant parasitic nematodes. 7 hrs (1 class, 6 lab). PR. PPTH 116 or COI. (2)

**PPTH 218. Physiology of Plant Pathogenic Fungi (3).** Nutrition,

growth metabolism, and variation of fungi. 5 hrs (2 class, 3 lab). PR. PPTH 104 or COI. (2)

**PPTH 224. Advanced Taxonomy of Fungi (3).** Identification of fungi at species level with emphasis on the plant pathogenic ones. 7 hrs (1 class, 6 lab). PR. PPTH 104 or COI. (2)

**PPTH 241. Advanced Plant Disease Epidemiology (3).** Quantitative aspects of plant disease epidemiology, modeling, and systems simulation, coupling models, quantifying yield loss and multiple disease effects. 5 hrs (2 class, 3 lab). PR. PPTH 141 or COI. (1)

**PPTH 251/MBB 251. Molecular Plant-Pathogen Interactions (3).** Molecular mechanisms of plant-pathogen interactions and application of molecular diagnostics and markers in plant pathology. 3 hrs (class). PR. PPTH 101 and BIO 101. (2)

**PPTH 290. Special Problems (3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. (1,2,M)

**PPTH 291. Special Topics (3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. (1,2,M)

**PPTH 299. Graduate Seminar (1).** Review of current literature in plant pathology. PR. COI. (1,2)

**PPTH 300. Master's Thesis (6).** (1,2,M)

**PPTH 400. Doctoral Dissertation (12).** (1,2,M)

### PUBLIC AFFAIRS (PAf)

*College of Public Affairs and Development*

**Degree offered:** *Master in Public Affairs*

The Master in Public Affairs program was conceived to address the improvement of the delivery of public service in the areas of national concern. The program aims to educate both current as well as future professionals in key positions of both government and non-government institutions to make them better decision makers, leaders, planners and program implementors. It provides a strong foundation for graduates to have a better appreciation of issues and capability in dealing with these issues emerging in the process of development.

*See Agrarian & Rurban Development Studies, Education Management, and Strategic Planning and Public Policy.*

### Public Affairs

**PAf 201. Political Economy of Public Affairs (3).** Various perspectives/approaches on the study of political economy with emphasis on the role of the government or the state vis-à-vis the polity and economy. PR. ECO 11 or COI. (1,2)

**PAf 203. Data Analysis and Modeling for Public Affairs (4).** Analytical tools, decision models, sources, uses and interpretation of social and economic data in public affairs. PR. STAT 1 or COI.

(1,2)

**PAf 204. Ethics in Public Affairs (3).** Theories, issues, and problems relating to ethical behavior in the public service. (1,2)

**PAf 242.1. Methods of Policy Analysis (3).** An examination of major concepts, principles, methods of economic analysis and their implications to problems of public policy. 3 hrs (class). (1,2)

### RURAL SOCIOLOGY (RS)

*Agricultural Systems Institute, College of Agriculture and Food Science*

**Degree offered:** *Master of Science*

The MS RS program requires a minimum of 31 units, these are 15 units of major courses, 9 units of minor courses, 1 unit of seminar (AERS 299) and 6 units of thesis (AERS 300).

### Agricultural Education and Rural Studies

**AERS 261. Social and Cultural Change (3).** Theories and models of social and cultural change, with emphasis on technology and social change, particularly problems related to the acceptance and diffusion of innovation in agriculture and other areas. 3 hrs (class). PR. COI. (1,2)

**AERS 262. Urban Sociology (3).** Sociological principles applied to the modern city; structure, growth, social and personal life in an urban setting. 3 hrs (class). PR. COI. (2)

**AERS 265. Sociology of Development (3).** Application of sociological theories and concepts to the problems of development at the international, national, and local levels, with emphasis on operationally significant concepts derived from current research and development experience. 3 hrs (class). PR. COI. (1)

**AERS 267. Perspectives in Community Analysis (3).** Theoretical foundations of the concept of community and their application in current community studies. 3 hrs (class). PR. COI. (1)

**AERS 281. Theory Construction (3).** Postulates in science, structure, functions and formats of theory; concept formation and definitions; origination of hypotheses; and introduction to the epistemological foundation of sociological theories. 3 hrs (class). PR. COI. (1)

**AERS 282. Social Research Design (3).** Methods of social research with emphasis on the major steps in the design and conduct of social research from problem definition to analysis, interpretation and write-up of research report. 3 hrs (class). PR. COI. (1,2)

**AERS 290. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. (1,2)

**AERS 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. (1,2)

**AERS 299. Graduate Seminar in Agricultural Education (1).** (1,2)

**AERS 300. Master's Thesis (6).** (1,2,M)

### SOCIOLOGY (SOC)

*Department of Social Sciences, College of Arts and Sciences*

**Degree offered:** *Master of Arts*

MA SOC applicants should have already taken the foundation courses SOC 100 or SOC 105, SOC 150 or SOC 195, otherwise, these courses may be required to be taken.

The MA SOC program requires a minimum of 37 units, these are 21 units of major courses, 9 units of minor courses, 1 unit of seminar (SOC 299) and 6 units of thesis (SOC 300). The major courses are composed of core courses SOC 250, SOC 292 or SOC 295 and other major courses to satisfy the minimum number of units.

