Nanjing Agricultural University
Module Catalogue
Environmental Engineering
Bachelor

Stand: 2019

Explanation:

1 credit point (1 LP) in our university corresponds to approximately 45 hours of workload and 1.5 ECTS.

Contents

1000 Mathematics Courses

Assigned modules:

1001 Calculus I B + Calculus II B
1002 Linear Algebra B
1003 Probability Theory

Course	**Calculus I B + Calculus II B**				
Type of course	lecture	**Credit points**	8,0	**ECTS**	12,0
Workload : 360 hours (Weekly hours: 8)					
In Class	144 hours	Self-study after class		216 hours	

Contents of the lecture

- Real numbers and functions: real numbers, bounded sets, functions, various common function classes, elementary functions
- Limit: the limit of the series, the nature of the series limit, the decision theorem of the series limit, the upper and lower limits and the Cauchy convergence principle, the limit of the function, the property of the function limit, the decision theorem of the function limit
- Continuous functions: continuous and discontinuous, continuous functions and their properties, properties of continuous functions on closed intervals, basic theorems of real numbers
- Derivative: the concept of derivative, the law of derivation, differential, high-order derivative
- Application of Derivatives: Differential Mean Value Theorem, L'Hospital Rule, Taylor Formula, Function Addition and Subtraction and Extremum, Function Convexity, Inflection Point and Function Mapping, Newton Method for Solving Equation
- Indefinite integral: the concept of indefinite integral, exchange integral method, partial integral method, rational function integral method, irrational function integral method, trigonometric function integral method
- Definite integral: the concept of definite integral, the necessary and sufficient conditions of integrable, the nature of definite integral, basic formula and calculation
- Application of definite integrals: various applications in geometry, examples of applications in physics
- Number of series: basic concept and property, positive series, variable series, nature of convergence series, infinite product

- Generalized integral: generalized integral over infinite interval, generalized integral of unbounded function
- Function term series: uniform convergence, uniform convergence and limit ordering, power series, Taylor series, approximation theorem, Fourier series
- The Limit and Continuity of Multivariate Functions: n-Dimensional Euclidean Space, the Limit and Continuity of Multivariate Functions, the Important Properties of Continuous Functions
- Differential theory of multivariate functions: partial derivatives, total differentials, directional derivatives and gradients, Taylor expansion of multivariate functions, implicit function theorems, properties of Jacobi matrices, function correlations, tangent planes of curves and tangent planes of surfaces, extreme value theory
- Integral with parametric variables: normal integral with parametric variables, generalized integral with parametric variables, Beta function and Γ function
- Re-integration: Jordan measurement in Rn, concept and property of re-integration, weighted integral as repetitive integral, variable substitution of re-integration, generalized re-integration, application of re-integration
- Line integral and area score: curve integral, surface integral, relationship between various integrals, curve integral and path-independent conditions

Course	**Linear Algebra B**				
Type of course	lecture	**Credit points**	2,0	**ECTS**	3,0
Workload : 90 hours (Weekly hours: 2)					
In Class	36 hours	Self-study after class		54 hours	

Contents of the lecture

- Determinants: permutations and inverse ordinal numbers, definition of n-order determinants, properties of determinants, determinants are expanded by rows (columns), Clem
- Matrix: the concept of matrix, matrix operation, block matrix, inverse matrix, elementary transformation and elementary matrix
- Linear correlation and rank of vectors: the concept of vectors and their linear operations, linear correlation of vectors, maximally linear independent groups of vectors and ranks, ranks of matrices
- Linear equations: the concept of linear equations, homogeneous linear equations, non-homogeneous linear equations
- Eigenvalues and eigenvectors of matrices: vector space, inner product and orthogonality of vectors,

eigenvalues and eigenvectors of matrices, similarities of matrices, diagonalization of real symmetric matrices

- Quadratic form: quadratic form and its standard form, transforming quadratic form into standard form, inertia theorem and canonical form, positive definiteness of quadratic form
- Linear space and linear mapping: linear space, basis and dimension, linear mapping, quotient space and direct sum
- Matrices, linear equations and determinants: basic operations of matrices, matrix and linear equations, determinants of square matrices
- Polynomials: basic concepts, roots of polynomials, factorization, introduction to multivariate polynomials
- Linear transformation: eigenvalue and eigenvector, invariant subspace, polynomial matrix method
- Bilinear type and Euclidean space: bilinear function, Euclidean space, linear transformation on Euclidean space, Hermite type and unitary space
- Affine space and projective space: affine space, affine transformation and motion, quadric surface, projective space

