Northern Technical University

الجامعة التقنية الشمالية

First Cycle – Bachelor's degree (B.Sc.) – Environment and Pollution Techniques Engineering

بكالوريوس هندسة تقنيات البيئة والتلوث

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1. Overview

This catalogue is about the courses (modules) given by the program of Environment and Pollution Techniques Engineering to gain the Bachelor of Science degree. The program delivers (40) Modules with (6000) total student workload hours and 240 total ECTS. The module delivery is based on the Bologna Process.

نظره عامه

يتناول هذا الدليل المواد الدراسية التي يقدمها برنامج هندسة تقنيات البيئة والتلوث للحصول على درجة بكالوريوس العلوم. يقدم البرنامج (٤٠) مادة دراسية، على سبيل المثال، مع (٦٠٠٠) إجمالي ساعات حمل الطالب و ٢٤٠ إجمالي وحدات أوروبية. يعتمد تقديم المواد الدراسية على عملية بولونيا.

2. Undergraduate Courses 2023-2024

Level One

Module 1

Code	Course/Module Title	ECTS	Semester
NTU102	Principles of Computer	3	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1	48	27
Description			
This course offers students a comprehensive exploration of the fundamental concepts and principles that underpin the field of computer science. By delving into various subjects including the historical development of computing, data representation, computer components, algorithms, programming languages, operating systems, applications, internet and networking, and cyber-security, students will develop a well-rounded understanding of the discipline. By examining the evolution of computer science over time, students will acquire a broad perspective on the field and its significance in contemporary society. Through a combination of theoretical knowledge and practical applications, this module equips students with the necessary foundation to pursue further studies or careers in computer science.			

Module 2

Code	Course/Module Title	ECTS	Semester
TECK101	**Derivatives and Integral**	**6**	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	0	93	57
Description			
Mathematics is the science and study of quality, structure, space, and change. Mathematicians seek out patterns, formulate new conjectures, and establish truth by rigorous deduction from appropriately chosen axioms and definitions. There is debate over whether mathematical objects such as numbers and points exist naturally or are human creations. The mathematician Benjamin Peirce called mathematics "the science that draws necessary conclusions". Albert Einstein, on the other hand, stated that "as far as the laws of mathematics refer to reality, they are not certain; and as far as they are certain, they do not refer to reality."			

Module 3

Code	Course/Module Title	ECTS	Semester
TECK102	Engineering Drawing	5	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
1	2	68	57
Description			
This lecture note has been prepared with the primary aim of alleviating the problems encountered in the students of Engineering Drawing course. The graphics of engineering design and construction may very well be the most important course of all studies for an engineering or technical career. The indisputable reason why graphics or drawing is so extremely important is that it is the language of the designer, technician, sanitarian, and engineer, used to communicate designs and construction details to others. The language of graphics is written in the form of drawings that represent the shape, size, and specifications of physical objects. The language is read by interpreting drawings so that physical objects can be constructed exactly as originally conceived by the designer. The text and the self-explanatory drawings are much helpful to understand the subject even for the beginners. More over, other subsidiary topics like sectioning, projection of points and lines are studied to enable students acquire concrete knowledge and skill for their professional career. Finally, it contains a glossary, which summarizes important terminologies used in the text.			

Module 4

Code	Course/Module Title	ECTS	Semester
NTU100	حقوق الانسان والديمقراطية	2	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	0	44	6
Description			
مادة حقوق الإنسان هي مادة دراسية تهدف إلى تعريف الطلاب بالمفاهيم والمبادئ الأساسية لحقوق الإنسان وتوضيح أهمية حقوق الإنسان في المجتمعات المعاصرة .تغطي المادة مجموعة واسعة من المواضيع المتعلقة بحقوق الإنسان، بدءًا من القوانين والمعاهدات الدولية ذات الصلة، وصولًا إلى التحديات والانتهاكات التي تواجه حقوق الإنسان في الواقع. تتناول مادة حقوق الإنسان مفاهيم أساسية مثل الكرامة الإنسانية، والمساواة، والحرية، والعدالة الاجتماعية، وتوضح كيف يتم تعريف وحماية هذه الحقوق في المستوى الدولي والوطني .تعرض المادة الطلاب للوثائق والمعاهدات الدولية المهمة في مجال حقوق الإنسان، مثل الإعلان العالمي لحقوق الإنسان والميثاق			

