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**Department of Biology**

**College of Science**

**University of Salahaddin**

**Subject:** Ecology & Pollution

**Course Book:** 3rd Stage/ Undergraduate Biology Students

**Lecturer's name:**

Dr. Dilshad G.A. Ganjo, (Ph.D.) (Theoretical)

Ms. Fattma Zrar Mohammad (M.Sc.) (Practical)

**Academic Year: 2018/2019**

**Course Book**

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| **1. Course names** | Ecology & Pollution |
| **2. Lecturer in charge** | Dr. Dilshad G.A. Ganjo (Ph.D.) (Theoretical)Ms Fattma Z. Mohammad (M.Sc.) (Practical) |
| **3. Department/ College** | Biology/Science |
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| **5. Time (in hours) per week**  | Theory 2hr./week **Practical : 18 hr./week + 4 hrs Project Research for Undergraduate students (2 students**) |
| **6. Office hours** | TBA on the office door  |
| **7. Semester code** |  |
| **8. Teacher's academic Profile**  | **Dr. Dilshad G.A. Ganjo (Theoretical)*** B.Sc. (Biology), Univ. of Baghdad (1976).
* M.Sc. (Microbial Physiology), Univ. of Salahaddin (1990).
* Ph.D. (Freshwater Ecology). Univ. of Salahaddin (1996).
* From up to now is the lecturer of Ecology and Pollution, College of Science, Biol. Dept. / Univ. of Salahaddin
* **SUPERVISION OF POSTGRADUATE STUDENTS**
* Previous Supervisions: 22 M.Sc. students and 8 Ph.D. students in different fields of the environment.
* Current Supervisions: 2 Ph.D. students.

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|  | **Ms. Fattma Z. Mohammad (M.Sc.) (Practical)** * B.Sc. (Biology), Univ. of Salahaddin (1990-1994).
* M.Sc. (Environmental Science), Univ. of Salahaddin (2015).
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| **9. Keywords** | Ecology, Pollution, Environmental Consequences |
| **10. Semesters overview:** The global condition of the environment is disastrous and in need of every citizen’s involvement to restore and protect it. The wellbeing of glob and its people is linked to the future of its environmental condition. Entering a new era (agenda 21) it is of most importance to pursue a path of sustainable development focusing on meeting the need of the present generation without compromising the ability of future generations to meet their needs. Environmental situations can only be successfully addressed by innovative government and grassroots initiatives at the national and community levels to prevent future degradation. The administration (i.e. University) must thus adopt a national environmental management policy. Ecology is one of the basic science semesters that comprise the Biology curriculum of the four years of Science College. The overall goal of these semesters is to provide with the knowledge and understanding of the scientific principles that are the basis of current approaches to know the general basis of the environment and subsequently its pollution (Environmental Awareness and Protection). |
| **11. Semester objective:**In the light of the increasing importance of environmental issues to Kurdistan and the global society, the administration must stand behind the overarching principle of sustainable development and guarantee its citizens a fundamental human right to:1. an environment that is not harmful to their health and wellbeing and
2. Have the environment protected, for the benefit of present and future generations.

The administration must launch a new approach, changing from reactive and sectored, towards a more strategic and integrative one beginning by lifting institutional barriers, some of them:* Lack of opportunity for public participation in environmental reviews.
* Lack of systematic and qualified monitoring.
* Weak or poorly utilized information systems and lack of planning.
* Inappropriate environmental standards or procedures.
* Weak environmental enforcement.
* Insufficient access to information, particularly relating to trade and environment aspects.
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| **12. Student's obligation****Exam policy:** There will be at least four obligate exams throughout the year (two exams in each semester), each exam will contain; thinking critical questions, short/long answer questions, illustration by diagrams ….. etc.**Practical exams:** * ***Compositional:*** In this type of exam the questions usually starts with Explain how, What are the reasons for…?, Why…?, How….?
* With their typical answers

 (Examples should be provided)* ***2.******True or false type of exams:***
* In this type of exam a short sentence about a specific subject will be provided, and then students will comment on the trueness or falseness of this particular sentence. (Examples should be provided)
* ***3. Multiple choices:***
* In this type of exam there will be a number of phrases next or below a statement, students will match the correct phrase. (Examples should be provided).
* **4. Fill the Blanks**:

