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| ***Title of the course:***  **Fundamentals of Environmental Biology** | | ***NEPTUN-code:***  **RKXBI1EBNF** | ***Weekly teaching hours:*** *l+cw+lw*  2+2+0/week | ***Credit*:** 4  ***Exam type****:* tm |
| ***Course leader:***  Prof. Dr. habil. Hosam Bayoumi Hamuda | | ***Position*:**  Associate professor  Private university professor | ***Required preliminary knowledge:-*** | |
| **Curriculum** | | | | |
| The aim of the course is to fill the gap between basic environmental science and advanced environmental biotechnology. The course is divided into two parts, the first dealing with biology and topics related to environmental sciences, and the second with environmental biotechnology. Environmental biology is a multidisciplinary subject and covers a wide range of topics such as ecological issues, global environmental problems and socio-economic scenarios, as well as modern fields such as molecular biology, genetics, ecology, etc. Topics covered. Biodiversity, taxonomy and modern classification. Hierarchy of biomolecules. Plasmids and their role in the adaptation of microorganisms to their environment. Biogenic elements. Types of micro-organisms. Fungi. Degradation of carbohydrates. Phototrophy and photosynthesis, light and dark phase. General characterisation and basic concepts of ecological systems. Soil microbiology. Water microbiology. Air microbiology. Microbiology of anaerobic environments. Antibiotics and their mechanism of action. Understanding environmental effects on animal and plant cells. Understanding the relationship between living organisms and environmental factors, the systems involved in the regulation of life functions and the behaviour and functioning of living systems. | | | | |
| **Detailed description of the subject, timetable** | | | | |
| **Weeks** | **Topics of lectures** | | | |
| 1. | **Lecture**: The main characteristics of living organisms. Biodiversity, systematics and modern classification. Hierarchy of biomolecules: Proteins. Carbohydrates. Lipids. DNA, RNA properties, biosynthesis.  **Practical**: Tools of microbiological laboratory, equipments, and safety regulations. Nutrient requirements of bacteria, types of nutrition. Cultivation of bacteria. Complex media. | | | |
| 2. | **Lecture:** DNA replication and Mutation. Occurrence and importance of mutations. Inheritance of genetic material. Possibilities of gene transfer. Plasmids and their role in the adaptation of microorganisms to the environment.  **Practical**: Methods of isolation and cultivation of microorganisms. Incubation conditions. Characteristics of cultivation in different cultural media. | | | |
| 3. | **Lecture:** Biogenic elements. Structure of cells. Classification of microorganisms. Type of microorganisms: comparison between akaryotic, prokaryotic and eukaryotic organisms. Basic concepts and structure, structure, and morphology of viruses. Virus multiplication. Interferons.  **Practical**: Theory and practical performance of biochemical examinations used to characterize microorganisms. The morphological characteristics of bacterial colonies. Bacterial types (size, shape, surface, edges). | | | |
| 4. | **Lecture:** The structure and morphology of the bacterial cell: Gram negative and positive bacterial cell. The archaea.  **Practical**: Bacterial motility test and growth on an agar slant. The more common strain maintenance and conservation methods. | | | |
| 5. | **Lecture**: Fungi: Characteristics of filamentous fungi and yeasts. The importance of fungi in agriculture and the food industry.  **Practical**: Morphological characterization of fungal cultures, construction and use of the microscope. Fungal culture conditions. Metabolism and reproduction of fungi. | | | |
| 6. | **Lecture**: Eukaryotes: unicellular organisms and algae. Types of microbial respiration: characteristics of aerobic and anaerobic respiration.  **1st written examination**  **Practical**: Bioremediation. Microbial ecology. The effect of environmental factors on microorganisms. Soil-Plant-Microbe interactions. | | | |
| 7. | **Lecture**: Overview of catabolic and anabolic processes. Energy acquisition by oxidative phosphorylation. Chemolithotrophic metabolism. Breakdown of carbohydrates. General characteristics of fermentations. Phototrophy and photosynthesis, light and dark phases.  **Practical**: Origin of eukaryotes, body organization. Lichens. The origin of eukaryotes, their body organization. Mycorrhiza. | | | |
| 8. | **Lecture**: General characterization and basic concepts of ecological systems: Trophic levels, food chains and networks. Types of interactions between microorganisms. Human and natural microbial partners. Roles of microorganisms in biogeochemical cycles.  **Practical**: Cell cycle. Mitosis and Meiosis. | | | |
| 9. | **Lecture**: Soil microbiology. Microbiology of water. Air microbiology. Microbiology of anaerobic environments. Microbial biofilms. Antibiotics and their mechanism of action.  **Practical:**. Studies of animal morphology and physiology. | | | |
| 10. | **Lecture**: Introduction to climatic variations and environmental factors on living organisms. Characteristics of colonial, tissue-organic organisms. Structure and organization of multicellular organisms.  **Practical**: The system of organisms representing the producing, consuming and degrading levels in the different climatic zones. | | | |