Module 5

Code	Course/Module Title	ECTS	Semester
ENPE112	Principles of Environmental Engineering	8	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	0	97	103
Description			
This subject teaches fundamental chemical, physical and biological principles which can be used to analyze data and formulate design solutions to environmental problems particularly related to water quality and treatment. The subject covers fluid flow in reactors, kinetics, material balances, nutrient cycles, transformation processes, and water resources and pollution. The way this knowledge is utilized by engineers for water quality engineering is examined. This subject enables students to master key theoretical and practical environmental engineering concepts through weekly workshop sessions, and formative and summative online exercises, develop design and collaborative skills through research group project, and enhance technical and reflective communication skills through written and oral reports. Upon completion of this subject, students acquire knowledge and skills in applying engineering and design solutions to an environmental problem and communicate in professionally varied ways relevant to professional engineering practice. Environmental Engineers design, build, manage and maintain systems that reduces air and water pollution, control erosion, improve recycling, manage resources, reduce impacts of			

construction, clean up pollution and much more. Many environmental engineers serve as consultants who help companies to comply with environmental regulations and clean up contaminated areas.

Module 6

Code	Course/Module Title	ECTS	Semester
NTU101	English Language	2	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	0	38	12
Description			
English is to learn different fundamental language skills of reading, writing, speaking, listening, thinking, viewing, and presenting. An emphasis on vocabulary and composition skills will be an ongoing part of the program. The course includes studies of various literary genres: short story, poetry, novel, drama, and non-fiction. The development of critical reading and writing skills is a major emphasis of the course. The course concentrates on a general review of grammar with emphasis upon usage. Strong attention will be given to the development of composition and critical reading skills. Vocabulary development and outside reading will complement this course of study. Literature study will be supported by composition. Literary emphasis includes the short story, novel, drama, and poetry.			

Module 7

Code	Course/Module Title	ECTS	Semester
TECK103	Workshop	4	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
0	3	45	55
Description			
The engineering workshop focuses on identifying hazards in the work environment and industrial safety guidelines. And training on how to measure and determine, and the use and work of memorization tools. Learn about the types of wood used in carpentry, the process of shaping it, and the use of carpentry tools and machines. Training in welding work, its types, and the welding process by welding. Training in various casting works and training in mechanical			

operations, including turning and milling. Training on pipe knowledge, how to connect, sanitary engineering works, and training on the basics of electrical workshops.

Module 8

Code	Course/Module Title	ECTS	Semester
TECK113	Engineering Mechanics	5	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	0	63	62
Description			
Mechanics is a branch of physics that deals with the motion and behavior of physical objects under the influence of forces. It provides a framework for understanding and describing the fundamental principles that govern the motion of objects in various physical systems. Mechanics encompasses both particle mechanics, which deals with the motion of individual particles, and rigid body mechanics, which considers the motion and forces acting on extended bodies with fixed shapes. Additionally, mechanics extends into areas such as fluid mechanics, which studies the motion of fluids, and continuum mechanics, which explores the behavior of materials as continuous media. To analyze and solve problems in mechanics, mathematical tools such as calculus, vector algebra, and differential equations are employed. These mathematical techniques help express and quantify the relationships between physical quantities such as force, mass, velocity, and acceleration.			

Module 9

Code	Course/Module Title	ECTS	Semester
ENPE111	**Analytical Chemistry**	**7**	**1**
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	**133**	**42**
Description			

Analytical chemistry is the study of elements and compounds in materials in the three cases solid, liquid, and gas, and knowing its percentages and quantities in the materials and knowing acidity or alkalinity of solutions and methods of its calculations. The learning and teaching strategy is designed to: Carefully cover in lectures the necessary fundamental material and analytical techniques, and demonstrate concepts with appropriate (and where possible practical) examples Allow students adequate time to practice the techniques using a large number of carefully selected tutorial problems.

Module 10

Code	Course/Module Title	ECTS	Semester
ENPE104	Physics	5	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	0	48	77
Description			

Material balance" redirects here. For the method of economic planning, see Material balance planning. For the device used to compare two masses, see Weighing scale and Balance.

In physics, a mass balance, also called a material balance, is an application of conservation of mass to the analysis of physical systems. By accounting for material entering and leaving a system, mass flows can be identified which might have been unknown, or difficult to measure without this technique. The exact conservation law used in the analysis of the system depends on the context of the problem, but all revolve around mass conservation, i.e., that matter cannot disappear or be created spontaneously.

Mass balances are used widely in engineering and environmental analyses. For example, mass balance theory is used to design chemical reactors, to analyse alternative processes to produce chemicals, as well as to model pollution dispersion and other processes of physical systems. Closely related and complementary analysis techniques include the population balance, energy balance and the somewhat more complex entropy balance. These techniques are required for thorough design and analysis of systems such as the refrigeration cycle.

