



Iligan Institute of Technology
of the Mindanao State University
Quality Education for a better Mindanao

DOCTOR OF PHILOSOPHY IN BIOLOGY

Introduction

The Mindanao State University has long been recognized as the premier university in the Southern Philippines. The various curricula offered by its seven autonomous campuses sufficiently provide an answer to the varied manpower needs of the Mindanao-Sulu-Palawan (MINSUPALA) Region. MSU-Iligan Institute of Technology, in particular, has been identified as a center of excellence in various disciplines of science and technology. As such, it is expected to continuously provide training and development of manpower resources in the region through its undergraduate and graduate programs.

Recently, the Commission on Higher Education (CHED) through the Mindanao Advanced Education Project (MAEP) identified MSU-IIT as a graduate center for several disciplines in the area of the sciences including biology. Geared towards substantial improvement in the manpower capability in the college/graduate levels in various institutions in Mindanao, MAEP provides financial assistance and scholarships to some faculty members from these institutions to pursue advanced degrees, either M.S. or Ph.D.

At present, MSU-IIT in consortium with MSU-Marawi, is offering the M.S. Biology program. Considering the strong faculty profile, adequate laboratory and library facilities of the Department of Biological Sciences in both campuses, it is deemed appropriate that the university through the MSU-Iligan Institute of Technology (MSU-IIT) will offer the Doctor of Philosophy (Ph.D.) in Biology with options in Molecular Biology, Microbiology, Genetics and Environmental Biology. In doing so, the Mindanao State University can answer the demand for advanced training in teaching and research capabilities in the region.

Objectives

Envisioned to develop the manpower resources in the MINSUPALA Region, the Ph.D. (Biology) program shall:

1. provide advanced formal training for instruction and research capabilities in the area of the biological sciences, and
2. fill the need for highly trained biologists in the government, private industries and academic sectors in the region.

Admission Requirements

Admission to the Ph.D. (Biology) Program shall require:

1. a B.S. degree in biological science or allied fields from a recognized institution of higher learning with a grade point average (GPA) of 2.0 or better (for the MS-Ph.D. direct program).
2. a M.S. degree in biological science or allied fields from a recognized institution of higher learning with a grade point average (GPA) of 2.0 or better in the M.S. degree (for the regular program).
3. three (3) letters of recommendation from former professors/immediate supervisor attesting to the student's intellectual capacity for advance studies.
4. satisfaction of the School of Graduate Studies'/institute's admission requirements.

Probationary, conditional or special admission may be granted to applicants with deficiencies (viz., GPA lower than 2.0, lack prerequisites, etc.) as may be determined by the Ph.D. Biology Program Committee.

Course Requirements

A minimum of 60 units (48 course work and 12 dissertation) shall be required for students entering the program with a B.S. degree and 39 units (27 course work and 12 dissertation) for students entering with a M.S. degree.

A. Core Courses (21 units) (Must be taken by students entering the program with a B.S. degree. Students entering with a M.S. degree who have taken any of these courses or their equivalents can have them validated. Request for validation must not exceed 9 units for those who obtained their M.S. degree from outside the MSUS).

Bio	211	Advanced Systematics	3 units
Bio	221	Advanced Ecology	3 units
Bio	241	Advanced Physiology	3 units
Bio	251	Advanced Genetics	3 units
Bio	261	Advanced Developmental Biology	3 units
Bio	267	Evolutionary Biology	3 units
Bio	281	Advanced Cell and Molecular Biology	3 units

B. Specialty Electives (24 units from any of the fields of specialization: Environmental Biology, Genetics, Molecular Biology and Microbiology.)

1. ENVIRONMENTAL BIOLOGY

Bio	213	Advanced Parasitology	3 units
Bio	222	Community Ecology	3 units
Bio	223	Terrestrial Ecology	3 units
Bio	224	Freshwater Ecology	3 units
Bio	225	Population Ecology	3 units
Bio	226	Ecological Methods	3 units
Bio	229	Pollution Biology	3 units
Bio	230	Problems in Environmental Biology	3 units
Bio	240	Environmental Toxicology	3 units
Bio	245	Biology of Reproduction	3 units
Bio	255	Genetics of Evolution	3 units
Bio	268	Ethology	3 units
Bio	290	Special Topics	3 units
Bio	291	Special Problem	3 units
Bot	211	Advanced Plant Systematics	3 units
Bot	227	Phytogeography	3 units
Bot	241	Physiology of Plants	3 units
EnSc	206	Environmental Impact Assessment	4 units
MB	221	Advanced Marine Ecology	3 units
MCB	221	Microbial Ecology	3 units
MCB	241	Microbial Physiology	3 units
Zoo	211	Advanced Animal Systematics	3 units
Zoo	227	Zoogeography	3 units

