Environmental Toxicology

(Course Code: EVS301)

**Fall semester, 2018-2019**

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| Coordinator | **Chogyel Wangmo** |
| Credits | 6 ECTS (Compulsory course), 30 in-class hours |
| Lecturers | **Chogyel Wangmo** (Environment and Climate Studies, The College of Natural Resources, Royal University of Bhutan) |
| Level | BSc |
| Host institution | Environment and Climate Studies, The College of Natural Resources, Royal University of Bhutan |
| Course duration | August 01- October 15, 2018 |

### Summary

*This 6 ECTS course covers the introduction to toxicology, different phases of toxicology, types of toxicants, the fate of toxicants, and risks assessments. The main content of the course focuses on the mobility of toxicants in the ecosystems. Students will do the laboratory practical to determine the toxicants including the dose response mechanisms.*

### Target student audiences

Second year BSc of Environment and Climate Studies students.

### Prerequisites

None

### Aims and objectives

This module provides fundamental knowledge on biological and health effects of environmental pollutants. It explores eco-toxicological issues and classifications related to environmental and human health. It will also equip students with practical experiences in testing environmental pollutants.

### General learning outcomes:

By the end of the course, successful students will:

* Define toxicology and toxicity
* Classify types of environmental toxicants
* Describe transfer of toxicants through living systems
* Calculate the dose response relationships of different xenobiotics
* Compare toxicological impacts of pollutants
* Explain ecological risk assessment of pollutants
* Evaluate the fate of toxic chemicals in the environment
* Identify the toxicity of pollutants in soil and water

### Overview of sessions and teaching methods

The course is delivered comprising of laboratory practical and case study with interactive sessions. The course starts with introduction to toxicants, phases of toxicity, factors affecting toxicology and risk assessment associated to toxicology. The focus will be on students’ participation and their engagement in learning by doing. The major sections of the study will depend on the laboratory practical and case studies used in different contexts.

### Course workload

The table below summarizes course workload distribution:

|  |  |  |  |
| --- | --- | --- | --- |
| **Activities** | **Learning outcomes** | **Assessment** | **Estimated workload (hours)** |
| **In-class activities** | | | |
| Lectures | Understanding theories, concepts, methodology and tools | Class participation | 30 |
| Moderated in-class discussions | Understanding the presence and fate of toxicants in the environment | Class participation | 20 |
| In-class assignments | Understanding different types of toxicants and their effects | Class participation | 10 |
| **Independent work** | | | |
| Lab experiments:   * Contribution to the case-study projects | Ability to detect and analyze data and methods for detections | Quality of group assignments and presentations | 30 |
| Reading and discussion of assigned papers for seminars and preparation for lectures | Familiarity with and ability to critically and creatively discuss key concepts, tools and methods to address the natural and man-made risks and hazards. | Class participation. | 20 |
| End semester examination | Ability to remember, analyze and classify toxicants and explain the factors affecting toxicants. |  | 40 |
| ***Total*** |  |  | ***150*** |

### Grading

The students’ performance will be based on the following:

* Level of preparedness for participation in class discussions and seminars (10 %) (from 100 % for active participation and demonstrated familiarity with the course readings to 0 % for completely ignoring in-class discussions);
* Applicability of proposed strategy for communication, awareness, evacuation, post event recovery and including preparedness to reduce the risks and hazards from the different types of disasters (40 %) (from 100% for clearly demonstrated input to 0 % for non-participation);
* Variety of proposals (40%)
* Quality of communication strategies (20%)

### Course schedule

|  |  |  |  |
| --- | --- | --- | --- |
| **Day** | **Time** | **Topic** | **Lecturer** |
| August Tuesday 07. |  | Definition of toxicology; Toxicity (Acute, sub-chronic and chronic toxicities) | Chogyel Wangmo |
| August Friday 10 |  | Scope and sub-disciplines of toxicology  Brief history of toxicology  Overview of potentially hazardous chemicals  Classification of toxicants; target organ (hepatotoxin, neurotoxin); Physical state (gas, solid); Mechanism of action (anticholinergic, inhibitor, uncoupler). | Chogyel Wangmo |
| August Tuesday 14 |  | Sources and important toxicants: Agriculture; Industries; Households; | Chogyel Wangmo |
| August, Friday, 21. |  | Case studies (Bhopal gas tragedy, 1984; Chernobyl nuclear meltdown, USSR, 1986; Gas well accident, Gaoqiao, China, 2003) | Chogyel Wangmo |
| August 21, Friday |  | General Phases in Toxicology; Exposure phase; Toxicokinetics phase (Distribution; Metabolism; Excretion; Toxicodynamics phase | Chogyel Wangmo |
| August 28, Friday |  | Factors Affecting Toxicity; Physicochemical properties of toxicants; | Chogyel Wangmo |
| Tuesday September 4 |  | Dose or concentration; Mode and duration of exposure; Environmental factors; Interaction; Biological factors; Nutritional factors. | Chogyel Wangmo |
| September, Friday 7 |  | Mobility of Chemicals in the Environment; Bioavailability, | Chogyel Wangmo |
| September, Tuesday, 11 |  | bioaccumulation, biotransformation and excretion; | Chogyel Wangmo |
| September Friday, 14 |  | Dose response relationship; Mode of action; Mixture toxicity; | Chogyel Wangmo |
| September, Tuesday, 18 |  | Development of resistance; Method of environmental diagnosis; Bioassay, biosensor and biomarkers; Impacts of toxicant | Chogyel Wangmo |
| September Friday, 21 |  | Laboratory practical | Chogyel Wangmo |
| September, Tuesday, 25 |  | Submission of laboratory work | Chogyel Wangmo |

### Course assignments

Course assignments will constitute a project:

* Assignment **#1** (mostly in-class) – doing case studies on types and classes of toxicants.
* Assignment **#2** (mostly in-class) – detection methodology of toxicants and understanding their phases in environment.
* Assignment **#3** – Detection of toxicants in laboratory (testing of samples) and submit report for assessment.

To complete the assignments the class will be divided into several groups. **Assignment #1** will help students to understand the types of toxicants for which a written report will be assessed.

**Assignment #2** will link the Assignment #1 where the detection methodology will be assessed in the form of written report.

**Assignment #3** is based on the assignments #2 where students will perform the laboratory tests. The laboratory tests will be assessed based on the performance of practical and submission of laboratory report.

### Literature

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