Level Two

Module 11

Code	Course/Module Title	ECTS	Semester
ENPE212	Fluid Mechanics	7	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	75	100
Description			
Fluid mechanics is a branch of physics that deals with the study of fluids and their motion. It entails the analysis of the behavior of liquids, gases, and plasmas under different conditions like motion, flow, and deformation. Fluid mechanics is divided into two categories: hydraulics (the study of liquids in motion) and aerodynamics (the study of gases in motion). The study of fluid mechanics is crucial in various fields, including aerospace engineering, civil engineering, chemical engineering, and mechanical engineering. It is used in designing various machines and structures, for example, turbines, pumps, and propellers. Fluid mechanics is also applied in understanding the circulation of blood in the human body and the way birds fly in the air. The principles of fluid mechanics are governed by fundamental laws such as Bernoulli's equation, which states that the pressure in a fluid decrease as the velocity of fluids increases, and Poiseuille's law, which describes the flow of fluids in a pipe. Understanding fluid mechanics is important in solving real-world problems like predicting natural disasters such as floods or designing efficient water distribution systems.			

Code	Course/Module Title	ECTS	Semester
ENPE210	Environmental Chemistry	7	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	75	100
Description			
Description of environmental chemistry: It is probably true to say that the term environmental chemistry has no precise definition. It means different things to different people. We are not about to offer a new definition. It is clear that environmental chemists are playing their part in the big environmental issues —stratospheric ozone (O3) depletion, global warming and the like. Similarly, the role of environmental chemistry in regional-scale and local problems —for example, the effects of acid rain or contamination of water resources —			

is well established. This brief discussion illustrates the clear link in our minds between environmental chemistry and human beings. For many people, 'environmental chemistry' is implicitly linked to 'pollution'. We hope this book demonstrates that such a view is limited and shows that 'environmental chemistry' has a much wider scope. Terms like contamination and pollution have little meaning without a frame of reference for comparison. How can we hope to understand the behavior and impacts of chemical contaminants without understanding how natural chemical systems work? For many years a relatively small group of scientists has been steadily unravelling how the chemical systems of the Earth work, both today and in the geological past. The discussions in this book draw on a small fraction of this material. Our aim is to demonstrate the various scales, rates and types of natural chemical processes that occur on Earth. We also attempt to show the actual or possible effects that humans may have on natural chemical systems. The importance of human influences is usually clearest when direct comparison with the unperturbed, natural systems is possible. rent theme. This theme emphasizes the link between natural chemical systems and organisms, not least humans, since water is the key compound in sustaining life itself. We will start by explaining how the main components of the near surface Earth —the crust, oceans and atmosphere —originated and how their broad chemical composition evolved. Since all chemical compounds are built from atoms of individual elements we begin with the origin of these fundamental chemical components

Module 12

Module 13

Code	Course/Module Title	ECTS	Semester
ENPE211	Computer programming	5	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
1	3	60	65

Description

Visual Basic (VB) is a programming language and development environment that is widely used for developing Windows-based applications. It provides a simple and intuitive syntax, making it suitable for beginners and experienced developers alike. Here are some common computer applications for Visual Basic:

1. Windows Desktop Applications: Visual Basic is primarily used for developing desktop applications that run on Windows operating systems.
2. Database Applications: Visual Basic integrates well with databases, allowing developers to create applications that interact with databases efficiently. It supports various database systems like Microsoft SQL Server, Oracle, MySQL, and Access, enabling developers to build database-driven applications for tasks like data entry, data management, reporting, and analysis.
3. Automation Tools: Visual Basic is often used to create automation tools and scripts for repetitive tasks. It can interact with other applications, such as Microsoft Office suite (Excel, Word, PowerPoint), to perform automated actions like generating reports,

manipulating data, and automating workflows.

Module 14

Code	Course/Module Title	ECTS	Semester
ENPE214	Environmental Geology	7	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	75	100
Description			
This section includes a description of the module, 100-150 words **Description** of environmental geology: Environmental geology is the application of geologic information to the entire spectrum of interactions between people and the physical environment. During a course in environmental geology, you will develop an understanding of how geology interacts with major environmental problems facing people and society. This is the essence of Introduction to Environmental Geology, Fourth Edition. Our strategy with this text is to: • Introduce you to the basic concepts and principles of physical and environmental geology, focusing on Earth materials and processes. • Provide you with sufficient information concerning natural hazards and the geologic environment so that you will be a more informed citizen. You will be better prepared to make decisions concerning where you live and how society responds to natural hazards and catastrophes such as earthquakes, volcanic eruptions, and flooding. • Help you develop an understanding of relationships between natural resources and pollution. We seek, find, and use resources and, as a result, may pollute our environment. Thus, it is important to know how we might minimize pollution problems. • Help you understand the basic concepts of environmental management as they relate to the geologic environment in areas such as waste management, environmental health, global change, and environmental assessment. After finishing your course in environmental geology, you will be better prepared to make decisions concerning where you build or buy a home, what resources you choose to utilize, and appropriate environmental actions relevant to society and Earth's ecosystems from a local to a global scale.			