2. GENETICS

Bio	252	Advanced Cytogenetics	3 units
Bio	253	Molecular Genetics	3 units
Bio	254	Developmental Genetics	3 units
Bio	255	Genetics of Evolution	3 units
Bio	256	Population Genetics	3 units
Bio	257	Genetics of Eukaryotes	3 units
Bio	258	Radiation Genetics	3 units

Bio 290	Special Topics	3 units
Bio 291	Special Problem	3 units

3. MOLECULAR BIOLOGY

Bio 246	Molecular Biology of Reproduction	3 units
Bio 253	Molecular Genetics	3 units
Bio 264	Molecular Basis of Growth Regulation	3 units
Bio 283	Molecular Biology of Fermentation	3 units
Bio 284	Molecular Biology of the Immune System	3 units
Bio 285	Recombinant DNA Technology	3 units
Bio 290	Special Topics	3 units
Bio 291	Special Problem	3 units
Chem 240	Structure and Function of Biomolecules	3 units
Chem 242	Lipids, Proteins and Carbohydrates	3 units
Chem 243	Enzymes	3 units
Chem 244	Nucleotides and Nucleic Acids	3 units

4. MICROBIOLOGY

MB 203	Marine Microbiology	3 units
MCB 204	Industrial Microbiology	3 units
MCB 205	Food Microbiology	3 units
MCB 206	Determinative Bacteriology	3 units
MCB 207	Microbial Toxins	3 units
MCB 208	Microbiological Techniques	3 units
MCB 209	Virology	3 units
MCB 210	Epidemiology	3 units
MCB 221	Microbial Ecology	3 units
MCB 241	Microbial Physiology	3 units
MCB 251	Microbial Genetics	3 units
MCB 290	Special Topics	3 units
MCB 291	Special Problem	3 units

C. Graduate Seminar (3 units from three (3) one-unit seminar courses.

Bio 296	Seminar in Biology	1 unit
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D. Doctoral Dissertation (12 units)

Bio 400	Doctoral Dissertation	12 units
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Other Requirements

1. After completion of all the core courses with a GPA of 2.0 or better, by a student entering the program with a B.S. degree, or after validating the core courses or their equivalents for students entering with a M.S. degree, the student takes a qualifying (written) examination which will be the basis for evaluating his/her ability to pursue doctoral studies. A committee of at least three members to be formed by the Ph.D. Biology Program Committee shall prepare and administer the examination.

2. After passing all the specialty courses (based on the program of study) with a weighted average grade of 2.0 or better, the student takes an oral specialty examination which will be given by his advisory/guidance committee. A dissertation proposal is a requirement for the specialty examination.

3. Final Examination (Oral defense of the dissertation before the advisory committee.

4. In the event a student entering the program fails in the qualifying (written) examination twice, the Ph.D. Biology Program Committee may recommend that the student take at least nine units of specialty courses and conduct a thesis leading to a M.S. degree or the student be dismissed from the program.

DOCTOR OF PHILOSOPHY BIOLOGY (Ph.D. Bio.)
(LIST OF COURSES BY SEMESTER)

First Year, First Semester

Course No.	Course Title	Units	Hrs/Wk			Prerequisite(s)
			Lec	Lab	Total	
Bio 221	Advanced Ecology	3	2	3	5	General Ecology
Bio 241	Advanced Physiology	3	2	3	5	General Physiology
Bio 251	Advanced Genetics	3	2	3	5	General Genetics
Bio 261	Advanced Developmental Biology	3	2	3	5	Developmental Biology
	Total	12	8	12	20	

First Year, Second Semester

Course No.	Course Title	Units	Hrs/Wk			Prerequisite(s)
			Lec	Lab	Total	
Bio 267	Evolutionary Biology	3	3	0	3	Core Courses
Elective 1	Specialty	3				Core Courses
Elective 2	Specialty	3				Core Courses
Elective 3	Specialty	3				Core Courses
Bio 296	Seminar in Biology	1	1	0	1	
	Total	13				

First Year, Summer

Course No.	Course Title	Units	Hrs/Wk			Prerequisite(s)
			Lec	Lab	Total	
Elective 4	Specialty	3				Core Courses
Elective 5	Specialty	3				Core Courses
Bio 296	Seminar in Biology	1	1	0	1	
	Total	7				

Second Year, First Semester

Course No.	Course Title	Units	Hrs/Wk			Prerequisite(s)
			Lec	Lab	Total	
Elective 6	Specialty	3				Core Courses
Elective 7	Specialty	3				Core Courses
Elective 8	Specialty	3				Core Courses
Bio 296	Seminar in Biology	1	1	0	1	
	(Dissertation Proposal Defense)					
	Total	10				

Second Year, Second Semester

Course No.	Course Title	Units	Hrs/Wk			Prerequisite(s)
			Lec	Lab	Total	
	(Comprehensive Examination)					Core Courses
Bio 400	Doctoral Dissertation	12				
	(Dissertation Proposal Defense)					
	Total	12				