In this type of exam, student will complete the sentences by filling the blanks with the missing words to complete the sentence Examples should be provided).**Classroom polices:**1. Attendance: Students are strongly encouraged to attend class on a regular basis.
2. Lateness: Lateness to class is disruptive
3. Electronic devices: All cell phones are to be turned off at the beginning of class and put away during the entire class.
4. Talking: During class please refrain from side conversations. These can be disruptive to your fellow students and your professor
5. No disrespectful to both the professor and to your fellow students.
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| **13. Forms of teaching**Different forms of teaching will be used to reach the objectives of the two semesters: power point presentations for the head titles and definitions and summary of conclusions, classification of plants and any other illustrations, besides worksheet will be designed to let the chance for practicing on several aspects of the semester in the classroom, furthermore students will be asked to prepare research papers on selective topics and summarize articles contents published in English into either Kurdish or Arabic language, those articles need to be from printed media or internet articles. There will be classroom discussions and the lecture will give enough background to translate, solve, analyze, and evaluate problems sets, and different issues discussed throughout the semester.To get the best of the semester, it is of outmost important to attend classes as much as possible (e.g. revision of the required lectures, teacher’s notes regularly as all of them are foundations for the semester. Lecture’s notes are for supporting and not for submitting the reading material including the handouts. Always we will try as much as possible to participate in classroom discussions, preparing the assignments given in both semesters. |
| **14. Assessment scheme**

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| --- | --- | --- |
| Component | Date | Percent |
| **Ecology** |
| Exam 1 | 00/00/2021 | 35% |
| Exam 2 | 00/00/2021 | 15% |
| **Pollution** |  |  |
| Exam 3 | 00/00/2022 | 35% |
| Exam 4 | 00/00/2022 | 15% |
| Total |  | 100% |

**Note:**Mean for the four examinations: 35% Practical Examination 15% Final examination: 60% |
| **15. Student learning outcome:**To improve environmental management several academically constraints are related to the process, which they are:* + Identifying the local environmental problems.
	+ Defining strategies.
	+ Implementing and monitoring policies.

This suggesting the need for capacity building for managing the environmental management process, alongside the need to build and strengthen academic structures. |
| **16. Semester Reading List and References‌:*** Any Reference Text Books on Ecology & Pollution published in 20 & 21st century.
* Students are encouraged to search for any other materials that may help improve their English language ability in reading, writing, listening and speaking Ecology & Pollution texts.
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| **17. The Topics:****First Semester Ecology, Fundamentals and Principles (Theoretical)**

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| --- | --- | --- |
| **Weeks** | **Topics Covered in Lectures** | **Hours** |
| **1** | * Introduction
* Ecology Defined
* Historical Review
* Scope and Range of Ecology
* Divisions of Ecology
* Subdivisions of Ecology
 | **2** |
| **2** | * The Earth's Climates
* Distribution of Life Forms on the Earth's Planet
* Horizontal Distribution
* Vertical Distribution
* Seasonal Distribution
 | **2** |
| **3** | * Ecosystems and Communities
* The Structure of Ecosystems
* Biotic Components
* Primary Producers
* Consumers
* Decomposers
 | **2** |
| **4** | * Abiotic Components
	+ Abiotic Resources
	+ Abiotic Conditions
 | **2** |
| **5** | * Tolerance Range
* Limiting Factors
* Combined law of Tolerance
* Ecological Niches
 | **2** |
| **6** | * Biomes
* Patterns of Life on Land
* Forests
* Grasslands
* Croplands
* Green House
* Desert and others
 | **2** |
| **FIRST EXAMINATION** |
| **8** | * Aquatic Ecosystems
* Surface Water
	+ Running Water
	+ Standing Water
* Underground Water
 | **2** |
| **9** | * Energy Flow Through Ecosystems
* Trophic Levels
* Food Chains and Food Webs
 | **2** |
| **10** | * Ecological Pyramids
	+ Pyramids of number
	+ Pyramids of Energy
	+ Pyramids of Biomass
 | **2** |
| **11** | * + - Biogeochemical Cycles (Recycling of Nutrients in Ecosystems)
		- Types of Biogeochemical Cycles
	+ Nutrient Cycles
	+ Hydrological Cycles
* Perfect Cycles
* Imperfect Cycles
 | **2** |
| **12** | * Succession
* Ecosystem Change and Stability
 | **2** |
| **13** | * + - Climatic and Non Climatic Factors
 | **2** |
| **14** | * + - Life Interactions
	+ Interactions that Harm Both Organisms
	+ Competition
	+ Interactions that Harm One Organism and Benefit the Other
	+ Predation
 | **2** |
| **15** | * + Interactions that Benefit One Organism and Have No Effect on the Other
	+ Commensalisms
	+ Interactions that Benefit Both Organisms
	+ Protocooperation
	+ Mutualism
 | **2** |
| **SECOND EXAMINATION** |