Module 15

Code	Course/Module Title	ECTS	Semester
ENPE217	Surveying	4	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1	45	55
Description			
Principles of Environmental Statistics is a discipline that applies statistical methods to analyze and interpret data related to the environment. It encompasses the collection, organization, and			

analysis of environmental data to gain insights into various ecological, climatic, and pollution-related phenomena. The subject focuses on developing statistical models and techniques specifically tailored for environmental data, which often exhibit complex spatial and temporal patterns. These principles aim to provide a solid foundation for understanding and quantifying uncertainty, variability, and trends in environmental measurements. Students studying this subject learn to apply statistical tools for designing environmental experiments, sampling methods, and data analysis, enabling them to make informed decisions in environmental management and policy-making. Overall, Principles of Environmental Statistics combines statistical theory and environmental science to address the unique challenges and complexities associated with environmental data analysis

Module 16

Code	Course/Module Title	ECTS	Semester
ENPE218	Microbiology techniques	7	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	75	100
Description			
Microbiology Techniques is a scientific field that focuses on the study and application of microorganisms. It encompasses various techniques, methods, and tools used to investigate, manipulate, and utilize microorganisms for different purposes. This subject explores the biology, genetics, physiology, and behavior of bacteria, viruses, fungi, and other microorganisms. Microbiology technology plays a crucial role in areas such as medicine, agriculture, food production, environmental science, and biotechnology. It involves the identification and characterization of microorganisms, the study of their interactions with humans, animals, and the environment, as well as the development of novel methods for diagnosis, treatment, and prevention of microbial infections. By harnessing the power of microbiology technology, scientists can unlock valuable insights into the microbial world and use this knowledge to improve human health, enhance industrial processes, and protect the environment.			

Module 17

Code	Course/Module Title	ECTS	Semester
ENPE219	Ecology	6	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	75	75
Description			
Applied Ecology is a scientific discipline that focuses on the practical application of ecological			

principles and concepts to address real-world environmental issues. It involves the study of how organisms interact with their environment, including both biotic (living) and abiotic (non-living) factors, and aims to understand and manage ecosystems to promote sustainability and biodiversity conservation. Applied ecologists employ a multidisciplinary approach, integrating knowledge from fields such as biology, environmental science, and conservation, to develop practical solutions for environmental challenges. They may work on diverse topics, including habitat restoration, wildlife management, pollution control, invasive species management, and ecosystem assessment. Through research, fieldwork, data analysis, and collaboration with stakeholders, applied ecologists contribute to the development and implementation of strategies that balance human needs with the preservation and restoration of natural systems.

Module 18

Code	Course/Module Title	ECTS	Semester
ENPE215	Hydrology	7	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	75	100
Description			

Description of Hydrology: The study generally included the both* Surface water reservoirs * Groundwater reservoirs
Hydrologic cycle is the water circulatory system on earth. The cycle has no beginning or end as the evaporated water rises to atmosphere due to solar energy. The evaporated water can be carried hundreds of miles before it is condensed and returned to earth in a form of precipitation. Part of the precipitated water is intercepted by plants and eventually returned to the atmosphere by evapotranspiration from plants and upper layers of soil, runs overland eventually reaching open water bodies such as streams, oceans or natural lakes or infiltrates through the ground forming deep or shallow groundwater aquifers. A good portion of the precipitated water evaporates back to the atmosphere thereby completing the hydrologic cycle.
The study also includes the study of water balance: the hydrologic budget or balance is a quantitative accounting technique linking the components of hydrologic cycle. It is a form of a continuity equation that balances the gains and losses of water with the amount stored in a region. The components of water budget are inflow, outflow and storage. Total Runoff * A part of infiltrated water moves in the form of inter flow which soon joins the stream, the remaining portion of infiltrated water percolates to deeper layers of the ground and is stored as groundwater. This groundwater sometimes also joins the stream flow through springs and seepage process. The stream flow is then called the total runoff i. e. it is sum of all the components of precipitation water. Direct runoff plus the losses gives total runoff. * The runoff can be expressed in depth units for a certain area or it can be expressed in volume units. It can also be expressed in discharge units for a specified time, the study It deals with the study and classification of the types of groundwater reservoirs and the types of water springs, as well as the nature of water-retaining rocks. The study also includes rivers, their classification, the nature and form of their presence, and their relationship with groundwater.