Second Year, Summer

Course No.	Course Title	Units	Hrs/Wk			Prerequisite(s)
			Lec	Lab	Total	
Bio 400	Doctoral Dissertation					
	Total					

Third Year, First Semester

Course No.	Course Title	Units	Hrs/Wk			Prerequisite(s)
			Lec	Lab	Total	
Bio 400	Doctoral Dissertation					
	Total					

Third Year, Second Semester

Course No.	Course Title	Units	Hrs/Wk			Prerequisite(s)
			Lec	Lab	Total	
	(Doctoral Dissertation Defense)					
	Total					

CATALOGUE OF COURSES

BIO 201 MICROTECHNIQUE

Fundamentals of microtechnique and principles of microscopy; preparing and mounting of cells, tissues, organs & whole organisms for microscopic study.

Credit : 3 units (2 hrs. lec.; 3 hrs. lab/wk)

BIO 211 ADVANCED SYSTEMATICS

Principles and methods of classification and phylogeny of living forms.

Credit : 3 units

Prerequisite(s) : Bio 105 (Systematics) or its equivalent.

BIO 213 ADVANCED PARASITOLOGY

Biology of parasites of marine organisms with emphasis on their taxonomic status and relationships: their morphology, physiology, ecology, host parasite relationships, manner of infestation, control and cure.

Credit : 3 units

Prerequisite(s) : Bio 160 (Parasitology) or its equivalent

BIO 221 ADVANCED ECOLOGY

Advanced principles of ecosystems: structure and function. It covers major ecosystems in terrestrial and marine environments.

Credit : 3 units

Prerequisite(s) : Bio 107 (General Ecology) or its equivalent.

BIO 222 COMMUNITY ECOLOGY

Principles on dynamics of communities, structure and function and interaction of component species and biodiversity.

Credit : 3 units

Prerequisite(s) : Bio 107 (General Ecology) or its equivalent.

BIO 223 TERRESTRIAL ECOLOGY

Composition and dynamics of terrestrial communities/ ecosystems.

Credit : 3 units

Prerequisite(s) : Bio 107 (General Ecology) or its equivalent.

BIO 224 FRESHWATER ECOLOGY

Composition and dynamics of freshwater communities/ ecosystems.

Credit : 3 units

Prerequisite(s) : Bio 107 (General Ecology) or its equivalent.

BIO 225 POPULATION ECOLOGY

Principles on dynamics of population; causes of rise and fall in numbers of population; regulation and management of population.

Credit : 3 units

Prerequisite(s) : Bio 107 (General Ecology) or its equivalent.

BIO 226 ADVANCED METHODS IN ECOLOGICAL RESEARCH

Analytical tools and research approach in the study of populations, communities and ecosystem.

Credit : 3 units

Prerequisite(s) : Bio 107 (General Ecology) or its equivalent.

BIO 227 PHYTOGEOGRAPHY

Ecology and distribution of plant populations on earth.

Credit : 3 units

Prerequisite(s) : Bio 107 (General Ecology). Bio 105 (Systematics)
recommended or their equivalents.

BIO 229 POLLUTION BIOLOGY

Discussions on types and causes of pollution in the environment. Methods on bioremediation and pollution control and prevention will be included.

Credit : 3 units

Prerequisite(s) : Bio 107 (General Ecology) or its equivalent.

BIO 230 PROBLEMS IN ENVIRONMENTAL BIOLOGY

Defining some environmental problems brought up as a result of human activity. Discussion of possible abatement and control.

Credit : 3 units.

Prerequisite(s) : Consent of instructor.

BIO 240 ENVIRONMENTAL TOXICOLOGY

Discussions on synthesis of toxins. Includes discussions on the principles of toxicology among organisms especially animals. Identification of common environmental toxins, their mechanisms of toxication and possible cure and prevention.

Credit : 3 units.

Prerequisite(s) : Bio 109 (General Physiology) and Chem 45
(Elementary Biochemistry) or their equivalents.

BIO 241 ADVANCED PHYSIOLOGY

Recent trends and concepts in physiology with emphasis on the universal physiological principles applied to all organisms.

Credit : 3 units

Prerequisite(s) : Bio 109 (General Physiology) or its equivalent.

BIO 254 DEVELOPMENTAL GENETICS

Genetic principles as applied to the development of organisms.

Credit : 3 units

Prerequisite(s) : Bio 120 (Developmental Biology) and Bio 106
(Gen. Genetics) or their equivalents.

BIO 255 GENETICS OF EVOLUTION

Role of genetic factors in evolution and speciation.

Credit : 3 units

Prerequisite(s) : Bio 106 (General Genetics) or its equivalent: Bio 110
(Evolution) recommended.

