# NATIONAL UNIVERSITY OF ENGINEERING
# COLLEGE OF ENVIRONMENTAL ENGINEERING
# ENVIRONMENTAL ENGINEERING PROGRAM

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## SA301 – BIOLOGY

### I. GENERAL INFORMATION

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| **CODE** | **:** | SA301 Biology |
| **SEMESTER** | **:** | 1 |
| **CREDITS** | **:** | 4 |
| **HOURS PER WEEK** | **:** | 6 (Theory – Practice) |
| **CONDITION** | **:** | Compulsory |
| **PREREQUISTES** | **:** | None |

### II. COURSE DESCRIPTION

The course prepares students in the concepts and fundamentals of biology that can be applied in other science fields such as Physics, Chemistry, Materials and Ecology. Students understand and analyze the structure, components and activity of cells in living bodies, and the fundamentals of genetic engineering. Students also understand and analyze important developments in biotechnology, new materials and the relationship between biology, environment and ecology.

### III. COURSE OUTCOMES

At the end of the course, students:

1. Understand the fundamentals of biological sciences and their application in technology and environment.
2. Understand basic concepts, principles and methods of biochemistry.
3. Understand basic concepts and method of cell biology, genetics, molecular biology and microbiology.
4. Understand the concepts and principles of ecological sciences and appraise its importance for environment care and improvement.

### IV. COURSE CONTENTS

#### 1. BIOLOGY AND BIOTECHNOLOGY

The importance of biology in technology development / Application of biological sciences for cell handling and understanding of biochemical processes.

#### 2. MOLECULES - CARBOHYDRATE

Important molecules in biology / Carbohydrates, amino acids and proteins / Lipids / Nucleic acids / Applications in biotechnology and medicine.

#### 3. BIOLOGICAL CELLS

Cell structure / Organisms and intracellular communication / Cell engines.

#### 4. ENERGY AND METABOLISM

Energy and metabolism / Enzyme kinetics.

#### 5. MOLECULAR BIOLOGY

Molecular biology / DNA transcription.

**6. MOLECULAR GENETICS**
Molecular genetics / Genes regulation / Boolean genetic circuits / Molecular genetics / Replication and recombination of DNA.

**7. CELL INHERITANCE**
Cell inheritance / Algorithms of DNA sequences aligning / Genetic sickness.

**8. GENETIC ENGINEERING**
Gene cloning / PCR / DNA sequencing / Expression systems in eucarionts and procarionts.

**9. PROTEIN SYNTHESIS AND REGULATION MODELS**
Protein synthesis / Regulation models.

**10. MICROBE POPULATION**
Growing of microbe population / Microbiological treatment of industrial waste.

**11. BIOTECHNOLOGY AND MICRO-ORGANISM CONTROL**
Micro-organism control / Pesticides, PCBs, plastics, cosmetics, resins / Bio-products in bacterium, yeast and animal cells / Application in modern medicine / Biofuel production / Industrial and medicinal use enzymes.

**12. ANIMAL CELLS CULTIVATION**
Kinetics, modeling and scale-up / Industrial applications / Tissue cultivation / Genetic therapy.

**13. GENETIC ENGINEERING IN PLANTS**
Genetic engineering in plants / Transgenic food / Peruvian laws.

**14. BIONIC ENGINEERING**
Bionic implants / Mechanical invents based on biological systems / Sensors and neuromorphic circuits / Simulation of cardiac pulses.

**15. ECOLOGY**
Basic concepts / Ecological thermodynamics / Bio-geo-chemical cycles: carbon cycle, nitrogen, phosphorus and sulfur cycles / Energy synthesis: hydrogen, methane, methane-genesis.

## V. METHODOLOGY

The course takes place in theory, practice and laboratory sessions. In theory sessions, the instructor presents the concepts and methods. In practice sessions, students analyze and solve problems related to different themes of the course. In laboratory sessions, students complete an experiment and present a report summarizing results sand conclusions. Active participation of students is encouraged in all sessions.

## VI. GRADING SYSTEM

The Final Grade (PF) is calculated with the following formula:

**PF = (EP + EF + PP) / 3**

ME: Mid-term exam EF: Final Exam
PP: Average of practice and laboratory work

## VII. BIBLIOGRAPHY


1. **Bruce Alberts, Alexander Jhonston**
   Essentials of Cell Biology
   Taylor and Francis Editions, 2008
2. **Harvey Lodish, Matthew Scott**
   Molecular Cell Biology

McGraw Hill Editions, 2010