Module 19

Code	Course/Module Title	ECTS	Semester

TECK202	Mathematics	6	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	1	75	75
Description			
In this course we highlight A course on vectors introduces the fundamental concepts and techniques related to vector algebra and vector calculus. Vectors are mathematical entities that have both magnitude and direction, and they are used to represent physical quantities such as displacement, velocity, force, and more. The course covers various aspects of vectors, including vector addition, subtraction, scalar multiplication, dot product, cross product, vector projections, and vector equations. Students learn to perform vector operations, manipulate vector quantities, and understand geometric interpretations of vectors. Applications of vectors in physics, engineering, and geometry are also explored. Differential Equations: Differential equations involve the study of equations that relate an unknown function to its derivatives. A course on differential equations focuses on understanding and solving various types of differential equations, including ordinary differential equations (ODEs) and partial differential equations (PDEs). Topics covered may include first-order ODEs, second-order linear ODEs, systems of ODEs,			

Module 20

Code	Course/Module Title	ECTS	Semester
ENPE216	Environmental Statistics	4	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1	45	55
Description			
Surveying is the process of determining the relative position of natural and manmade features on or under the earth's surface, the presentation of this information either graphically in the form of plans or numerically in the form of tables, and the setting out of measurements on the earth's surface. It usually involves measurement, calculations, the production of plans, and the determination of specific locations. The surveyor may be called on to determine heights and distances; to set out buildings, bridges and roadways; to determine areas and volumes and to draw plans at a predetermined scale. The measurement of surveying are essentially those of distance, both horizontal and vertical , and direction. The objective of surveying is to familiarize the student with the basic topics in surveying science			

by collecting and interpreting information related to land and its geography, and using that information in effective planning and management. Finally, preparing the student to be able to apply projects using surveying equipment.

Level Three

Module 21

Code	Course/Module Title	ECTS	Semester
TECK300	Engineering Analysis	5	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	NAL	60	65
Description			

Engineering analysis involves the application of scientific analytic principles and processes to reveal the properties and state of the system, device or mechanism under study. Engineering analysis is decomposition, it proceeds by separating the engineering design into the mechanisms of operation or failure, analyzing or estimating each component of the operation or failure mechanism in isolation, and re-combining the components according to basic physical principles and natural laws.
Engineering analysis and applied analysis are synonym terms for mathematical analysis/calculus beyond basic differential equations such as applied for various advanced physics & engineering topics (including Fourier analysis, Lagrangian & Hamiltonian mechanics, Laplace transforms, Sturm–Liouville theory, and others) but still can involve mathematical proofs.

Engineering analysis is the primary method for predicting and handling issues with remote systems such as satellites and rovers. Engineering analysis for remote systems must be ongoing since the health and safety of the remote system can only be affected remotely (and because any failure could have fatal consequences).

The capabilities of engineering analysis therefore must incorporate trending as well as analysis. Trending should be proactive, predictive, comprehensive and automated. Analysis must be reactive, investigative, targeted and hands-on. Together trending and analysis allow operators to both predict potential situations and identify anomalous events that threaten a remote system.

Module 2**2**

Code	Course/Module Title	ECTS	Semester
ENPE310	Water Pollution	7	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	75	100
Description			
Water is the most important natural resource in the world since without it, life cannot exist and most industries could not operate. Although human life can exist for many days without food, the absence of water for only a few days has fatal consequences. The presence of a safe and reliable source of water is thus an essential prerequisite for the establishment of a stable community. In the absence of such a source, a nomadic life style becomes necessary and communities must move from one area to another as demands for water exceed its availability.			

Module 2**3**

Code	Course/Module Title	ECTS	Semester
ENPE311	Soil pollution and remediation	6	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	75	75
Description			
soil mechanics, the study of the physical properties and utilization of soils, especially used in planning foundations for structures and subgrades for highways. Soil is a natural aggregate of mineral particles, sometimes including organic constituents; it has solid, liquid, and gaseous phases. How the soil of a given site will support the stresses put upon it by the weight of structures, or how it will respond to movement in the course of construction, depends upon six properties—internal friction (the resistance of a soil mass to sliding, inversely related to the amount of moisture in the soil and thus greater in sands and gravel than clays) and cohesion (molecular attraction between soil particles, much higher in clays than sands or silt), both of which lessen the tendency of soils to shear, or slide along planes; compressibility (the degree to which soil may be made denser by various means including tamping and vibration, and thus able to support greater loads); elasticity (the ability of soil to reexpand after being compressed); permeability (the degree to which a soil will conduct a flow of water); and capillarity (the degree to which water is drawn upward from the normal water table).			

Module 24

Code	Course/Module Title	ECTS	Semester
ENPE315	Environmental Thermodynamic	5	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**

2	2	65	60
Description			
Thermodynamics is a branch of physics that deals with heat, work, pressure, and temperature, and their relation to energy, entropy, and the physical properties of matter and radiation. The behavior of these quantities is governed by the four laws of thermodynamics which convey a quantitative description using measurable macroscopic physical quantities, but may be explained in terms of microscopic constituents by statistical mechanics. Thermodynamics applies to a wide variety of topics in science and engineering, especially physical chemistry, biochemistry, chemical engineering and mechanical engineering, but also in other complex fields such as meteorology.			