Course	**Probability Theory**				
Type of course	lecture	**Credit points**	2,0	**ECTS**	3,0
Workload : 90 hours (Weekly hours: 2)					
In Class	36 hours	Self-study after class		54 hours	

Contents of the lecture

- Classical Probability and Probability Space: Experiment and Event, Classical Probability, Geometric Probability, Probability Space, Nature of Probability, Conditional Probability and Multiplication Formula, Independence of Event, Full Probability Formula and Bayes Formula, Probability and Frequency
- Random variables and probability distributions: random variables and their independence, discrete random variables, continuous random variables, probability distribution functions, distributions of random variable functions, ρ quantiles of random variables
- Random vector and its distribution: random vector and its joint distribution, discrete random vector and its distribution, continuous random vector and its joint density, distribution of random vector functions, conditional distribution and conditional density, order statistics
- Mathematical expectations and variance: mathematical expectations, the nature of mathematical expectations, the variance of random variables, covariance and correlation coefficients, conditional mathematical expectations and entropy
- Introduction to stochastic processes: Poisson process, Markov chain, time series, strictly stationary

series

- Basic knowledge of probability theory: random events and probability, random variables and their distribution, numerical characteristics of random variables, the law of large numbers and central limit theorem
- Basic concepts of mathematical statistics: simple random samples, sampling distribution
- Parameter estimation: point estimation, maximum likelihood estimation based on truncated samples, selection criteria for estimators, interval estimation, interval estimation of the mean and variance of a normal population
- Hypothesis test: basic concepts of hypothesis test, hypothesis test for a single normal population parameter, hypothesis test for two normal population parameters, distribution fit test, independence test, rank sum test
- Regression analysis: univariate linear regression, multiple linear regression
- Analysis of variance: analysis of variance for one-factor experiments, analysis of variance for two-factor experiments
- Practical Multivariate Statistical Analysis: Basic concepts of multivariate analysis, parameter estimation and testing of multivariate normal distribution, principal component analysis, discriminant analysis, cluster analysis

2000 Physics and Mechanics Courses

Assigned modules:

2001 Physics B
2002 Physical Experiment B
2003 Electrotechnics
2004 Engineering Mechanics

Course	**Physics B**				
Type of course	lecture	**Credit points**	2,0	**ECTS**	3,0
Workload : 90 hours (Weekly hours: 2)					
In Class	36 hours	Self-study after class		54 hours	

Contents of the lecture

- Particle kinematics: space-time model and particle reference system, basic concepts of particle kinematics, natural equations of natural coordinate acceleration, translational reference frame transformation
- Newton's laws of motion: Newton's laws of motion, common forces in mechanics, examples of applications of Newton's laws, inertial forces in non-inertial reference frames
- Motion Theorem and Conservation Law: The concept of work, the kinetic energy theorem, the potential energy of a conservative force system, the functional theorem of a particle system, the conservation of mechanical energy, the momentum theorem of a particle and a particle system, the dynamics of a variable mass particle, the law of conservation of momentum of the centroid motion theorem, the reference system of the centroid , Collision, angular momentum theorem, angular momentum theorem, angular momentum theorem of particle system, conservation of angular momentum
- Rigid body rotation: rigid body fixed-axis rotation kinematics degree of freedom, rigid body fixed-axis rotation dynamics rotational inertia, rigid body plane motion-the combination of rigid body translation and rotation
- Basics of special relativity mechanics: deviations from Newtonian mechanics, two basic principles of special relativity, time delay and length contraction, relativistic speed transformation rules, relativistic dynamics
- Energy, heat and work of temperature: description of thermodynamic system, the zeroth law of

thermodynamics temperature, heat and work, first law of thermodynamics of internal energy, work of volume change