### Psychology

**PSY 255/ENS 255. Environmental Psychology (3).** Analyses of the confluence of psychological processes and environmental contexts from a transactional perspective. 3 hrs (class). PR. COI.

### Sociology

**SOC 205. Formal Organizations (3).** Comparison and critical analysis of theoretical and methodological approaches to modern formal organization in developed and developing countries. 3 hrs (class). PR. SOC 100 or COI. (1)

**SOC 212. Sociology of Power (3).** Power as a social phenomenon; theories, structures and processes of power in society. 3 hrs (class). PR. COI. (2)

**SOC 242. Population Studies (3).** Population concepts, methods and issues related to society. 3 hrs (class). PR. COI. (1)

**SOC 250. Advanced Sociological Theories (3).** Critique of major sociological theories and neo-versions as they apply to social realities and concerns. 3 hrs (class). PR. SOC 150 or COI. (2)

**SOC 260. Technology Assessment and Impact Analysis (3).** Basic features and strategies of technology assessment with emphasis on environmental, economic, social and institutional impact analyses and evaluation; policy implications of technology. 3 hrs (class). PR. COI. (2)

**SOC 265/ENS 265. Gender and Environments (3).** Theories, research, and issues relevant to the analyses of gender relations in the home and work environments. 3 hrs (class). PR. COI. (1)

**SOC 290. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. 2 hrs (class). PR. COI.

**SOC 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. 2 hrs (class).



**SOC 292. Qualitative Social Research (3).** Perspectives, methods, analysis, and interpretation in qualitative research. 3 hrs (class). PR. SOC 250 or COI. (1)

**SOC 295. Survey Research (3).** Basic logic and skills of survey research design and analyses; uses and implications of survey research. 3 hrs (class). PR. SOC 195 or COI. (2)

**SOC 299. Graduate Seminar (1).** May be taken twice. (1,2)

**SOC 300. Master's Thesis (6).**

### SOIL SCIENCE (SOIL)

*Agricultural Systems Institute, College of Agriculture*

**Degrees offered:** *Master of Science and Doctor of Philosophy*

#### Areas of specialization:

*MS and PhD:* Soil Chemistry and Mineralogy, Soil Conservation and Management, Soil Fertility, Soil Microbiology, Soil Morphology, Genesis and Classification, Soil Physics

Students who have been admitted to the graduate programs in Soil Science must register the foundation courses (SOIL 1, SOIL 10, SOIL 110, SOIL 120, SOIL 130, SOIL 141, and SOIL 150) in which they are deficient during their first year of residence.

The MS SOIL program requires a minimum of 31 units, these are 15 units of major courses, 9 units of minor courses, 1 unit of seminar (SOIL 299) and 6 units of thesis (SOIL 300). The major courses are composed of core courses SOIL 151, SOIL 240, STAT 162 or AGR 112 and other major courses to satisfy the minimum number of units.

The PhD SOIL program requires a minimum of 37 units, these are 15 units of major courses, 9 units of cognate courses, 1 unit of seminar (SOIL 299) and 12 units of dissertation (SOIL 400). The major courses are composed of core courses SOIL 151, SOIL 240, STAT 162 or AGR 112, 3 units in Statistics above 100 level, and other major courses to satisfy the minimum number of units.

SOIL 1 and SOIL 110 or SOIL 111 are required for students with SOIL as minor/cognate. A student who lacks these foundation courses will not be considered as having taken a minor in Soil Science.

The required courses need not be included in the program of study of the student if they have previously taken these courses at UPLB. Students who have taken equivalent courses in other institutions must take placement examinations, except SOIL 1 during the first year of residence.

#### Soil Science

**SOIL 210. Morphology, Genesis, and Geography of Soils (3).** Properties, development, and distribution of major soil groups and their relation to agriculture. 3 hrs (class). PR. SOIL 110. (1)

**SOIL 221. Advanced Soil Microbiology (3).** Soil microorganisms; microbiological processes involving organic matter and nitrogen transformation; nature of the soil organic fraction. 3 hrs (class). PR. SOIL 120 or COI. (2)

**SOIL 224/MBB 224. Biotechnology of Soil-Microbe-Plant Interactions (3).** Biotechnological approaches in the study of beneficial soil microbe-plant interactions and related principles, processes and applications. 5 hrs (2 class, 3 lab). PR. SOIL 120 or MCB 150 and BIO 101 or COI. (2)

**SOIL 230. Advanced Soil Physics (3).** Dynamic processes occurring in soils with emphasis on the transient water, solute gas, and heat. 3 hrs (class). PR. SOIL 130 and MATH 28 or COI. (2)

**SOIL 240. Advanced Soil Chemistry (3).** Important chemical phenomena in soils; physicochemical study of soils; certain fundamental properties of clays. 3 hrs (class). PR. SOIL 140. (1)

**SOIL 250. Advanced Soil Fertility (3).** Soil conditions in relation to plant growth, including soil transformation processes of both organic and inorganic constituents; concepts of nutrient availability. 3 hrs (class). PR. SOIL 150 or COI. (1,2)

**SOIL 260. Environment and Land Use (3).** Analysis of environmental factors in land-use investigations; recognition of competitive uses and land-use optimization on regional and local levels. 5 hrs (2 class, 3 lab). PR. COI. (2)

**SOIL 290. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2,M)

**SOIL 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1)

**SOIL 299. Graduate Seminar (1).** May be repeated once for a maximum of 2 units. PR. COI. (1,2)

**SOIL 300. Master's Thesis (6).** (1,2,M)

**SOIL 400. Doctoral Dissertation (12).** (1,2,M)

### STATISTICS (STAT)

*Institute of Statistics, College of Arts and Sciences*

**Degrees offered:** *Master of Science and Doctor of Philosophy*

The MS STAT program requires a minimum of 31 units, these are 15 units of major courses, 9 units of minor courses, 1 unit of seminar (STAT 299) and 6 units of thesis (STAT 300). The major courses are composed of core courses STAT 241, STAT 242 and other 200 level courses in statistics to satisfy the minimum number of units.