| 11. | **Lecture**: Importance of plants in the ecosystems. Plant classification. The main types of multicellular plant organization.  **Practical**: Forms of multicellular organization. Plant morphology. Examination of fixed plant tissues, drawing up a report based on the microscopic examination. | | | |
| 12. | **Lecture**: Animal Kingdom. Invertebrates and Vertebrates.  **2nd Written examination**  **Practical**: Studies of animal morphology, cytology, and physiology | | | |
| 13. | **Lecture**: Living organisms in the biosphere. The practice of animal and fungi identification, the recognition of the main groups (indicator groups) that are especially important from the point of view of environmental protection.  **Practical**: The impact of human activities on the organization and functioning of the ecosystems. | | | |
| 14. | **Lecture**: Introducing the relationship between living organisms and environmental factors, the systems involved in the regulation of life functions, and understanding the behavior and functioning of living systems.  **Practical**: Interactions between microorganisms and higher plants, animals and human activity. Consequences of human interventions. | | | |
| **Mid-term requirements** | | | | |
| **Participation in occupations:**  Participation in practical lessons and lectures is obligated.  Students should not absent more than 2 lectures and 2 practical lessons. If more, the course result is disable | | | | |
| **Mid-terms, protocols, reports, etc.:**  The activities of the student positively complete the course when the student send the homework, reports, etc. and succeed in 2 mid-term exams – at the 6th and 12th weeks- (theory + practice together). For the student who has miss any requirement can completed in the make-up examination will be in the 15th week. | | | | |
| **The method of obtaining a signature / mid-term mark:**  To pass the course: the student should pass 2 mid-term written examinations, (Dates: 1st exam will be on the 6th and the second on the 12th week) solving the homework questions and write essay (min. 5 pages) (sending Deadline: 22nd of November 2025) as well as the practical final report of the practices.  Results: Total marks of the subject at the end of the semester are less than 50%, the student should go for correction opportunities are available according to 17§(6) of Education and Examination Regulations (TVSZ). The rewrite examination will be on the 15th week, in Lab 8 at 13:00 pm  marks: 85-100%: excellent (5), 75-84%: good (4), 65-74%: satisfactory (3), 50-64%: pass (2), 0-49%: fail (1). | | | | |
| **Professional competencies:** | | | | |
| I Knowledge of general and specific mathematical, natural and social scientific principles, rules, relations, and procedures as required to pursue activities in the special field of environment protection  Knowledge of the learning, knowledge acquisition, and data collection methods of the special fields of environment protection, their ethical limitations and problem-solving techniques.  Comprehensive knowledge of the basic features and interrelations of environmental elements and systems, as well as of the environmentally harmful substances affecting them.  Able to cooperate with engineers involved in the development and application of production and other technologies to develop the given technology in terms of environment protection.  Able to participate creatively in engineering work based on their multidisciplinary skills, as well as to adapt to continuously changing circumstances.  Collaboration with civil organizations engaged in environment protection, but willing to argue to develop optimal solutions.  Constantly upgrading their knowledge of environment protection by attending organized professional development training courses.  Sharing experiences with colleagues, thus promoting their development.  Taking responsibility towards society for their decisions made in the scope of environment protection. | | | | |
| **Literature:** | | | | |
| J.H. Postlethwait and J.L. Hopson (2009): Modern Biology. Holt, Rinehart and Winston. A Harcourt Education Company, New York, London. ISBN-13: 978-0-03-006769-4  Kenneth Todar (2008): [Todar’s Online Textbook of Bacteriology](http://www.freebooks4doctors.com/link.php?id=1427). University of Wisconsin  David M. Sander (2007): [Big Picture Book of Viruses](http://www.freebooks4doctors.com/link.php?id=1452).  Julie B. Wolf (2005): [Applied Molecular Biology](http://www.freebooks4doctors.com/link.php?id=1221). Beginning Laboratory Manual. University of Maryland, Baltimore County (UMBC).  T. A. Brown (2002): [Genomes](http://www.freebooks4doctors.com/link.php?id=1378) 2nd edition Bios Scientific Publishers Ltd IBSN: 9781859962282  Harry L. T. Mobley, George L. Mendz, Stuart L. Hazell (2001): [Helicobacter pylori: Physiology and Genetics](http://www.freebooks4doctors.com/link.php?id=1376). ASM Press ISBN: 9781555812133  Madigan, Martinko and Parker (2000): Biology of Microorganisms. 8th edition Southern Illinois University, Carbondale | | | | |
| **Comment**:  Attendance at the lectures is mandatory! Obligations of attendance can be fulfilled in case of a maximum of 4 absences. In case of 5th absence from the sessions, the course can no longer be completed. At least sufficient (50-64% = 2) completion of the med-term exams, preparation of practical reports, written of one essay and solving the homework questions. | | | | |