- Gas kinetic theory: Macro description and micro description of ideal gas, statistical regularity, statistical significance of pressure and temperature of ideal gas, energy sharing theorem, internal energy molar heat capacity of ideal gas, velocity and velocity distribution of gas molecules, Boltz Mann density distribution law, mean free path of collision of gas molecules
- The second law and entropy of cyclic thermodynamics: the quasi-static process of ideal gas, the conversion of heat and work, the efficiency of the cyclic process, the reversible Carnot cycle, the refrigeration cycle heat pump, the technical cycle, the classic expression of the second law of thermodynamics Irreversibility, Carnot's theorem
- Electrostatic field in vacuum: Coulomb's law of conservation of charge and electric charge, principle of superposition of electric field electric field strength vector field strength, electric flux Gauss theorem, loop theorem potential, image description of electric field
- Conductors and dielectrics in electrostatic fields: conductors in electrostatic fields, capacitors and capacitors, energy in electric fields, dielectrics in electrostatic fields
- Current and electric field: classic microscopic image of metal conduction, constant current and constant electric field, Ohm's law, Joule's law, power supply and its electromotive force, Kirchhoff's equations of constant circuit, transient process of RC circuit
- Constant magnetic field: Lorentz force Hall effect of magnetic induction intensity vector, magnetic field on current-carrying wire, magnetic moment of current-carrying coil, field equation of constant magnetic field in vacuum, magnetic field of current Biot-Savart law
- Electromagnetic induction: unifying the roads of "electricity" and "magnetism", the laws of electromagnetic induction, eddy electric fields, mutual and self-inductance, the energy of the transient magnetic field of LR circuits
- Maxwell's equations: displacement current, integral form of Maxwell's equations
- Light interference: interference of two beams of monochromatic light, interference of Young's wave splitting surface, double beam interference of split amplitude, multi-beam interference, optical film interference, coherence of light waves, interference of polarized light
- Diffraction of light: basic theory of light diffraction, Fresnel diffraction, Fraunhofer diffraction, multi-slit Fraunhofer diffraction and diffraction grating, several gratings, rigorous coupled wave analysis method

Course	**Physical Experiment B**				
Type of course	practice	**Credit points**	0,5	**ECTS**	1,0
Workload : 22,5 hours (Weekly hours: 0,5)					

In Class	9 hours	Self-study after class	13,5 hours

Contents of the lecture

- Measuring the moment of inertia of objects by torsion
- Determination of the modulus of elasticity of a metal wire by static method
- Standing wave experiment on a string
- Computer remote control Pasco series experiment-mechanics part
- Verification of Newton's second law of motion
- Verification of the law of conservation of momentum
- Study on Stress-Strain Characteristics of Elastic Materials
- Measurement of solid linear expansion coefficient by light lever method
- Cooling method to measure the specific heat capacity of metals
- Determination of specific heat capacity of air
- Measuring the EMF and Internal Resistance of the Power Supply with the Compensation Method
- Research on Volt-ampere Characteristics of Resistive Elements
- Hall method
- Use of an oscilloscope
- Research on Characteristics of Balanced Bridge and Unbalanced Bridge
- Adjustment and use of spectrometer
- Measuring the radius of curvature of a lens with a Newton's ring
- Measurement of refractive index and dispersion with Abbe refractometer
- Observation of and research on polarized light

Course	**Electrotechnics**				
Type of course	lecture and practice	**Credit points**	2,0	**ECTS**	3,0
Workload : 90 hours (Weekly hours: 2)					
In Class	36 hours	Self-study after class		54 hours	

Contents of the lecture

- Basic electrical quantities in the circuit, basic components and constraints in the circuit, the basic law of circuits - Kirchhoff's law

- The connection and equivalent transformation of the resistors, the equivalent transformation of the unsupported power supply and the associated power supply, the equivalent transformation of a controlled port-port network
- Rules of linear resistance circuit: superposition theorem, substitution theorem, Thevenin's theorem (Norton's theorem), maximum power transfer theorem, reciprocity theorem, duality principle
- Basic concepts such as sine quantity, phasor, phasor model, phasor diagram, complex impedance, complex admittance, phasor method analysis of sinusoidal steady-state AC circuit, the calculation of parameters like active power, reactive power, apparent power and complex power, characteristics of series resonant and parallel resonant circuits, basic concepts and analysis methods for three-phase circuits
- Circuit model of coupled inductor, mutual inductance voltage, analysis of coupled inductor and ideal transformer circuit.
- Nonlinear component and analysis of Nonlinear Resistor Circuits, the typical method is small signal analysis.
- The concept and calculation of the effective value of non-sinusoidal periodic current and voltage, the calculation of the average power of the non-sinusoidal periodic current circuit, harmonic analysis of non-sinusoidal periodic current circuits
- The first-order and second-order circuit differential equations, zero input response, zero state response of First Order Circuit
- Laplace transform, Laplace inverse transformation, Linear System Complex Frequency Domain Analysis, which lays foundation for automatic control principle course
- the Z parameter equation, the Y parameter equation, the T parameter equation, the H parameter equation and calculation of two port network parameters
- Basic knowledge of semiconductor: semiconductor diodes, transistors, field effect transistors
- Basic amplifying circuit: triode common-emitter, common-base, common-collector amplifier circuit, FET amplifier, introduces dynamic micro-variable equivalent circuit to analyze triode working status
- Constant current source circuit: mirror current source, small value current source and proportional current source, bipolar triode differential amplifying circuit and ideal integration operating amplifying circuit
- Proportional computing circuit, summing operational circuit, passive/active filter and voltage comparator
- Feedback amplifier circuit, introduces voltage, current, series, parallel, DC, AC negative feedback and the concept of deep negative feedback
- Signal generation circuit, sinus oscillation circuit: transformer feedback type, inductance feedback type, capacitive feedback type, non-sinusoidal signal generator includes rectangular wave, triangular wave, sawtooth wave generator
- Experiment