BIO 256 POPULATION GENETICS

Principles governing the behavior of genes in populations

Credit : 3 units

Prerequisite(s) : Biology 106 (Gen. Genetics) or its equivalent

BIO 257 GENETICS OF EUKARYOTES

Advances in the identification, characterization and manipulation of genes in eukaryotic systems.

Credit : 3 units

Prerequisite(s) : Bio 106 (Gen. Genetics) or its equivalent.

BIO 258 RADIATION GENETICS

Change in genetic structure, manifestation and function when genes/chromosomes are exposed to various ionizations.

Credit : 3 units

Prerequisite(s) : Bio 106 (Gen. Genetics) or its equivalent.

BIO 261 ADVANCED DEVELOPMENTAL BIOLOGY

Recent concepts on the regulation of fertilization, development and differentiation.

Credit : 3 units

Prerequisite(s) : Bio 120 (Developmental Biology) or its equivalent.

BIO 262 CELL DIFFERENTIATION IN EMBRYONIC SYSTEMS

Current concepts on embryonic development

Credit : 3 units

Prerequisite(s) : Biology 120 (Development Biology) or its equivalent

BIO 264 MOLECULAR BIOLOGY OF GROWTH REGULATION

Discussions on the molecular/cellular bases of growth and differentiation regulations.

Credit : 3 units

Prerequisite(s) : Bio 109 (Gen. Physiology) or its equivalent.

BIO 267 EVOLUTIONARY BIOLOGY

Major and general concepts of evolution of organisms. Discussions on different theories of evolution both micro- and macro- evolution.

Credit : 3 units
Prerequisite(s) : Consent of instructor.

BIO 268 ETHOLOGY

Natural history of behavior, genetics and learning on the shaping of behavior, physiological and adaptive value of behavior, mechanisms of response to environment and the adaptiveness of the behavioral response.

Credit : 3 units.
Prerequisite(s) : Consent of instructor.

BIO 281 ADVANCED CELL AND MOLECULAR BIOLOGY

Recent advances in cell and molecular biology including neurobiology and techniques in molecular biology and genetic engineering.

Credit : 3 units
Prerequisite(s) : Bio 108 (Cell Biology) or its equivalent.

BIO 283 MOLECULAR BIOLOGY OF FERMENTATION

The physiology, biochemistry and genetics of fermentation and the production of secondary metabolites and substances of economic importance.

Credit : 3 units
Prerequisite(s) : Consent of instructor.

BIO 284 MOLECULAR BIOLOGY OF THE IMMUNE SYSTEM

Molecular determinants of antigenicity and immunogenicity. Discussions on the biochemistry of adjuvants and the structure and function of antibodies will be included.

Credit : 3 units
Prerequisite(s) : Consent of instructor.

BIO 285 RECOMBINANT DNA TECHNOLOGY

Molecular biology techniques and genetic engineering protocols in recombinant DNA.

Credit : 3 units
Prerequisite(s) : Bio 127 (Gen. Microbiology) and Bio 106 (Gen. Genetics) or their equivalents.

BIO 287 ADVANCED THEORETICAL BIOLOGY

Recent advances in theories and principles applicable in bioinformatics, evolutionary and epidemiological genomics and proteomics, and ecological modeling and simulation.

Credit : 3 units (3 hrs lec/week)
Prerequisite(s) : Cell and Molecular Biology or its equivalent or consent of the instructor

BIO 288 CRITIQUE IN EVOLUTION

The different theories on evolution

Credit : 3 units

Prerequisite(s) : Biology 157 (Comp. Ana. & Phylogeny of Vertebrates)
 Biology 107 (Gen. Ecology) and Biology 106
 (Gen. Genetics) or their equivalents

BIO 289 PHILIPPINE BIOLOGY

Philippine flora and fauna

Credit : 3 units

Prerequisite(s) : Biology 103 (Fundamentals of Plant Biology) and
 Biology 102 (Fundamentals of Animal Biology) or their
 equivalents

BIO 290 SPECIAL TOPICS

Thorough discussion on assigned topics in a particular field of specialization
(To be enrolled under the student's adviser)

Credit : 3 units

BIO 291 SPECIAL PROBLEM

Assigned experimental or laboratory work on any special topic related to one's field of specialization.
Reporting and discussions of results.
(To be enrolled under the student's adviser)

Credit : 3 units

BIO 293 BIOMETRY

Mathematical skills and the processes of statistical analysis necessary in the
collection and interpretation of experimental data

Credit : 3 units

Prerequisite(s) : Stat 33 (Biostatistics) or its equivalent

BIO 294 BIOETHICS

Critical analysis of issues arising from science, technology, belief structures, rights of an individual and
society, and their interrelationships. Topics focus on the ethics of recombinant DNA research, eugenics,
germinal choice, in vitro fertilization, abortion, transexualization and euthanasia.

