



DEPARTMENT OF BIOLOGY, COLLEGE OF SCIENCE
UNIVERSITY OF THE PHILIPPINES BAGUIO

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CRE 220: Environmental Microbiology

COURSE SYLLABUS

2ND SEMESTER | AY 2023-2024

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APPROVED ACADEMIC CALENDAR

UNIVERSITY OF THE PHILIPPINES BAGUIO PROPOSED ACADEMIC CALENDAR ACADEMIC YEAR 2023-2024



As of 05 May 2023	FIRST SEMESTER (Aug 2023 – Jan 2024)	SECOND SEMESTER (Jan – June 2024)	MIDYEAR (June – July 2024)
Deadline for filing application for transfer, appeal for readmission and extension for MRR	10 Jul, Mon	11 Dec, Mon	
ADVANCE REGISTRATION FOR FIRST YEAR STUDENTS	25 Jul, Tue – 27 Jul, Thu		
Removal examination period	07 Aug, Mon – 18 Aug, Fri	15 Jan, Mon – 26 Jan, Fri	07 Jun, Fri – 19 Jun, Wed
Validation for advanced credits	04 Aug, Fri – 05 Sep, Tue	12 Jan, Fri – 09 Feb, Fri	29 May, Wed – 27 Jun, Thu
GENERAL REGISTRATION			20 Jun, Thu
Graduating students (4 th , 5 th , 6 th , 7 th Year etc.)	22 Aug, Tue	29 Jan, Mon	
Third Year & graduate students	23 Aug, Wed	30 Jan, Tue	
Second Year & graduate students	24 Aug, Thu	31 Jan, Wed	
First Year & graduate students	24 Aug, Thu	01 Feb, Thu	
All others & Last day of registration	25 Aug, Fri	02 Feb, Fri	
START OF CLASSES	29 Aug, Tue	05 Feb, Mon	21 Jun, Fri
WELCOME ASSEMBLY FOR FIRST YEAR STUDENTS	29 Aug, Tue		
Deadline for Change of Matriculation (CoM)	06 Sep, Wed	13 Feb, Tue	23 Jun, Mon
Deadline for filing application for graduation	18 Sep, Mon	27 Feb, Tue	24 Jun, Mon
Deadline for Colleges to submit to OUR tentative list of candidates for graduation	25 Sep, Mon	05 Mar, Tue	26 Jun, Wed
UP College Admission Test (UPCAT)	c/o OADS		
Reading/Wellness Break	12 Oct, Thu – 18 Oct, Wed	01 Apr, Mon – 06 Apr, Sat	
MID-SEMESTER	26 Oct, Thu	06 Apr, Sat	05 Jul, Fri
DEADLINE FOR DROPPING SUBJECTS	28 Nov, Tue	08 May, Wed	12 Jul, Fri
UP Baguio Foundation Day	02 Dec, Sat		
DEADLINE FOR FILING LEAVE OF ABSENCE	06 Dec, Wed	17 May, Fri	16 Jul, Tue (for enrolled students only)
END OF CLASSES	20 Dec, Wed	01 Jun, Sat	25 Jul, Thu
Integration Period	21 Dec, Thu – 22 Dec, Fri	03 Jun, Mon	26 Jul, Fri
FINAL EXAMINATIONS	03 Jan, Wed – 10 Jan, Wed		29 Jul, Mon – 30 Jul, Tue
Graduating students		04 Jun, Tue – 06 Jun, Thu	
Other students		04 Jun, Tue – 11 Jun, Tue	
Curriculum Committee Meeting	15 Jan, Mon	27 May, Mon	
DEADLINE FOR SUBMITTING GRADES	17 Jan, Wed		02 Aug, Fri
Graduating students		14 Jun, Fri	
Other students		18 Jun, Tue	
UP Foundation Day		18 Jun, Tue	
Last day for graduating students to clear deficiencies incurred in previous semesters*	19 Feb, Mon	19 Jun, Wed	09 Sep, Mon
College Faculty Meeting to approve candidates for graduation	19 Feb, Mon	19 Jun, Wed	09 Sep, Mon
Deadline for Colleges to submit APPROVED list of candidates for graduation	21 Feb, Wed	24 Jun, Mon	11 Sep, Wed
UNIVERSITY COUNCIL MEETING	23 Feb, Fri	27 Jun, Thu	16 Sep, Mon
BOR MEETING TO APPROVE GRADUATION	Per BOR schedule	Per BOR schedule	Per BOR schedule
COMMENCEMENT EXERCISES		24 Jul, Wed	

*Graduating students must submit the requirements for academic deficiencies (INCs/4.0s) incurred in the previous semesters to Colleges at least seven (7) days before the last day to clear deficiencies.