The PhD STAT program requires a minimum of 37 units, these are 15 units of major courses, 9 units of minor courses, 1 unit of seminar (STAT 399) and 12 units of dissertation (STAT 400). The major courses are composed of core courses STAT 341, STAT 342 and other 200 level courses in statistics to satisfy the minimum number of units.

A PhD graduate student is expected to have a wide exposure to actual problems in statistical theory and methods through practicum in statistical consultation. As an option, a graduate student may choose to gain experience in University-level teaching. This involves

assisting in a course or courses for one semester which will be determined by the Graduate Faculty of Statistics

**STAT 235. Mathematics in Statistics (3).** Matrices; transformations; infinite series; inequalities; generating functions; special functions. 3 hrs (class). PR. MATH 28 or MATH 38. (1)

**STAT 241. Statistical Theory I (3).** Probability, random variables, probability distributions; expectations, moments, and characteristic functions; distributions of functions of random variables; sampling distributions. 3 hrs (class). PR. STAT 142 or COI. (1)

**STAT 242. Statistical Theory II (3).** Parametric point and interval estimation; theory of hypothesis testing; introduction to linear models. 3 hrs (class). PR. STAT 241. (2)

**STAT 250. Multivariate Statistical Methods (3).** Multivariate normal populations; tests of hypotheses on means, multivariate analysis of variance; classification by linear discriminant function; inferences from covariance matrices; principal components; and factor analysis. 3 hrs (class). PR. STAT 162 and MATH 120 or COI. (1,2)

**STAT 251. Linear Models I (3).** Multidimensional normal distribution; distributions of quadratic forms; full rank models; estimation and tests of hypotheses. 3 hrs (class). PR. STAT 142 and STAT 235 or COI. (1)

**STAT 252. Linear Models II (3).** Linear models not of full rank; experimental design models and components-of-variance models; distributional properties of point estimators; test of hypotheses. 3 hrs (class). PR. STAT 251. (1,2)

**STAT 263. Sampling and Sample Surveys (3).** Simple random, stratified, systematic, multistage and multiphase sampling; ratio and regression estimation; sampling with varying probabilities. 3 hrs (class). PR. STAT 141 or COI.

**STAT 264. Statistics for Epidemiology (3).** Statistical methods in the collection, organization and analysis of epidemiologic data and subsequent interpretation. 5 hrs (2 class, 3 lab). PR. STAT 1 or COI. (1)

**STAT 266. Time Series Analysis I (3).** Stationary stochastic processes; covariance and autocorrelation functions; autoregressive and moving average processes. 3 hrs (class). PR. COI. (1,2)

**STAT 290. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units.

**STAT 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI.

**STAT 299. Graduate Seminar (1).** May be taken twice.

**STAT 300. Master's Thesis (6).** (1,2,M)

**STAT 341. Theory of Probability (3).** Measure-theoretic probability; characteristic functions; generalized and compound distributions; limit theorems; stochastic processes. 3 hrs (class). PR. STAT 242

or COI.

**STAT 342. Statistical Inference (3).** Statistical inference and statistical decision theory; sufficiency; most powerful tests; unbiasedness; invariance. 3 hrs (class). PR. STAT 341 or COI. (2)

**STAT 363. Sampling Theory of Surveys (3).** Stratified multistage sampling; sampling on successive occasions; problems and approaches in the development of multistage surveys. 3 hrs (class). PR. STAT 263 or COI.

**STAT 399. PhD Graduate Seminar (1).**

**STAT 400. Doctoral Dissertation (12).**

### STRATEGIC PLANNING AND POLICY STUDIES (SPPS)

*Institute of Governance and Rural Development, College of Public Affairs and Development*

**Degree offered:** *Master in Public Affairs*

The MPAf SPPS program consist of 31 units, these are 13 units of core courses, 12 units of specialization courses and 6 units of electives.

The core courses are PAF 201, PAF 203, PAF 204 and DM 224. The specialization courses are SPPS 201, SPPS 202, SPPS 291, SPPS 298 and SPPS 299. The 3 unit elective course can be selected from the following, AECO 251, DM 220, ENS 221/SFFG 221, HUME 103, SPPS 221, SPPS 232.