Credit : 1 unit

Prerequisite(s) : Consent of Instructor

BIO 295 INDIVIDUAL STUDIES

An independent research project in a specific area of study under the guidance of an appropriate faculty.

Credit : 1-6 units depending on the student and academic adviser

Prerequisite(s) : None

BIO 296 SEMINAR IN BIOLOGY

Oral presentation and discussion of current researches in biology

Credit : 1 unit

Prerequisite(s) : None

BIO 298 ADVANCED RESEARCH METHODOLOGY

Principles and methods in biological research including statistical analysis

Credit : 3 units

Prerequisite(s) : Stat 33 (Biostatistics) or its equivalent

BIO 300 MASTER'S THESIS

A formal, detailed report on the research conducted based on an approved thesis proposal. The research must be an original contribution to the area of specialization.

Credit : 6 units

BIO 400 DOCTORAL DISSERTATION

Formal, detailed report on the research conducted based on approved thesis proposal. The research must be an original contribution on the area of specialization.

Credit : 12 units (to be enrolled four times. 3 units/semester)

BOT 215 AQUATIC BOTANY

Identification, classification and biology of aquatic plants, including the algae, in both fresh and marine waters

Credit : 3 units

Prerequisite(s) : Biology 103 (Fundamentals of Plant Biology) or its equivalent

BOT 232 MORPHOLOGY OF HIGHER VASCULAR PLANTS

Anatomy and histology of higher vascular plants

Credit : 3 units

Prerequisite(s) : Biology 103 (Fundamentals of Plant Biology) or its equivalent

BOT 233 MORPHOLOGY OF THALLOPHYTES

Anatomy and histology of thallophytes

Credit : 3 units

Prerequisite(s) : Biology 103 (Fundamentals of Plant Biology) or its equivalent

BOT 241 ADVANCED PLANT PHYSIOLOGY

Recent developments in the field of photosynthesis, photorespiration, respiration, biosynthesis, hormones, transport and other physiological activities of plants

Credit : 3 units

Prerequisite(s) : Biology 103 (Fundamentals of Plant Biology) or its equivalent

BOT 242 PLANT AND WATER RELATIONS

Mechanisms of and factors affecting water utilization in plants

Credit : 3 units

Prerequisite(s) : Biology 103 (Fundamentals of Plant Biology) or its equivalent

BOT 262 PLANT GROWTH AND DEVELOPMENT

Patterns and regulation of plant growth and development

Credit : 3 units

Prerequisite(s) : Biology 103 (Fundamentals of Plant Biology) or its equivalent

CHEM 240 STRUCTURE AND FUNCTION OF BIOMOLECULES

Structure and function of biochemical systems: their regulation, biosynthesis and coordinated metabolic pathways. Recent literature in molecular biology.

Credit : 3 units

CHEM 242 LIPIDS, PROTEINS, AND CARBOHYDRATES

Advances in lipid, protein and carbohydrate chemistry. Extraction and separation methods in lipid, protein and carbohydrate analysis.

Credit : 3 units

Prerequisite(s) : Chem 240

CHEM 243 ENZYMES

Enzyme structure and function: allosterism. Equilibrium and kinetic aspects of enzyme reactions. Coenzyme functions and structures. Biochemical mechanisms and their regulation.

Credit : 3 units

Prerequisite(s) : Chem 240.

CHEM 244 NUCLEOTIDES AND NUCLEIC ACIDS

The replication of living organisms, mutations, repair mechanisms. Recent development in biochemistry of nucleoside and nucleic acids.

Credit : 3 units

Prerequisite(s) : Chem 240.

CHEM 281 ENVIRONMENTAL CHEMISTRY

Deals with the nature of air, land and water pollution: pollutants and their effects on the physical, chemical and biological processes and interrelationships between man and his environment: includes pollution monitoring, pollution control and abatement.

Credit : 3 units lecture

ENSC 201 PRINCIPLES OF ENVIRONMENTAL SCIENCE

Materials and geologic processes and nature of the lithosphere, hydrosphere and atmosphere. Biosphere, principles and interactions associated with land, air and water environments and environmental health.

Credit : 3 units (2 units lec, 1 unit lab)

ENSC 202 ENVIRONMENTAL LAWS AND POLICIES

Environmental laws and policies in research and development in support of environmental management, planning and community advocacy. Institutional framework / organizations involved with environmental issues.

Credit : 1 unit lecture

ENSC 203 RESOURCE MANAGEMENT AND CONSERVATION

Natural resources focus on Philippine resources, issues and problems of natural resource management and conservation.

Credit : 3 units lecture

ENSC 206 ENVIRONMENTAL IMPACT ASSESSMENT

Framework and methodology for environmental impact assessment and monitoring, prediction and assessment of impacts on the physical and biological environment, assessment of environmental resources in terms of their potential for utilization and corresponding impact to human activities.