HOLIDAYS IN ACADEMIC YEAR 2023-2024			
2023		2024	
Ninoy Aquino day	21 Aug, Mon	New Year's Day	01 Jan, Mon
National Heroes Day	28 Aug, Mon	Lunar New Year	10 Feb, Sat
Baguio Day	01 Sep, Fri	EDSA People Power Revolution Anniversary	25 Feb, Sun
Commemoration of the 1986 Sipat Peace Talks	13 Sep, Wed	Maundy Thursday	28 Mar, Thu
All Saints Day	01 Nov, Wed	Good Friday	29 Mar, Fri
All Souls Day	02 Nov, Thu	Black Saturday	30 Mar, Sat
Bonifacio Day	27 Nov, Mon	Araw ng Kagitingan	09 Apr, Tue
Feast of the Immaculate Conception of Mary	08 Dec, Fri	Labor Day	01 May, Wed
Christmas Day	25 Dec, Mon	Independence Day	12 Jun, Wed
Rizal Day	30 Dec, Sat	Cordillera Day	15 Jul, Mon
Last day of the Year	31 Dec, Sun		
Eid 'l Fitr**			
Eid 'l Adha**			

**The proclamations will be issued after the approximate dates of the Islamic holidays have been determined in accordance with the Islamic calendar (Hira) or the lunar calendar, or upon Islamic astronomical calculations, whichever is possible or convenient.

ABOUT UP BAGUIO

The University of the Philippines (UP) was founded in 1908 with its first campus in Manila. Its foundation was then followed soon after by the establishment of constituent units (CUs) and campuses that are strategically located all over the country. In over a century, UP has established eight constituent Universities from its 17 campuses.

The University of the Philippines Baguio (UP Baguio) began as the University of the Philippines College of Baguio (UPCB) (among the growing number of UP campuses in the Philippines), UPCB was established through the initiative of UPCB Alumni in Baguio, Benguet in 1961. UP Baguio became the 7th constituent university of the UP system in 2002 with a goal to be a hub of knowledge generation and human resource training and development in Northern Luzon.

UP Baguio takes pride in its contribution in nurturing and developing innovative programs in the arts and sciences as it continues to develop the niche it has created over the past decades - Cordillera studies.

Vision

The University of the Philippines envisions itself as a leading regional and global university in an environment that sustains 21st century learning, knowledge creation, and public service for society and humanity. As a constituent of the University of the Philippines System, UP Baguio will sustain its lead position in the delivery of tertiary education in the North.

UP Baguio will continue to nurture and develop innovative programs in the arts and sciences. It will also continue to develop the niche it has created over the past decade in Cordillera Studies.

Mission

Our mission, therefore, as a unit of the UP system and as the leading institution of higher learning in Northern Luzon, is to spearhead the offering of the highest standard of education and to contribute to the overall upgrading of the quality of instruction in the region.

We seek to create an impact by informing our students with a regional perspective, while they are informed with a national and global outlook.

Objectives

Based on the vision, the mandate, and the mission of the university in knowledge creation and public service, four goals were derived:

1. To contribute to national development by building expertise in different fields through the developing and strengthening of academic programs and research policies;
2. To optimize the use of resources through adequate budgetary and policy support, alumni support, and innovation of resource generation;
3. To promote equity amidst diversity in the efforts to achieving excellence and internationalization; and
4. To strengthen and enhance human resource management and promotion systems for the improvement of the welfare of constituents.

ABOUT THE COLLEGE OF SCIENCE

Subsequent to the reorganization of UP Baguio after its institution as the 7th constituent university of the UP system in 2002, the College of Science (CS), being one of the three colleges emerging from the reorganization, evolved from the merger of the Division of Natural Sciences and Mathematics and the Sports, Physical Education and Recreation Division.

The College offers four undergraduate programs, such as the BS Mathematics, BS Biology, BS Computer Science, BS Physics, and three graduate degree programs, namely, Master of Science in Conservation and Restoration Ecology (MS CaRE), Master of Science in Mathematics, and Doctor of Philosophy in Mathematics. All of these programs are regularly reviewed and upgraded to prepare students for careers in education, research, and/or postgraduate studies.

Vision

The College of Science aims to continue offering high standard and relevant quality education through good practices in program implementation that follows innovative pedagogical strategies that utilizes appropriate technology in supporting this endeavor.