Module 25

Code	Course/Module Title	ECTS	Semester
ENPE312	Air Pollution	7	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	75	100
Description			
Air Pollution is the presence of undesirable material in air, in quantities large enough to produce harmful effects. This definition does not restrict air pollution to human causes, although we normally only talk about these. The undesirable materials may damage human health, vegetation, human property, or the global environment as well as create aesthetic insults in the form of brown or hazy air or unpleasant smells. Many of these harmful materials enter the atmosphere from sources currently beyond human control. However, in the most densely inhabited parts of the globe, particularly in the industrialized countries, the principal sources of these pollutants are human activities. These activities are closely associated with our material standard of living. To eliminate these activities would cause such a drastic decrease in the standard of living that this action is seldom considered. The remedy proposed in most industrial countries is to continue the activities and control the air pollutant emissions from them.			

Module 26

Code	Course/Module Title	ECTS	Semester
TECK301	Numerical Analysis	5	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**

4	NAL	60	65
Description			
Numerical analysis is a branch of mathematics that solves continuous problems using numeric approximation. It involves designing methods that give approximate but accurate numeric solutions, which is useful in cases where the exact solution is impossible or prohibitively expensive to calculate. Numerical analysis also involves characterizing the convergence, accuracy, stability, and computational complexity of these methods. Numerical analysis is the area of mathematics and computer science that creates, analyzes, and implements algorithms for solving numerically the problems of continuous mathematics. Such problems originate generally from real-world applications of algebra, geometry, and calculus, and they involve variables which vary continuously. These problems occur throughout the natural sciences, social sciences, medicine, engineering, and business. Beginning in the 1940's, the growth in power and availability of digital computers has led to an increasing use of realistic mathematical models in science, medicine, engineering, and business; and numerical analysis of increasing sophistication has been needed to solve these more accurate and complex mathematical models of the world. The formal academic area of numerical analysis varies from highly theoretical mathematical studies to computer science issues involving the effects of computer hardware and software on the implementation of specific algorithms.			

Module 27

Code	Course/Module Title	ECTS	Semester
ENPE317	Hydraulic	6	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	60	90
Description			
Hydraulic This course aims to establish fundamental knowledge of hydraulic design and engineering of the water treatment plants. Students are introduced to standard hydraulic behavior inside the water treatment plant facilities. In addition, they will understand how to measure and control the flow of wastewater, which was implemented together with the conservation of mass inside the water treatment plant.			

Module 28

Code	Course/Module Title	ECTS	Semester
ENPE411	Water Pollution Control	6	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	75	75
Description			
Water pollution control involve the design of water supply facilities, determination of the design capacity, estimation of the population growth, estimation of the unit water use, water pollution, and methods of control. The effect of water pollution depends upon the type of pollutants and their concentration. Water pollution, to a larger extent, can be controlled by a variety of methods. Rather than releasing sewage waste into water bodies, it is better to treat them before discharge. Practicing this can reduce the initial toxicity and the remaining substances can be degraded and rendered harmless by the water body itself. If the secondary treatment of water has been carried out, then this can be reused in sanitary systems and agricultural fields. Some chemical methods that help control water pollution are precipitation, the ion exchange process, reverse osmosis, and coagulation. As an individual, reusing, reducing, and recycling wherever possible will advance a long way in overcoming the effects of water pollution.			

Module 29

Code	Course/Module Title	ECTS	Semester
ENPE312	Air Pollution Control	7	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	75	100
Description			
Air Pollution is the presence of undesirable material in air, in quantities large enough to produce harmful effects. Many of these harmful materials enter the atmosphere from sources currently beyond human control. Most of the fine particles in the atmosphere are secondary particles. Nonetheless, the control of primary particles is a major part of air pollution control engineering. Many of the primary particles, e.g., asbestos and heavy metals, are more toxic than most secondary particles. Although primary particles are generally larger than secondary particles, many primary particles are small enough to be repairable and are thus of health concern. If possible the collected particles are recycled to somewhere in the process that generates them. Most often (e.g., ash and soot from coal combustion), the collected particles go to a landfill. With the rapidly expanding industry, ever more urbanized lifestyles, and an increasing population, concern over the control of man-made air pollutants is now clearly a necessity. Effective ways must be found both to reduce pollution and to cope with existing levels of pollution.			