### Strategic Planning and Policy Studies

**SPPS 201. Strategic Planning: Theory and Methods (3).** Theoretical perspectives and techniques in strategic planning. PR. COI. (1,2)

**SPPS 202. Methods of Policy Analysis (3).** Policy analytic process and quantitative and qualitative methods of analysis. 3 hrs (class). PR. PAF 203 or COI. (1,2)

**SPPS 221. Social Policies and the Disadvantaged Groups (3).** Critique of issues and policies for the disadvantaged groups within a social development framework. 3 hrs (class). PR. SPPS 202 or COI. (1,2)

**SPPS 232. Science and Technology Policy Analysis (3).** Applications of S & T policy analysis on contemporary societal concerns. 3 hrs (class). PR. COI. (1,2)

**SPPS 272/ENS 272. Science, Technology and Development (3).** Interactions of science, technology and development in society and the nation's economy, and their implications on nation-building and human well-being. 3 hrs (class). PR. None. (1, 2)

**SPPS 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited in the student's program will not exceed 4 units. (1, 2)

**SPPS 298. Field Studies (3).** PR. COI. (1,2,M)

**SPPS 299. Graduate Seminar (1).** May be taken twice. PR. COI. (1, 2)

### Technology Management

**TM 232. Science and Technology Policy (3).** The analysis of science and technology as “public goods”, the evolution of government policies on science and technology (S&T), contemporary government policies on S&T and their interrelations with trade and industrial development protection of intellectual property, research and development, development of S&T, human resources, issues on the role of government in the management of S&T policies on the economy and society. (1,2)

### TROPICAL MARINE ECOSYSTEMS MANAGEMENT (TMEM)

*School of Environmental Science and Management*

**Degree offered:** *Professional Masters*

The Professional Masters in TMEM is a joint program with UP Marine Science Institute of UP Diliman, and UP Visayas.

### TROPICAL MARINE ECOSYSTEMS MANAGEMENT

**TMEM 201. Tropical Marine Ecosystems (3).** Ecological foundations of tropical marine ecosystems. 4 hrs (2 class, 3 lab).

**TMEM 202. Dynamics of Tropical Marine Socio-ecological Systems (4).** Interactions of social, political, cultural, economic, and ecological dimensions in tropical marine ecosystems. 8 hrs (2 class, 6 lab). PR. TMEM 201.

**TMEM 203. Marine Environmental Planning and Management (4).** Principles and tools of marine environmental planning and management. 8 hrs (2 class, 6 lab). PR. TMEM 201.

**TMEM 210 Intercultural Understanding in the Management of Tropical Marine Ecosystems (1).** Multi-cultural realities and diversity issues in tropical marine ecosystem management in Southeast Asia and the Coral Triangle. 1 hr (class).

**TMEM 211 Communication in Tropical Marine Ecosystem Management (1).** Communicating knowledge, issues, and policies to stakeholders involved in tropical marine ecosystem management. 1 hr (class).

**TMEM 220. Marine Protected Area Management and Governance (3).** Integration of socio-ecological systems and designs; legal frameworks, governance and administration principles, and sustainable financing schemes. 5 hrs (2 class, 3 lab). PR. TMEM 203.

**TMEM 221. Strategic Planning for Marine Protected Areas (5).** Application of strategic planning principles and tools to marine protected areas. 9 hrs (3 class, 6 lab). PR. TMEM 220.

**TMEM 222. Marine Protected Area Management Plan Implementation (5).** Management processes, systems and standards in the operation of single site marine protected areas. 9 hrs (3 class, 6 lab). PR. TMEM 221.

**TMEM 223. Marine Protected Area Networks and Large Marine Ecosystems (5).** Networking and alliance building within and among local, provincial, and national entities for the governance of marine protected area systems. 9 hrs (3 class, 6 lab). PR. TMEM 222.

**TMEM 296/TMEM 299. Seminar/Graduate Seminar (1).** Presentation of relevant issues in tropical marine ecosystem management. 1 hr (class). PR. COI.

**TMEM 297/TMEM 290. Special Problem (3).** Implementation and presentation of work on a special problem. 9 hrs (lab). PR. TMEM 223 and TMEM 296.

**TMEM 299. Graduate Seminar (1).**

### VETERINARY EPIDEMIOLOGY (VE)

*College of Veterinary Medicine*

**Degree offered:** *Master in Veterinary Epidemiology*

The MVE program is designed to prepare veterinarians and other animal health professionals to design and implement epidemiological studies and surveillance system; apply epidemiological principles and methods to risk analysis, surveillance, prevention and control of diseases in animal populations; evaluate the risks and relevant factors pertaining to specific diseases and to formulate an appropriate prevention or control strategy or a research study; manage, analyze and interpret animal health data; and communicate effectively the results of an assessment, surveillance or investigation to appropriate groups involved in animal or human health, key policy makers, farmers, the media and the public.

The admission requirements of the Graduate School shall be followed. In addition, applicants shall be holders of DVM or related degree in life sciences from any recognized institution and with at least one year experience in veterinary or related practice.

The MVE requires all student to earn a total of 30 units for graduation. At least 18 units of major courses, 3 units of Special Topics (VEPI 291), 6 units of Field Project (VEPI 295) and 3 units elective must be earned. The major courses are VEPI 221, VEPI 222, VEPI 223, VEPI 224, VEPI 225 and STAT 264. The electives can be chosen from the following: VEPI 226, VEPI 227, VEPI 228, VPH 222, DM 220, SPPS 202, LGD 210, DEVC 201, DEVC 202, DEVC 261, AECON 111, and AECON 241.