Credit : 4 units lec 2 / lab 2

ENSC 220 ENVIRONMENTAL GEOLOGY

Geological materials and processes related to their influences on man's physical environment. Effect of landscape modification and geological hazards such as earthquakes and landslides. Properties of minerals rocks sediments and soils, and geological aspect of waste disposal and water resources. Occasional field trips.

Credit : 3 units

ENSC 226 ELEMENTS OF GEOGRAPHY

Models of the earth, map reading, determination of locations, spatial distributions of coastal and marine resources, transportation and human settlements.

Credit : 3 units

ENSC 230 METEOROLOGY AND CLIMATOLOGY

Elements of weather and climate, their measurements, acquisitions, processing, and application of climatological data; classification of world and Philippine climates.

Credit : 3 units (2 units lec, 1 unit lab)

ENSC 236 ENVIRONMENTAL EDUCATION

Rationale of environmental education, and sustainable development, curriculum development, teaching strategies, designing projects and then demonstrating them. Reports, classroom experience, and other devices provide feedback on the implementation of the strategies.

Credit : 3 units

Prerequisite(s) : Educational Psychology and Methods of Teaching.

ENSC 240 ENVIRONMENTAL PHYSIOLOGY AND TOXICOLOGY

Physical and chemical environment as it affects the physiology and population dynamics of organisms including humans. Stability and maintenance of biochemical cycles.

Credit : 3 units

Prerequisite(s) : Gen. Biology or Gen. Zoology

ENSC 244 ANALYTICAL PROCEDURES IN ENVIRONMENTAL CHEMISTRY

Analytical procedures applicable to research in environmental science.

Credit : 2 units lab

ENSC 252 POLLUTION PREVENTION

Past and future industrial development in relation to environmental issues and trends. Economically sustainable industrial development and clean production practices and their practical applications in developed and developing countries. Techniques that promote prevention of pollution.

Credit : 3 units (2 units lec, 1 unit lab)

ENSC 254 PRINCIPLES OF SOLID WASTE MANAGEMENT

Solid waste problems in the municipal, industrial, and agricultural areas. Interrelationships with other environmental problems and socio-economic aspects. Quality and quantity variations of solid waste treatment and management systems; recycling and resource control.

Credit : 3 units (2 units lec, 1 unit fieldwork)

ENSC 256 WASTEWATER TREATMENT

Chemical, physical and biological factors affecting development of water supplies: water quality: municipal and industrial water treatment processes consisting of removal of particulate matter, softening, disinfection, corrosion control, aeration, and taste and odor removal.

Credit : 3 units (2 units lec, 1 unit lab)

ENSC 260 MAN AND HIS ENVIRONMENT

Political, economic, psychological, sociological and anthropological aspects in the design and management of human environments.

Credit : 3 units lecture.

ENSC 264 ENVIRONMENTAL PLANNING AND MANAGEMENT

National, regional and local efforts to plan for the allocation and use of environmental resources with emphasis on land use. Technical, economic and institutional considerations that influence plan development, preparation and implementation.

Credit : 3 units lecture

ENSC 268 ENVIRONMENTAL MANAGEMENT THROUGH COMMUNITY DEVELOPMENT

Local community / government approaches to community environmental management; training and technological aspects of environmental management at the community level; effective communications to build partnerships for sustainable community development; waste recovery and recycling.

Credit : 3 units lecture.

ENSC 280 RESOURCE USE AND DEVELOPMENT

Effects of resource use and development on the environment, on social, technical and economic problems.

Credit : 3 units lecture.

ENSC 284 FOREST AND WATERSHED MANAGEMENT

Principle of multiple use, classification and distribution of forests, management in relation to forest products; regulation, conservation practices and treatment of aggregate resources of a drainage basin for the production of water and the control of erosion, stream flow and flood.

Credit : 3 units lecture

ENSC 296 GRADUATE SEMINAR

Oral presentation and discussion on the current researches in environmental science.

Credit : 1 unit

ENSC 298 RESEARCH METHODOLOGY

Methods of research including statistics with focus on environmental studies. Course requirement- Research Proposal.

Credit : 3 units

Prerequisite(s) : Biostatistics

ENSC 299 MASTER'S THESIS

Formal, detailed report on a research conducted based on an approved thesis proposal.

Credit : 6 units

MB 203 MARINE MICROBIOLOGY

Marine microorganisms with emphasis on their role in the degradation and recycling of nutrients in the marine ecosystem and biotechnological applications of some important forms.

Credit : 3 units (2 hrs. lec.; 3 hrs. lab/wk)

MB 212 ADVANCED INVERTEBRATE ZOOLOGY

Systematics of marine invertebrates; their relationship, life cycle, external and internal anatomy.

Credit : 3 units (2 hrs. lec.; 3 hrs. lab/wk)

MB 214 MARINE PLANKTONOLOGY

Biology of marine aquaculture, their importance in the economy of the sea with emphasis on their role in the food chain; sampling methodology, and preparation for biomass and productivity estimates.