It will further its objectives by initiating interdisciplinary programs anchored on disciplinary specializations in its efforts to enhance efficiency of research conduct and management.

It will continue to encourage and reward scientific productivity by conducting researches responsive to the needs of the region, nation and the global community.

The college envisions itself moving towards a more inclusive and equitable environment that enables faculty members to lead on with exemplary qualifications – mindful of scholarly research and dedicated to public service.

Furthermore, it will support UP Baguio's wellness program for both academic and support staff to guarantee efficiency in service to the university and the society.

Lastly, the college, together with the university, will take initiative to continue, strengthen and widen the reach of its involvement in public service by sharing individual and collective expertise with other academic institutions, local government units, Non-Government Organizations (NGOs), peoples' organizations and indigenous communities in the region and other areas.

Mission

In line with the vision of the College, it is our mission, therefore, to produce scientific leaders and civic-minded citizens with high regard for integrity, compassion, and genuine service who lead in research study that follows ethical standards and excellence in instruction, research and public service.

It is our mission to improve on basic facilities and design where researchers can work more collaboratively and efficiently.

We pursue to guarantee the safety of researchers, to minimize adverse impact to the environment, to respect research protocols involving indigenous communities, and to ensure professional conduct as we encourage good instruction, research and public service in upholding the University's banner of honor and excellence.

Objectives

In accordance to the mission and vision of the University, the college aims to accomplish the following objectives:

1. To continue in formulating new degree programs while sustaining the old ones;
2. To encourage interdisciplinary researches across programs;
3. To institutionalize the Science Research Center (SRC) in continuing research responsive to the need of the region, and in the enhancement of interdisciplinary collaboration within the departments of the College and even with other faculty members in other Colleges of the UP Baguio;
4. To have a closer linkage with the UP Baguio Cordillera Studies Center (UP Baguio- CSC) as the University's research center and as an aide in putting up the Biodiversity and Innovation Research center;
5. To foster an environment suitable for the growth of the academic and support staff; and,
6. To provide public service based on each academic and support staff's specialization.

ABOUT THE DEPARTMENT OF BIOLOGY

The Department of Biology emerged from being a Discipline under the then Division of Natural Sciences and Mathematics in 2002. Currently, it offers a Bachelor's degree in Biology, and a Master's degree in Conservation and Restoration Ecology (MS CaRE).

The BS Biology is a four-year program with a thesis requirement. It provides thorough grounding in the biological sciences by:

- Instilling among the students important biological principles, theories, concepts and methods;
- Keeping them abreast with the latest developments in Biology and Allied Sciences
- Honing their research skills in the field and in the laboratory; and
- Inculcating in them a scientific and ethical culture of science.

The BS Biology program offers three Areas of Concentration: General Biology, Ecology & Systematics, and Microbiology.

Vision

Aligned with the goals of the College of Science and the University of the Philippines Baguio, the vision of the Department of Biology is to be a leader in academic excellence, research, and community involvement in Northern Luzon. We envision to be an active contributor to the university's commitment to deliver high-quality education by maintaining responsive curricula and instituting relevant academic programs integrating perspectives rooted in specific disciplines in biology. The department aspires for a more inclusive and equitable academic environment empowering teaching staff, personnel, and students to better engage in scholarly work, interdisciplinary research, and public service.

Mission

The Department of Biology commits to develop, adopt, and employ best practices in innovative pedagogies and technologies in scientific inquiry. We strive to generate knowledge through interdisciplinary research rooted in biology disciplines. We pursue a vibrant academic environment that produces researchers, professionals, and scientific leaders competent and equipped to responsibly and ethically address and manage environmental and health challenges. We extend our service to the public by sharing individual and collective expertise with various educational institutions, local government units, non-governmental organizations, peoples' organizations, and indigenous communities in the Cordillera Administrative Region and the rest of Northern Luzon.