Students begin the program with 6 units of required courses in summer. The Field project may be in the form of a research study, a case study, risk analysis study, a program evaluation or a scientific epidemiological report on animal disease and will be presented and defended orally before a panel. Students shall submit a paper in publishable form as a requirement for graduation.

Please refer to Veterinary Medicine for the list of courses.

### VETERINARY MEDICINE (VM)

*College of Veterinary Medicine*

**Degree offered:** *Master of Science, Master in Veterinary Epidemiology*

**Areas of specialization:** Veterinary Anatomy, Veterinary Pharmacology and Physiology, Veterinary Microbiology, Veterinary

Parasitology, Veterinary Pathology, Veterinary Public Health, Veterinary Internal Medicine, Veterinary Surgery, Veterinary Theriogenology

The MS VM is a requires a minimum of 32 units consisting of 9 units of core courses (VPHY 241, VEPI 221, VMED 261), 9 units of courses in the chosen area of specialization, 6 units of electives, 1 unit of Special Topics, 1 unit of Graduate Seminar and 6 units of Master's thesis (VMED 300).

Major courses depend on the area of interest in which the student will eventually perform thesis work. Electives can be taken from courses offered outside the area of interest.

### Veterinary Anatomy

**VETA 201. Advanced Macroscopic Anatomy of the Dog (3).** Detailed description of the macroscopic anatomy of the dog. 7 hrs (1 class, 6 lab). PR. VETA 102 or COI. (1)

**VETA 202. Advanced Comparative Anatomy (3).** Detailed description and comparison of the macroscopic anatomy of the pig, horse, chicken, and cattle (or sheep, goat or carabao). 7 hrs (1 class, 6 lab). PR. VETA 102 and VETA 103 or COI. (2)

**VETA 203. Applied Anatomy (3).** Anatomical features essential to diagnostic, surgical, theriogenological, and postmortem procedures. 7 hrs (1 class, 6 lab). PR. VETA 102 or COI. (1)

**VETA 204. Advanced Microscopic Anatomy (3).** Comparative functional histology and ultrastructure of tissues and organs in various species of domestic animals. 7 hrs (1 class, 6 lab). PR. VETA 104 or COI. (1)

**VETA 205. Neuroanatomy (3).** Structure and function of the nervous system; anatomical diagnosis of neurologic disorders. 5 hrs (2 class, 3 lab). PR. VETA 201 and VETA 204 or COI. (2)

**VETA 207. Histological and Electron Microscopic Techniques (3).** Techniques in the preparation of animal tissues, microbes and parasites for the light and electron microscopy. 7 hrs (1 class, 6 lab). PR. VETA 104 or COI. (2)

### Veterinary Epidemiology

**VEPI 221. Veterinary Epidemiological Methods (3).** Application of epidemiological concepts and methods for systematic inquiry into disease status of animal populations. 5 hrs (2 class, 3 lab). PR. COI. (1)

**VEPI 222. Veterinary Surveillance (3).** Epidemiologic concepts and methods for surveillance of animal and zoonotic diseases. 5 hrs (2 class, 3 lab). PR. COI. (1,M)

**VEPI 223. Epidemiologic Approach in the Control of Infectious Animal Diseases (3).** Application of epidemiology in the control of infectious diseases in animals. 5 hrs (2 class, 3 lab). PR. VPH 121 or COI. (1,M)

**VEPI 224. Outbreak Investigation and Control (3).** Epidemiologic approach to the investigation and containment of disease outbreaks. 5 hrs (2 class, 3 lab). PR. VPH 121 or COI. (1,2)

**VEPI 225. Veterinary Risk Analysis (3).** Introduction to Animal Health Risk Analysis. 5 hrs (2 class, 3 lab). PR. COI. (1,2)

**VEPI 226. Veterinary Informatics (3).** Application of informatics in veterinary epidemiology. 7 hrs (1 class, 6 lab). PR. COI. (1,2)

**VEPI 227. Environmental Animal Health (3).** Factors that may have adverse effects on the health of animal and human populations and the wider environment, and their management. 3 hrs (class). PR. None. (2)

**VEPI 228. Veterinary Diagnostics (3).** Evaluation of veterinary diagnostic tests in populations. 5 hrs (2 class, 3 lab). PR. VPH 121 or COI. (1).

**VEPI 291. Special Topics in Veterinary Epidemiology (3).** 5 hrs (2 class, 3 lab). PR. None. (1)

**VEPI 295. Field Project in Veterinary Epidemiology (6).** Research project in veterinary epidemiology. 18 hrs. PR. COI. (2)

### Veterinary Microbiology

**VMCB 221. Applied Immunology (2).** Veterinary immunodiagnostic techniques; principles, applications, limitations and interpretation of results. 4 hrs (1 class, 3 lab). PR. VMCB 122, VMCB 123 and VMCB 124 or COI. (1)

**VMCB 222. Clinical Microbiology (2).** Isolation, cultivation, and identification of pathogenic bacteria and fungi affecting the domestic animals. 4 hrs (1 class, 3 lab). PR. VMCB 122 or COI. (1)

**VMCB 223. Bacterial and Viral Pathogens of Domestic Animals (4).** Characteristics of pathogenic bacteria and viruses relevant to their pathogenesis, epidemiology, and control in domestic animals. 8 hrs (2 class, 6 lab). PR. VMCB 122 and VMCB 123 or COI. (2)