Credit : 3 units (2 hrs. lec.; 3 hrs. lab/wk)

MB 217 ICHTHYOLOGY

Biology of fishes on classification, anatomy, life cycle, physiology and ecology; conservation and economic importance.

Credit : 3 units (2 hrs. lec.; 3 hrs. lab/wk)

MB 221 ADVANCED MARINE ECOLOGY

Composition and dynamics of marine ecosystems.

Credit : 3 units

Prerequisite(s) : Bio 107 (General Ecology)

MB 226 MARINE ECOSYSTEMS

Structure and function of marine ecosystems.

Credit : 3 units (2 hrs. lec.; 3 hrs. lab/wk)

MB 228 MARINE PRODUCTIVITY

Principles of primary productivity with emphasis on photosynthesis, chemosynthesis, respiration, growth, biomass, chlorophyll; methods of measurement.

Credit : 3 units (2 hrs. lec.; 3 hrs. lab/wk)

MB 229 MARINE POLLUTION

Types of marine pollutants; their sources, distribution and movement; measurements of the level of pollution and methods of control.

Credit : 3 units (2 hrs. lec.; 3 hrs. lab/wk)

MB 240 MARINE TOXICOLOGY

Venomous and toxic marine organisms; chemical analysis of toxins, their physiological effects, and pharmacologic importance.

Credit : 3 units (2 hrs. lec.; 3 hrs. lab/wk)

MB 241A MORPHOLOGY AND PHYSIOLOGY OF MARINE ANIMALS

Structure and function relationships of marine animals with emphasis on nutrition, respiration, osmoregulation, and excretion.

Credit : 3 units (2 hrs. lec.; 3 hrs. lab/wk)

MB 241B MORPHOLOGY AND PHYSIOLOGY OF MARINE PLANTS

Structure and function relationships of marine plants with emphasis on nutrition, respiration, osmoregulation, and excretion.

Credit : 3 units (2 hrs. lec.; 3 hrs. lab/wk)

MB 292 MARINE RESOURCE MANAGEMENT

Principles of marine resource conservation, rational utilization, protection and management of the marine environment; conservation laws.

Credit : 3 units (2 hrs. lec/seminar/ & 3 hrs. field observations)

MB 293 MARICULTURE

Principles of aquaculture and their application to the culture of economically important marine organisms; prevention and control of their pests, diseases and parasites; economic feasibility analysis of mariculture ventures.

Credit : 3 units (2 hrs. lec.; 3 hrs. lab/wk)

MB 294 FISHERIES BIOLOGY

Biology, population dynamics and stock assessment of the living resources of the sea and man's interaction with them.

Credit : 3 units (2 hrs. lec.; 3 hrs. lab/wk)

MB 296 SEMINAR IN MARINE BIOLOGY

Oral presentation and discussion of current researches in biology.

Credit : 1 unit (1 hr./wk seminar session)

MB 298 MARINE METHODOLOGY

Methods and techniques in marine biological research or in oceanographic work.

Credit : 3 units (3 hrs. lec/wk)

MB 300 MASTERAL THESIS

A research study or project to be conducted by the masteral student.

Credit : 6 units

MCB 201 INDUSTRIAL MICROBIOLOGY

Thorough discussions on the industrial applications of microorganisms. Major classes of products and processes and microorganisms used in industrial processes will be discussed.

Credit : 3 units
Prerequisite(s) : Bio 127 (Gen. Microbiology) or its equivalent

MCB 203 MARINE MICROBIOLOGY

Marine microorganisms with emphasis on their role in the degradation and recycling of nutrients in the marine ecosystem. Discussions on the biotechnological applications of some important forms will be included.

Credit : 3 units

MCB 205 FOOD MICROBIOLOGY

Discusses the normal flora of foods, their significance, and the manner in which foods may be protected from microbial contamination and microbial spoilage. Food products manufactured by microbial fermentation, the role of foods in the transmission of diseases and food poisoning will be discussed.

Credit : 3 units
Prerequisite(s) : Bio 127 (Gen. Microbiology) or its equivalent.

MCB 206 DETERMINATIVE BACTERIOLOGY

Thorough discussions on the criteria for classification and identification of bacteria. Specific groups of bacteria will be isolated and identified.

Credit : 3 units
Prerequisite(s) : Bio 127 (Gen. Microbiology) or its equivalent.

MCB 207 MICROBIAL TOXINS

Thorough discussions on the physical, chemical, and biological properties of bacterial and fungal toxins.

Credit : 3 units
Prerequisite(s) : Bio 127 (Gen. Microbiology) or its equivalent.

MCB 208 MICROBIOLOGICAL TECHNIQUES

Discussions on standard techniques used in industrial quality control, safety monitoring and in microbiological research laboratories.