**Second Semester Pollution, Types and its Environmental Consequences (Theoretical)**

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| --- | --- | --- |
| **Weeks** | **Topics Covered in Lectures** | **Hours** |
| **1** | * Introduction
* Historical Review
* Types of Pollutants
* Sources of Pollution
 | **2** |
| **2** | * Types of Pollution
* Water Pollution
* Contamination of Drinking Water
* Dams and their impact on the environment
 | **2** |
| **3** | * Air Pollution
* Climate Change/Global Warming
* Carbon footprint
 | **2** |
| **4** | * Wildlife Conservation and Species Extinction
* Loss of Tropical Rainforests
 | **2** |
| **5** | * Ecosystem destruction
* Energy conservation
* Food safety
 | **2** |
| **6** | * Genetic engineering
* Intensive farming
* Land degradation
* Land use
* Deforestation
* Mining
 | **2** |
| **FIRST EXAMINATION** |
| **8** | * Natural disasters
* Nuclear issues
 | **2** |
| **9** | * Other pollution issues
* Overpopulation
* Resource depletion
 | **2** |
| **10** | * Soil contamination
* Sustainable communities
 | **2** |
| **11** | * Toxins
 | **2** |
| **12** | * Waste
* Types
* Solutions
 | **2** |
| **13** | * + - Other Types of Pollution
* Noise Pollution
* Visual Pollution
 | **2** |
| **14** | * Ideal Pollution
 | **2** |
| **15** | * Pollution by medicines
* Pollution by canned foods
* Pollution by Radiation
* Others
 | **2** |
| **SECOND EXAMINATION** |

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| **18. Practical Topics**  | **Hours** |
| **First Semester Ecology (Practical)**Lab. 1: Introduction to practical Ecology, course outline Lab. 2: Some important terms in practical ecology (Ecological terminology)Lab. 3: Metrology (Parameters and Instruments) Lab. 4: Sampling (Terrestrial ecology: - Determination of minimum size and number of quadrate?) Lab. 5: Terrestrial ecology: - Determination of density, frequency and abundance of species present in a community by the quadrate methodLab. 6: Sensory examination Lab. 7: First semester- 1st examinationLab. 8: Soil environment Lab. 9: Ecosystem structure and Function Lab. 10: Ecological PyramidLab. 11: Ecosystem AnalysisLab. 12: First semester- 2nd examinationLab. 13: Ecological SuccessionLab. 14: Community SimilarityLab. 15: Determination of HardnessLab. 16: Determination of pH and EC**Second Semester Pollution (Practical)**Lab. 1: Introduction to practical Pollution, course outline Lab. 2: Biochemical Oxygen demand (BOD)Lab. 3: Chemical Oxygen demand (COD)Lab. 4: Phosphate in detergents Lab. 5: Sulfur compounds in waterLab. 6: Air PollutionLab. 7: Second semester- 1st examinationLab. 8: Algae as indicators of organic PollutionLab. 9: Invertebrates are Pollution indicatorsLab. 10: Preparation of soil sample by digestion methodLab. 11: Noise PollutionLab. 12: Soil contaminationLab. 13: Water Pollution and the sources of Pollution of aquatic bodiesLab. 14: Bio-indicators used for bio-remediation of contaminated water with sewage  | 333333333333333333333333333333 |
| **19. Examinations:****General Notes*** Every sitting exam assigned for the students, question papers corrected, marks rewarded, next lecture discus and solve the exam questions and place a copy of answers into their notes after giving several ways of answering. The corrected papers are given to the students for reviewing their errors. Exam answer papers are to be saved for future references.
* The exam paper covers most of the lectures and indicated:

Exam instructions, selective answers, definitions, mechanisms, explanations, Drawings, write an assay, diagrams, differences…etc. * The exam questions usually are clear, direct and obvious, while some others are critical thinking questions.

**Examples of Questions****Q1-** If an organism introduced into a new ecosystem, two probabilities are expected:1. It may die,
2. It may live (i.e. thrive and bloom). Discuss why?

**Q2-**Give a brief (causes and environmental consequences) on:Acid Rain; Ozone Depletion; Thermal Pollution; Eutrophication, Methemoglobinemia, etc.**Q3-**Concerning your report on “environmental pollution in Kurdistan". What are your main conclusions and what you recommend for eliminating and/or mitigate such cases of pollution in the future? **Q4-**Represent by ecological pyramids the following feeding relationships:1. Pyramid of Biomass (mg.m-3) in a pond;* 100 phytoplankton
* 12 zooplankton
* 6 fish

2. Pyramid of Energy (Kcal.m-2) in a grassland;* 10,000 Grasses
* 10 Mice
* 2 Snakes
* 1 Hawk

3. Pyramid of Number in a tree* 1 tree
* 150,000 Herbivorous insects
* 120,000 Carnivorous insects
* 2 Birds
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**An Example of Practical Ecology and Pollution Exam:**