**VMCB 224. Veterinary Mycology (2).** Cultivation and identification of pathogenic fungi of veterinary importance. 4 hrs (1 class, 3 lab). PR. VMCB 122 or COI. (1)

**VMCB 225. Advances in Veterinary Immunology (3).** Current research and development in veterinary immunology. 3 hrs (3 class). PR. VMCB 124 or COI. (2)

**VMCB 226. Advances in Veterinary Virology (2).** Current research and development in veterinary virology. 2 hrs (class). PR. VMCB 123 or COI. (2)

**VMCB 227. Veterinary Anaerobic Bacteriology (2).** Isolation, cultivation, and identification of anaerobes affecting domestic animals. 4 hrs (1 class, 3 lab). PR. VMCB 122 or COI. (1,2)

**VMCB 228. Pathogenicity and Virulence of Bacteria and Viruses in Animals (3).** Mechanisms and determinants of pathogenicity and virulence of animal bacteria and viruses. 5 hrs (2 class, 3 lab). PR. COI. (2)



**VMCB 229/MBB 229 . Biotechnology in Immunoprophylaxis and Diagnostics of Animal Diseases (3).** Principles and applications of biotechnological advances in vaccine design and development and veterinary diagnostics. 5 hrs (2 class, 3 lab). PR. VMCB 221 or VPAR 234 or COI. (1)

### **Veterinary Medicine**

**VMED 253. Advanced Equine Medicine (3).** Recent and advanced techniques in diagnosis, treatment, prevention and control of diseases and disorders of horses. 5 hrs (2 class, 3 lab). PR. VMED 153 or COI. (1)

**VMED 254. Advanced Swine Medicine (3).** Recent and advanced techniques in diagnosis, treatment, prevention and control of diseases and disorders of pigs. 5 hrs (2 class, 3 lab). PR. VMED 154 or COI. (1)

**VMED 255. Advanced Poultry Medicine (3).** Recent and advanced techniques in diagnosis, treatment, prevention and control of diseases and disorders of poultry. 5 hrs (2 class, 3 lab). PR. VMED 154 or COI. (2)

**VMED 256. Advanced Ruminant Medicine (3).** Recent and advanced techniques in diagnosis, treatment, prevention and control of diseases and disorders of cattle, buffaloes, sheep and goats. 5 hrs (2 class, 3 lab). PR. VMED 153 or COI. (2)

**VMED 261. Complementary and Alternative Veterinary Medicine (3).** Nonconventional, traditional and new approaches, methods and techniques in the diagnosis, treatment, prevention and control of diseases and disorders of animals. 5 hrs (2 class, 3 lab). PR. VMED 151 or COI. (1)

**VMED 291. Special Topics in Veterinary Medicine (1-3).** May be repeated provided that the total number of units to be credited to the student's program will not exceed 3 units. 1 hr a week (1 class). PR. None. (1,2)

**VMED 299. Graduate Seminar in Veterinary Medicine (1).** 1 hr (class). PR. None. (2)

**VMED 300. Master's Thesis (6).**

### **Veterinary Parasitology**

**VPAR 231. Advanced Veterinary Entomology (3).** Arthropods of medical and veterinary importance and their relation to animal host and environment; control and prevention. 5 hrs (2 class, 3 lab). PR. VPAR 131 or COI. (1)

**VPAR 232. Advanced Veterinary Helminthology (3).** Relationship of helminth parasites to their host and environment; immune response to parasitic infection; advances in treatment and control. 5 hrs (2 class, 3 lab). PR. VPAR 132 or COI. (2)

**VPAR 233. Advanced Veterinary Protozoology (2).** Parasitic protozoa and their relation to animal hosts and environment; control and prevention. 4 hrs (1 class, 3 lab). PR. VPAR 131 or COI. (1)

**VPAR 234. Immunology of Parasitic Infections (2).** Parasitic antigens; immunodiagnostic tests in clinical parasitology; immune

reactions to parasitic protozoa, helminth and arthropods; evasion of the immune response and principles of immunoprophylaxis. 2 hrs (class). PR. VMCB 124 and VPAR 132 or COI. (2)

**VPAR 235. Clinical Parasitology (3).** Laboratory diagnostic techniques for the collection, examination, identification and preservation of parasites of domestic and wild animals, fishes and other aquatic animals. 7 hrs (1 class, 6 lab). PR. VPAR 132 or COI. (1)

**VPAR 236. Systematic Helminthology (3).** Taxonomy and nomenclature of helminth parasites. 5 hrs (2 class, 3 lab). PR. VPAR 132 or COI. (2)

### **Veterinary Public Health**

**VPH 222. Microbial and Parasitic Zoonoses (3).** Biological, ecological, and epidemiological features of microbial and parasitic infections transmissible between man and vertebrate animals. 3 hrs (class). PR. VPH 122 or COI. (1, 2)

**VPH 223. Veterinary Epidemiological Investigation of Foodborne Diseases (2).** Principles and techniques in the epidemiological investigation of foodborne illnesses of man and/or animals from foods of animal origin. 2 hrs (class). PR. VPH 222 or COI. (1, 2)

**VPH 224. Veterinary Public Health Consideration in Foods of Animal Origin (3).** Veterinary public health concerns in the production, processing, handling and inspection of animal-derived foods. 5 hrs (2 class, 3 lab). PR. VPH 222 or COI. (1, 2)