Credit : 3 units
Prerequisite(s) : Bio 127 (Gen. Microbiology) or its equivalent.

MCB 209 VIROLOGY

Basic characteristics of viruses: structures, chemical composition, reproduction and ways in which viruses are classified into taxonomic groups. Also discusses the ability of viruses to cause disease and methods used to study viruses in the laboratory.

Credit : 3 units
Prerequisite(s) : Bio 127 (Gen. Microbiology) or its equivalent.

MCB 210 EPIDEMIOLOGY

Thorough discussions on occurrence and distribution of microbial diseases, control and quantitative procedures.

Credit : 3 units

Prerequisite(s) : Bio 127 (Gen. Microbiology) or its equivalent.

MCB 221 MICROBIAL ECOLOGY

Interrelationship between microorganisms and the biotic and abiotic components of their environment.

Credit : 3 units

Prerequisite(s) : Bio 127 (General Microbiology) or its equivalent.

MCB 241 MICROBIAL PHYSIOLOGY

Metabolic activities and other factors affecting the growth of microorganisms.

Credit : 3 units

Prerequisite(s) : Bio127 (General Microbiology) and Chem 45
(Elementary Biochemistry) or their equivalents

MCB 251 MICROBIAL GENETICS

Principles of heredity in microbial systems and their application in microbiology and molecular biology.

Credit : 3 units

Prerequisite(s) : Bio 127 (Gen. Microbiology) and Bio 106 (Gen.
Genetics) or their equivalents.

OCEA 201 FUNDAMENTALS OF PHYSICAL, CHEMICAL, AND
BIOLOGICAL OCEANOGRAPHY

Physical dynamics and chemical processes of the oceans and instrumentations related to analysis. Biological systems in the sea in relation to the physical and chemical dynamics.

Credit : 3 units (2 units lec, 1 unit fieldwork)

OCEA 211 BIOLOGICAL OCEANOGRAPHY

Biological systems and processes in the sea; the structure of marine ecosystems and biological flow of energy and matter under various natural and man-made factors; major emphasis on systems ecology, synecology, population ecology, and physiological ecology.

Credit : 3 units (2 hrs lec; 3 hrs lab)

OCEA 221 PHYSICAL OCEANOGRAPHY

Comparative descriptions and physical dynamics of oceans; theories of energy transmissions and the resultant motions such as currents, waves, and tides; instrumentation in oceanographic investigations.

Credit : 3 units (2 hrs lec; 3 hrs lab)

OCEA 231 CHEMICAL OCEANOGRAPHY

Comparative constituents of seawater and the various analytical techniques used to determine their concentrations; emphasis on salinity, major and minor elements, macro- and micronutrients, dissolved and particulate organic and inorganic substances; equilibrium processes which qualitatively and quantitatively affect them.

Credit : 3 units (2 hrs lec; 3 hrs lab)

STAT 233 BIOSTATISTICS

Application of statistical methods in biological problems.

Credit : 3 units (3 hrs lec/wk)

ZOO 211 ADVANCED ANIMAL SYSTEMATICS

Principles and methods of classification and nomenclature in animals.

Credit : 3 units

Prerequisite(s) : Bio 105 (Systematics)

ZOO 220 ORNITHOLOGY

Taxonomy and distribution of birds

Credit : 3 units

Prerequisite(s) : Biology 157 (Comp. Ana. & Phylogeny of Vertebrates)
and Biology 107 (Gen. Ecology) or their equivalents

ZOO 227 ZOOGEOGRAPHY

Ecology and distribution of animal populations on earth.

Credit : 3 units

Prerequisite(s) : Bio 107 (General Ecology); Bio 105 (Systematics)
recommended or their equivalents.

ZOO 243 COMPARATIVE ENDOCRINOLOGY OF VERTEBRATES

Hormonal and parahormonal mechanisms with emphasis on the comparative endocrinology of vertebrates

Credit : 3 units

Prerequisite(s) : Biology 109 (General Physiology) or its equivalent

ZOO 244 PHYSIOLOGY OF REPRODUCTION

Reproductive processes and relation of hormones

Credit : 3 units

Prerequisite(s) : Biology 109 (General Physiology) or its equivalent

ZOO 247 PHYSIOLOGY OF INSECTS

Functions of the different structures of various insect groups

Credit : 3 units

Prerequisite(s) : Biology 109 (General Physiology) or its equivalent

ZOO 263 EXPERIMENTAL EMBRYOLOGY

Experimental studies of differentiation and organization in embryonic systems

Credit : 3 units

Prerequisite(s) : Biology 120 (Developmental Biology) or its equivalent

ZOO 271 COMPARATIVE HISTOLOGY OF VERTEBRATES

Structure and function of tissues of vertebrates

Credit : 3 units

Prerequisite(s) : Biology 102 (Fundamentals of Animal Biology) or its equivalent