Module 30

Code	Course/Module Title	ECTS	Semester
ENPE320	Solid waste management	6	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	75	75
Description			
Solid waste management is the systematic handling and disposal of solid waste materials to minimize their negative impact on the environment and human health. It encompasses various activities such as collection, transportation, treatment, and disposal of solid waste. The primary objectives of solid waste management are to reduce the volume of waste generated, promote recycling and reuse, and ensure safe and efficient disposal of remaining waste. This subject covers a range of topics, including waste segregation, landfill management, waste-to-energy technologies, composting, and recycling methods. Effective solid waste management practices are crucial for preventing pollution, conserving resources, and maintaining a sustainable environment for future generations.			

Level Four

Module 31

Code	Course/Module Title	ECTS	Semester
TECK401	Engineering project literature view, Exp. programme	6	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
0	3	45	105
Description			
Final Year Projects represent the culmination of study towards the Bachelor of Engineering degree. Projects offer the opportunity to apply and extend material learned throughout the program. Assessment is by means of a seminar presentation, submission of a thesis, and a public demonstration of work undertaken. In contrast to the majority of courses studied elsewhere in the program, projects are undertaken individually or in small groups. This necessarily introduces the dimension of workload management into the program to enable completion of a large, relatively unstructured "assignment" over the course of the semester. The projects undertaken span a diverse range of topics, including theoretical, simulation and experimental studies, and vary from year to year. The emphasis is necessarily on facilitating student learning in technical, project management and presentation spheres. This course consists of a combination of Part A and Part B which reflects the full year multi term sequence program. As it is a single course of 30 units in one semester, approval by the Course Coordinator is required before enrolling in this course.			

Module 3**2**

Code	Course/Module Title	ECTS	Semester
ENPE415	Environmental Impact Assessment and Legislation	5	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	NA	45	80
Description			
This course deals with the definition of the environment and its main problems, the emergence and development of its law, its definition and its sources and a statement of the main principles on which it is based. The article deals with regional and international efforts			

to protect. It also presented details of the penal and civil aspects of the environment, the role of the judiciary in enforcing environmental legislation in a dimension through a review of some environmental crimes and violations and the legal system related to liability cases Civil for environmental damage.

Module 33

Code	Course/Module Title	ECTS	Semester
ENPE417	Health and Safety	6	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	75	75
Description			
The Environmental Health and Safety (EHS) course is a comprehensive educational program designed to equip individuals with the knowledge and skills necessary to promote and maintain a safe and healthy environment in various settings. This course covers a wide range of topics related to environmental protection, occupational health, and safety regulations. Participants in the EHS course learn about the identification and management of potential hazards in the workplace, such as chemical, biological, and physical agents. They explore strategies for risk assessment, mitigation, and emergency preparedness to prevent accidents, injuries, and environmental damage. Moreover, the course provides an overview of relevant laws and regulations, including occupational safety standards and environmental protection policies. Participants gain insights into compliance requirements and learn how to develop and implement effective safety programs and policies in different industries and organizations. Throughout the course, emphasis is placed on fostering a culture of safety, promoting ethical practices, and engaging stakeholders in environmental and occupational health initiatives. By the end of the course, individuals are equipped with the knowledge and tools necessary to proactively address and mitigate potential risks, ensuring the well-being of workers, communities, and the environment.			

Module 34

Code	Course/Module Title	ECTS	Semester
ENPE412	Wastewater Pollution Control	7	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	75	100
Description			
Course Objectives: To give information about wastewater quality criteria and wastewater standards, wastewater properties and the basics, operations and design criteria of physical,			

chemical and biological treatment processes used in wastewater treatment.
Summary of the Course: Wastewater quality criteria and wastewater standards, Wastewater properties and related parameters, Measurement of wastewater flow rates, Screens and grinders, Sand traps, Balancing, Pre-settlement, Activated sludge process, Classical activated sludge process modifications, Nitrogen and phosphorus removal in wastewater treatment.
Course Learning Outcomes: Distinguishes and evaluates wastewater quality criteria and standards. Interprets parameters of physical, chemical and biological pollutants in wastewater and designs wastewater treatment plant flow chart according to desired standards. Applies wastewater flow rate measurement methods and evaluates the results. It defines the basic working principles of the physical, chemical and biological treatment process units of the wastewater treatment plant and explains the design criteria. It relates the internal dynamics of the physical, chemical and biological treatment process units of the wastewater treatment plant and their connections with each other, identifies the operating problems and offers suggestions for their solutions.

Module 35

Code	Course/Module Title	ECTS	Semester
	Water Supply Engineering	6	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	60	90
Description			
Course Objectives: To introduce the components of water supply systems, to make engineering calculations of water supply systems, to prepare an applied project. Abstract Content of the Course: Population estimation methods, unit water consumption, flow characteristics, surface water collection, water intake from rivers and lakes, groundwater collection, water transmission, classification of transmission lines, hydraulic calculation, water accumulation, reservoir volume determination, reservoir types, water distribution , solution of network systems, equipment of water networks, application project. Course Learning Outcomes: Determines population and demand flow in water supply systems. Defines water intake structures. Performs chamber volume determination. Realizes the design of the transmission lines. Solves the water distribution networks and prepares the application project.			