**VPH 227. Advanced Epidemiology (2).** Design and conduct of epidemiological investigation; statistical methods for organization, presentation, and analysis of epidemiological data; critical evaluation of published epidemiological research on public health. 2 hrs (class). PR. COI. (2)

**VPH 228. Environmental Sanitation in Animal Industries (3).** Sanitation in animal and animal product establishments. 5 hrs (2 class, 3 lab). PR. COI. (1)

### **Veterinary Pharmacology**

**VPHM 241. Physiological Disposition of Xenobiotics (3).** Absorption, distribution, biotransformation, excretion, and pharmacokinetics of drugs and poisons in vertebrates. 3 hrs (class). PR. VPHY 241 or COI. (1)

**VPHM 242. Veterinary Toxicology (2).** Clinical aspects of common poisoning that affect domestic animals with emphasis on selected organic and heavy metal poisoning. 2 hrs (class). PR. VPHM 241 or COI. (2)

### **Veterinary Physiology**

**VPHY 241. Physiological Biochemistry (3).** Biochemical principles as related to interpretation of normal and altered physiological state in domestic mammals and birds and other appropriate animal models. 3 hrs (class). PR. CHEM 160 and VPHY 141 or COI. (1)

**VPHY 242. Animal Cell Physiology (3).** Structural and functional aspects of molecular and subcellular processes in higher animals. 2

hrs (class). PR. VPHY 241 or COI. (1)

**VPHY 243. Advanced Mammalian Physiology (3).** The physiology of excitable tissues; cardiovascular, respiratory, gastrointestinal, renal, and autonomic nervous systems; acid-base balance. 5 hrs (2 class, 3 lab). PR. VPHY 242 or COI. (2)

**VPHY 244. Neurophysiology and Neuroendocrinology (3).** The neural circuitry and mechanisms regulating different physiological activities of animals. 3 hrs (class). PR. VPHY 242 or COI. (1)

**VPHY 245. Mechanisms of Hormone Action (2).** Cellular and molecular actions of steroid and peptide hormones; recent techniques in hormone research. 2 hrs (class). PR. VPHY 242 or COI. (2)

**VPHY 247. Experimental Physiology (2).** Methods in experimental animal physiology. 6 hrs (lab). PR. VPHY 243 or COI. (1,2)

### Veterinary Pathology

**VPTH 221. Biology and Pathology of Laboratory Animals (3).** Biology and diseases of common laboratory animals used in biomedical research. 3 hrs (class). PR. COI. (3)

**VPTH 222. Veterinary Necropsy (3).** Postmortem examination, interpretation, and diagnosis; collection, preservation, and packing of specimens for laboratory examinations. 7 hrs (1 class, 6 lab). PR. VPTH 122 or COI. (2)

**VPTH 223. Histopathology (3).** Light microscopic examination of cellular changes and tissue reactions to injurious agents with emphasis on lesion description, morphologic, and etiologic diagnosis. 7 hrs (1 class, 6 lab). PR. VPTH 122 or COI. (2)

**VPTH 224. Clinical Biochemistry (2).** Measurements of various chemical constituents of body fluids and electrolytes; analysis and interpretation of results with emphasis on clinical enzymology. 4 hrs (1 class, 3 lab). PR. VPTH 123 or COI. (1)

**VPTH 225.1. Comparative Pathology I (2).** Etiology, gross and microscopic tissue alterations, interpretation and diagnosis of diseases affecting domestic animals, wildlife, and aquatic animals. 6 hrs (lab). PR. VPTH 222 and VPTH 223. (1)

**VPTH 226. Pathology of Microbial Infections (2).** Etiology, pathogenesis, and diagnosis of common microbial diseases affecting domestic animals. 2 hrs (class). PR. VMCB 223 and VMCB 224. (1,2)

**VPTH 227. Pathology of Parasitic Infections (2).** Etiology, pathogenesis, and diagnosis of common parasitic diseases affecting domestic animals. 4 hrs (1 class, 3 lab). PR. VPTH 223 and VPAR 132. (1,2)

### Veterinary Surgery

**VSUR 251. Veterinary Anesthesia (3).** Application of different methods of analgesia and anesthesia in surgical procedures. 5 hrs (2 class, 3 lab). PR. VSUR 151 or COI. (1)

**VSUR 253. Advanced Equine Surgery (3).** Recent and advanced

techniques in equine surgery. 5 hrs (2 class, 3 lab). PR. VSUR 251. (2)

**VSUR 254. Veterinary Diagnostic Ultrasound (3).** Analysis and Interpretation of diagnostic ultrasound in different species of animals. 5 hrs (2 class, 3 lab). PR. VSUR 154 or COI. (2)

**VSUR 256. Advanced Ruminant Surgery (3).** Recent and advanced techniques in bovine, bubaline, caprine and ovine surgery. 5 hrs (2 class, 3 lab). PR. VSUR 251. (2)

### Veterinary Theriogenology

**VTHE 251. Laboratory Animal Theriogenology (3).** Recent and advanced techniques in theriogenology of laboratory animals. 5 hrs (2 class, 3 lab). PR. VMED 155 or COI. (1)