**Q1/ Choose the correct answers for the following from the below listed words: (40 Marks)**

**relative humidity , 1/9, direct effects, Fertilizer, Positive tropism, bioaerosol, Random, Potassium, qualitative, ocular micrometer , Stratosphere, Ecological pyramids , stage micrometer , Highly reactive, visibility, systematic, Calibrator, quantitative, Humidity, 1/10, Adaptation, predators, humus, starch, , Aero plankton, pioneer species, KI, Mesosphere, heterotrophs, weather, turbidity, climate , strong buffering power, inverted, phosphate, aerosol, B, acclimation, barometer, decibel , lattice-like design, A, Secondary ecological succession, tropism, Biomass pyramids , visibility, Organic fertilizers, barograph, indirect effects, upright**

1. Horizon ………………provide plants with nutrients they need for the great life.
2. …………………. are those first species that colonize places where previously they were no living beings.
3. ……………………is an instrument that continuously records changes in atmospheric pressure.
4. …………………..are graphical representations of the number of individuals in different nutritional levels.
5. Secchi disk used to determine the degree of ………………….. in freshwater.
6. …………………...is a layer that protect the earth from meteoroids.
7. Species that kill and eat their prey have no long term interaction with them are called…………………....
8. …………………...is the conditions that occurred very recently or are currently happening.
9. …………….is a natural or synthetic substance or mixture used to enrich soil so as to promote plant growth.
10. ……………..is reversible physical change in a adapting organism in response to environmental pressure.
11. A psychometer is an instrument commonly used in laboratories to measure…………………....
12. The effect of chemical fertilizer on the soil is not immediately obvious, because soil have…………………... due to their component.
13. In the pyramid’s of energy, since there is always a loss of energy at each [trophic level](http://www.biology-online.org/dictionary/Trophic_level) the energy pyramid is always…………………...**.**
14. Microorganisms occur in the air in the form of colloidal system called…………………...**.**
15. The biological phenomenon, indicating growth or turning movement a plant in response to an environmental stimulus is called…………………...
16. The content of …………………... in fertilizers will reduce the protein content of wheat, maize, grams, etc., grown on that soil.
17. The sound intensity is measured in …………………..**,** which is equal to…………………...th of Bell.
18. The analytical characters are those which are directly observed in the field, they are…………………... and …………………...
19. …………………... is an indicator used in the biochemical oxygen demand.
20. Dust particle size is measure by using…………………... and …………………...**.**

**Q2. Put (T) for true statements and put (F) for the false statements: (40 Marks).**

1. The most favorable method measuring of COD is dichromate reflux method.
2. Lotic-ecology is the study of ecology of standing water.
3. For getting 70 percent of degradation of organic matters, the sample need to be incubated for 5 days, which the sample should be incubated for 10 for getting 95 percent oxidation.
4. Noise pollution has only negative effects on human, animals, Living things but not living things.
5. Effects of fertilizer could be noticed via germination of seeds of *Avena fatua*.
6. TSS refers to small solid particles which remain suspended in water and that can be trapped by a filter.
7. The shape of the pyramid of numbers vary from ecosystem to ecosystem.
8. One of the function of atmosphere is the protections from rapid cooling at night and heating at day.
9. In COD, after titration with Na2S2O3 (0.1M), the end point color is yellow.
10. Water vapor is variable but typically makes up about 1-4% of the atmosphere.
11. Phosphate content in fertilizers decreases Vitamin C and carotene content in vegetables and fruits.
12. The O horizon is the layer in which humus and other organic materials are mixed with mineral particles.
13. The number of individuals in the quadrate and their occurrence is called abundance.
14. That portion of the surface of earth, in which living thing exist is called atmosphere.
15. Ecological succession is the observed process of change in the species structure of an ecological community over time.
16. BOD5always be less than COD, because in COD the chemical oxidants oxidize most of the organic pollutants.
17. Solar radiation is estimated by sun shine recorder or cample stock.
18. Condensed water molecules in the air, their diameter are more than 10 µm is called fumes.
19. The taste examination can be done upon certainty that the sample has no infectious bacteria or polluting substance in it.
20. The index of dissimilarity and dissimilarity can be calculated only by “1-S”.

**Q3/ Give an example for the following: (10 Marks)**

1. Hydrocarbon
2. Degradable pollutant
3. Chemical Oxidant
4. Bioaerosol .
5. TSS
6. Non-degradable pollutant
7. TDS
8. Organic Fertilizer
9. Water Pollutant
10. Soil pollutant