COURSE DESCRIPTION AND REQUIREMENTS

About the Instructor

	Faculty member in charge	Contact details
	Name, PhD <i>PhD in Biotechnology</i> Associate Professor of Biology College of Science University of the Philippines Baguio	Email address: @up.edu.ph

Course Details

Course Number:	CRE 220
Course Title:	Environmental Microbiology
Course Description:	Students will be introduced to the basic principles of Environmental Microbiology through classroom lectures and laboratory instructions. This course will deal with the study of the composition and physiology of microbial communities in the environment. Lectures will include advanced topics in microbial ecology and how this relates to geochemical processes in natural and managed environments. The course will also cover advanced methods used in the study of microorganisms found in soil, water, air and sediments.
Prerequisite:	Any course on General Microbiology or Biology 120
Semester/s Offered:	
Course Credit:	3 units
Number of Hours:	5 hours (2 hrs. Lec; 3 hours lab)
Course Requirements	
Lecture: 60%	
	Two written exams, 15% each 30%
	Written Journal Report 15%
	Oral Presentation of Journal Report 20%
	Oral Reports on Selected Topics/ Special Problem 15%
	Final Examination 20%
Laboratory: 40%	
	Written Report on Group or Individual Special Problem 50%
	Oral Report on Group/Individual Special Problem 50%

Program Learning Outcomes (PLOs)

The Program Learning Outcomes (PLO) of the MS CaRE Program are as follows:

PLO 1	To demonstrate genuine concern and passion for environmental issues that have impacts on species, ecosystems, and people
PLO 2	To practice professional and ethical integrity in diverse social and academic settings
PLO 3	To generate knowledge through independent transdisciplinary research
PLO 4	To communicate scientific outputs to key stakeholders and the general public
PLO 5	To assess ecological patterns and processes through rigorous and ethical scientific inquiry that supports evidence-based predictions for conservation and restoration decisions

PLO 6	To design a framework that can influence research and policies on the conservation and restoration of species, habitats, and ecosystems
PLO 7	To utilize immersive ground-truthing as a mechanism to ensure conservation and restoration interventions are both scientifically robust and socioculturally situated
PLO 8	To establish linkages with local communities, academia, non-government organizations, and government agencies in support of conservation and ecological restoration.
PLO 9	To integrate multidisciplinary approaches, local and indigenous knowledge systems, and community partnerships to consistently champion conservation and restoration across diverse ecosystems.
PLO 10	To adhere and commit to a life-long application of evolving ecological knowledge and collaborative practices to advance conservation and restoration efforts
PLO 11	To embody competence in ecological stewardship and sustainable resource management

Course Learning Outcomes (CLOs)

At the end of this course, the student should be able to:

CLO 1	Appreciate the role of microorganisms in geochemically and environmentally significant processes occurring in different types of environment.
CLO 2	Describe microbial communities and discuss important topics like microbial evolution or succession, and current topics on Microorganisms and One Health (e.g. bioremediation, the presence of bacterial antibiotic- and trace metal- resistant genes in livestock, aquaculture and agricultural products and other related topics);
CLO 3	Analyze scientific papers published in reputable journals in Microbiology and present a written and oral report from an original article or a synthesis paper related to CLO 2;
CLO 4	Design a research study with applications of traditional and basic molecular techniques in isolation, purification, cultivation, identification and phylogenetic analysis of pertinent microorganisms, or a concept for an App on any topic related to CLO2 or any topic on Microbial Ecology
CLO 5	Present an oral and written report of the results of a Special Problem to stakeholders

Mapping of CLOs with PLOs

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11
CLO 1	F		I				I		I	I	
CLO 2	F		F	M						M	
CLO 3		F	F								
CLO 4		M	F		F	F	F		I	M	F
CLO 5		F		F				I			

LEGEND: *I*-Introduced; *M*-Moderately achieved; *F*-Fully achieved

Class Rules

1. The University rule on class attendance (**Article 346** of the University Code) shall be strictly enforced in the class.
2. If a student misses a short quiz, their grade in that quiz is zero. If a student misses a long exam for a valid reason (with proper documentation), they may take a makeup exam within

one week after the date of the exam. A student who fails to take any exam for invalid reasons will get a grade of 0% for that exam.

3. Cheating, in any form, will warrant you a grade of 5.0 on this course or expulsion from the University.

Grading Scheme

Grade	Equivalent	UP Classification	Grade	Equivalent	UP Classification
96 – 100	1.00	Excellent	65 – 69	2.75	Satisfactory
93 – 95	1.25	Excellent	60 – 64	3.00	Passing
89 – 92	1.50	Very Good	55 – 59	4.00	Conditional
85 – 88	1.75	Very Good	Below 55	5.00	Fail
80 – 84	2.00	Good	DRP		Dropped
75 – 79	2.25	Good	INC		Incomplete
70 – 74	2.50	Satisfactory			