**VTHE 253. Advanced Equine Theriogenology (3).** Recent and advanced techniques in theriogenology of horses. 5 hrs (2 class, 3 lab). PR. VTHE 251. (2)

**VTHE 254. Advanced Porcine Theriogenology (3).** Recent and advanced techniques in theriogenology of pigs. 5 hrs (2 class, 3 lab). PR. VTHE 251. (2)

**VTHE 256. Advanced Bovine and Bubaline Theriogenology (3).** Recent and advanced techniques in theriogenology of cattle and buffaloes. 5 hrs (2 class, 3 lab). PR. VTHE 251 (2)

**VTHE 257. Advanced Ovine and Caprine Theriogenology (2).** Recent and advanced techniques in theriogenology of sheep and goats. 5 hrs (2 class, 3 lab). PR. VTHE 251 (2)

### WILDLIFE STUDIES (WLDL)

The program of Wildlife Studies is a joint offering of the Institute of Biological Sciences(CAS) and Department of Forest Biological Sciences (CFNR).

**Degree offered:** *Master of Science*

**Areas of specialization:** Wildlife Biology, Wildlife Conservation, Wildlife Management.

The MS WLDL program requires a minimum of 31 units, these are 15 units of major courses, 9 units of minor courses, 1 unit of seminar (WLDL 299) and 6 units of thesis (WLDL 300).

### Wildlife

**WLDL 205. Advanced Wildlife Management (3).** Identification, management and conservation of large and small game species. 3 hrs (class). PR. WLDL 105 or its equivalent. (2)

**WLDL 258. Wildlife Population Dynamics (3).** Analysis and prediction of changes in wildlife population. 3 hrs (class). PR. STAT 162 or STAT 164 and WLDL 155 or its equivalent. (1)

**WLDL 290. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. (1,2)

**WLDL 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. (1)

**WLDL299. Graduate Seminar (1).** May be taken twice. (2)

**WLDL 300. Master's Thesis (6).** (1,2)

*For other information, see listing under Botany, Forest Biological Sciences, and Zoology*

## ZOOLOGY (ZOO)

*Institute of Biological Sciences, College of Arts and Sciences*

**Degree offered:** *Master of Science*

**Areas of specialization:** Animal Physiology, Invertebrate Zoology, Parasitology, Animal Ecology

The MS ZOO program requires a minimum of 31 units, these are 15 units of major courses, 9 units of minor courses, 1 unit of seminar (ZOO 299) and 6 units of thesis (ZOO 300).

### Zoology

**ZOO 225. Endocrinology (3).** Anatomy and functional relationships of the endocrine glands in vertebrates. 3 hrs (class). PR. ZOO 120. (2)

**ZOO 226. Physiology of Reproduction (3).** Comparative physiology of reproduction in higher animals, factors involved in fertility mechanisms. 5 hrs (2 class, 3 lab). PR. ZOO 120. (1)

**ZOO 228. Animal Toxicology (3).** Toxic substances, their modes of action and effects on invertebrates and vertebrates. 3 hrs (class). PR. ZOO 120. (2)

**ZOO 242. Advanced Invertebrate Biology (3).** Recent advances in the biology of invertebrates with emphasis on the free-living forms. 3 hrs (class). PR. ZOO 142. (2)

**ZOO 250. Community Ecology of Animals (3).** Factors and processes affecting biodiversity and interactions among animals in their communities. 5 hrs (2 class, 3 lab). PR. ZOO 150. (1)

**ZOO 251. Zoogeography (3).** Theories and concepts in global distribution of wild animals. 3 hrs (class). PR. ZOO 150. (1)

**ZOO 252. Biology of Freshwater Zooplankton (3).** Freshwater zooplankton morphology, physiology, reproduction, taxonomy, and ecology with emphasis on Philippine species. 7 hours (1 class, 6 lab). PR. BIO 150. (2)

**ZOO 253. Ecology of Animal Parasites (3).** Basic concepts and recent advances in the ecology of parasites affecting man and other vertebrates. 3 hrs (class). PR. ZOO 173 or its equivalent. (1)

**ZOO 254. Reef Fish Ecology (3).** Dynamics of populations and communities of reef-associated fishes. 3 hrs (class). PR. ZOO 150. (2)

**ZOO 255. Invasion Zoology (3).** Dispersal, establishment and adaptations of invasive animal species. 3 hrs (class). PR. ZOO 150. (2)

**ZOO 260. Applied Malacology (3).** Medical, agricultural and ecological importance of mollusks. 5 hrs (2 class, 3 lab). PR. ZOO 142 or ZOO 160. (1)

**ZOO 273. Advanced Animal Parasitology (3).** Biology and control of parasites affecting animals in the Philippines. 5 hrs (2 class, 3 lab). PR. COI. (2)

**ZOO 276. Environmental Parasitology (3).** Parasites as indicators of ecosystem health and their transmission dynamics in ecosystems, animals, and humans. 3 hrs (class). PR. ZOO 173. (1)

**ZOO 290. Special Problems (1-3).** May be taken twice provided that total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2)

**ZOO 291. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2)

**ZOO 299. Graduate Seminar in Zoology (1).** May be repeated for a maximum of 2 units. PR. Graduate standing. (1,2)

**ZOO 300. Master's Thesis (6).** (1,2)

**Dual Doctor of Philosophy (PhD) by Research**