Module 36

Code	Course/Module Title	ECTS	Semester
TECK403	Engineering project/ analysis and discussion, conclusion, writing, defense	6	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	NAL	45	105
Description			
Final Year Projects represent the culmination of study towards the Bachelor of Engineering degree. Projects offer the opportunity to apply and extend material learned throughout the program. Assessment is by means of a seminar presentation, submission of a thesis, and a public demonstration of work undertaken. In contrast to the majority of courses studied elsewhere in the program, projects are undertaken individually or in small groups. This necessarily introduces the dimension of workload management into the program to enable completion of a large, relatively unstructured "assignment" over the course of the semester. The projects undertaken span a diverse range of topics, including theoretical, simulation and experimental studies, and vary from year to year. The emphasis is necessarily on facilitating student learning in technical, project management and presentation spheres. This course consists of a combination of Part A and Part B which reflects the full year multi term sequence program. As it is a single course of 30 units in one semester, approval by the Course Coordinator is required before enrolling in this course.			

Code	Course/Module Title	ECTS	Semester
ENPE419	Control of Sludge Treatment	6	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	60	90
Description			
Course Objectives: Examining the treatment and disposal alternatives of treatment sludge obtained from different sources, defining and designing appropriate processes and processes for the treatment of domestic wastewater treatment plant sludge. Course Summary Content: Sources, quantity and properties of sludge, sludge treatment systems, sludge promotion, thickening, anaerobic digestion, aerobic digestion, other stabilization methods, conditioning, dewatering: mechanical dewatering techniques, sludge drying beds and lagoons, heat drying, composting, disinfection, incineration, delivery of sludge to the field, evaluation of sludge, final removal. Course Learning Outcomes: Defines the pollutant properties and treatment targets of sludge. Compares different treatment methods and creates flow charts. Selects different processes and processes used for sludge treatment and uses design criteria. Solves design examples for different sludge treatment			

units. Identifies and compares different processes and processes used for final evaluation purposes.

Module 37

Module 38

Code	Course/Module Title	ECTS	Semester
TECK402	Engineering Economics	6	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1	45	105
Description			
Engineering economics is a branch of economics that applies economic principles and concepts to engineering projects and decision-making processes. It involves assessing the financial viability and economic feasibility of engineering projects, evaluating costs and benefits, and analyzing the time value of money. Engineering economics helps engineers and project managers make informed decisions by considering factors such as investment costs, operational expenses, expected revenues, and potential risks. It encompasses techniques like cost estimation, cash flow analysis, net present value, internal rate of return, and benefit-cost analysis. By applying these methods, engineering economics enables professionals to determine the most economically efficient solutions, optimize resource allocation, and assess the profitability and sustainability of engineering endeavors. Overall, it provides a quantitative framework for evaluating the economic implications of engineering choices and facilitates the selection of the most financially viable alternatives.			

Module 39

Code	Course/Module Title	ECTS	Semester
ENPE413	Control & Measuring Engineering	6	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	75	75
Description			
Several examples of chemical process control illustrate the necessity for process modeling, process dynamics and control. It is advantageous to make use of some form of automatic control. Automatic control of a process offers many advantages, such as enhancing process safety, satisfying environmental constraints, meeting ever-stricter product quality specifications, more efficient use of raw materials and energy and increasing profitability. Considering all the benefits that can be realized through process control, it is well worth the time and effort required to become familiar with the concepts and practices used in the field. Control systems are used to maintain process conditions at their desired values by manipulating certain process variables to adjust the variables of interest. There are several common attributes of control systems such as,			

the ability to maintain the process variable at its desired value in spite of disturbances that might be experienced and, the ability to move the process variable from one setting to a new desired setting.

Module 40

Code	Course/Module Title	ECTS	Semester
ENPE418	Wastewater Network Engineering	6	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	75	75
Description			
Course Objectives: Introducing the properties of wastewater, examining the application details for the collection of used water, designing the network systems and preparing an applied project. Abstract Content of the Course: Physical, chemical and biological properties of wastewater, collection of used water, collection of rain water, hydraulics of sewer systems, amount and change of wastewater, different situations in passing channel length sections, design principles of wastewater sewage systems, calculation of precipitation water flow, storm water sewerage design principles of systems, planning of promotion centers, application projects. Course Learning Outcomes: Defines wastewater characteristics. Defines wastewater collection systems. Designs and reports wastewater sewage systems. Designs and reports storm water sewage systems. Solves wastewater collection networks and makes an application project.			

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