Course Outline

TIMELINE	CLO	Topic	Teaching and Learning Activities	Assessment Tool
Weeks 1 - 3	1, 2, 4	I. Scope of Environmental Microbiology a. Microbial Evolution or Succession b. Plant-Microbe Interaction c. Animal-Microbe Interaction <i>This chapter will provide an overview of the course and will introduce the different types of microorganisms that will be taken up in the course. It will also provide a general description of the major structural features and functions of these microbes that are related to the field of environmental microbiology. Discussion on microbial evolution and microbial interactions as well as interactions of microbes with other organisms will be highlighted in this chapter.</i>	Lecture and Class Discussion	Soil and water sampling
Weeks 4 - 6	1, 2 4	II. Microorganisms in Their Natural Environments a. Lithoecosphere b. Hydroecosphere c. Atmosphere d. Extreme Environments e. Biofilms	Lecture and Class Discussion Journal Reporting	Cultivation of soil/ water bacteria Plating/ enumeration of bacteria Group report

		<i>This chapter will focus on the physico-chemical characteristics of the different environments found on the earth in relation to their potential as a microbial environment; the number of microbes, diversity and activities in each medium and their impact to human life will also be discussed.</i>		
Weeks 7 - 10	3, 4	III. Advanced Methods used in the Study of Microorganisms in the Environment a. Molecular Methods i. DNA/RNA extraction ii. Polymerase Chain Reaction, Reverse-Transcription PCR and Real-Time(RT) PCR iii. Gel Electrophoresis iv. Gene Sequencing for: Molecular Identification and phylogenetic analysis v. Basic Recombinant DNA Technology-Plasmid Analysis/ molecular cloning (e.g. generating GM crops) vi. Reporter Genes b. Basic Metagenomics <i>This chapter will explain the principles behind the laboratory techniques that are currently being used in the study of environmental microbiology.</i>	Lecture and Class Discussion	Purification and culture of bacterial isolates Plasmid/ Genomic DNA extraction Exercises on use of BLAST & MEGA Software for Microbial Identification and Phylogenetic Analysis
Weeks 11 - 13	1, 2, 3	IV. Review of Microbial Activities of Ecological Importance a. Effects of disturbances on microbes involved in Biogeochemical Cycles i. Carbon Cycle ii. Nitrogen Cycle iii. Sulfur Cycle iv. Iron Cycle b. Microorganisms and Climate Change c. Bioremediation <i>This chapter will focus on the cycling of biotic and abiotic forms of the important chemical elements on earth to attain balance and stability. Understanding of these biogeochemical cycles will help environmental microbiologists to</i>	Lecture and Class Discussion	Peer discussion

		<i>predict the development of microbial communities and activities in different environments.</i>		
Weeks 14 - 16	1, 2, 3, 5	V. Urban and Rural Microbiology a. Zoonosis b. Domestic and Indoor Microbiology c. Bioaerosols in Selected Urban Spaces d. Bacterial Antibiotic Resistant Genes (ARGs) in crops and aquacultured products e. Bioterrorism f. Risk Assessment <i>This chapter will deal with how pathogenic microbes are spread, often causing diseases in indoor and domestic environments, how pathogens are potential biological warfare agents. It will also deal with risk assessment, in terms of infection, illness or mortality from microbial pathogens.</i>	Lecture and Class Discussion	Special Problem presentation

Laboratory Exercises

Week	Laboratory Exercises
1	Orientation/ Library Work/ Discussion of Group/ Individual Special Projects
2	Submission of Outline of Group/ Individual Proposals (Special Problems) Review of Basic Laboratory Aseptic Techniques-Preparation/ Sterilization of Materials for Soil or Aquatic Sediment or Water Sampling
3	Soil and water Sampling, and Preparation of materials and nutrient media
4	Determination of Soil moisture, pH, and organic content Water Quality Analyses: Coliform, MPN, Membrane Filtration Technique
5	Cultivation of soil or water bacteria/ Serial Dilution Technique (First enrichment)
6	Streak Plate Practice; Second Enrichment (Second Enrichment)
7	Plating/ Enumeration of Microorganisms
8	Purification of Microbial Isolates and Microscopic/ Phenotypic Characterization
9	Propagation of Isolates
10	Genomic and/or Plasmid DNA Preparation
11	Gel Electrophoresis, PCR
12	Preparation and Submission of samples for DNA Sequencing

13	Exercises on use of BLAST & MEGA Software for Microbial Identification and Phylogenetic Analysis
16	Group/ Individual Reports

Suggested Journals in Microbiology for Journal Reports:

Science
Nature Microbiology
Applied and Environmental Microbiology
Journal of Bacteriology
FEMS Letters
Science and Engineering Journal (Microbiology Edition)

References/ Reading List

(To be updated on a yearly basis)

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