  -Study on the law of maximum power transfer

  -Improvement of Power Factor of String AC Circuit

  -Research on RLC Series Resonant Circuit

  -Transistor amplifier circuit

  -FET amplifier circuit

  -Design and debugging

  -Design of differential amplifier circuit

  -Audio amplifier

Course	Engineering Mechanics				
Type of course	lecture	Credit points	3,0	ECTS	4,5
Workload : 180 hours (Weekly hours: 3)					
In Class	54 hours	Self-study after class		81 hours	

Contents of the lecture

- Static axioms and force analysis of objects: basic concepts of statics, static axioms, force analysis of constraints and constrained objects
- Plane meeting force system and plane force couple system: geometric method for synthesis and equilibrium of plane meeting force system, analytical method for synthesis and equilibrium of plane meeting force system, concept and calculation of moment of plane force to point, plane force couple theory
- Plane general force system: Simplified principal vector and principal moment of plane general force system, equilibrium conditions and equations of plane general force system, equilibrium static indetermination and static indetermination of object system, calculation of plane truss and its internal force, friction problem
- Space general force system: space meeting force system, moment of force to point and moment of force to axis, space force couple, simplified principal vector and principal moment of space general force system to a point, equilibrium equation of space general force system and examples, center of gravity
- Kinematics of points: vector method of point motion, rectangular coordinate method of point motion, natural method of point motion
- Basic motion of rigid body: parallel movement of rigid body, fixed axis rotation of rigid body, speed and acceleration of each point in rigid body rotation, transmission ratio of gear train
- Synthetic motion of points: absolute motion relative motion implicated motion, point velocity synthesis theorem, implicated motion is the acceleration synthesis theorem at the point of translation, implicated motion is the acceleration synthesis theorem at the point of rotation
- Plane motion of a rigid body: Overview and simplification of plane motion of a rigid body, equations of motion and motion decomposition of a plane figure, velocity analysis of points in a plane figure, acceleration analysis of points in a plane figure
- Basic equations of particle dynamics: basic laws of dynamics, differential equations of motion of particles
- Momentum theorem: momentum and impulse, momentum theorem of the point system, mass center theorem
- Momentum moment theorem: momentum moment of particle and particle system, Momentum moment theorem, Rotational differential equation of rigid body about fixed axis, Moment of inertia of rigid body about axis, Momentum theorem of mass point relative to centroid, Differential equation of plane motion

of rigid body

- Kinetic energy theorem: concepts and calculations of work and kinetic energy, kinetic energy theorem, power and power equations, potential field and potential energy and their properties
- D'Alembert's principle: inertial force and D'Alembert's principle, simplification of rigid body inertial force system, dynamic restraint force of bearing when rigid body rotates around a fixed axis, concepts of static balance and dynamic balance
- Principles of virtual displacements: classification degrees of freedom and generalized coordinates of constraints, ideal constraints on virtual displacements and virtual work, principles of virtual displacements and their applications
- Universal Equations of Dynamics and Lagrange's Equations: Universal Equations of Dynamics, Lagrange's Equations, First Integration of Lagrange's Equations
- Collisions: Characteristics of collision phenomena and their assumptions, recovery coefficients, basic theorems for collision processes, concentric collisions of two objects

3000 Informatics Courses

Assigned modules: **3001** Basics of Information Technology
3002 Python Programming II

Course	**Basics of Information Technology**				
Type of course	lecture and practice	**Credit points**	2,0	**ECTS**	3,0
Workload : 90 hours (Weekly hours: 2)					
In Class	36 hours	Self-study after class		54 hours	

Contents of the lecture

- Overview of C language: the historical background of the emergence of C language, the characteristics of C language, a simple introduction to C program, the steps of using C program
- Data type, operator and expression: data type of C, constant and variable, integer data, real data, character data, variable initial value, mixed operation between various types of numeric data, arithmetic operator and arithmetic expression, assignment operator and assignment expression, comma operator and comma expression
- The simplest C programming - sequential programming: C statement overview, three basic structures of the program, assignment statement, the concept of data input and output and its implementation in C language, input and output of character data, format input and output, examples of sequential structure programming
- Select structure programming: relational operator and relational expression, logical operator and logical expression, if statement, switch statement
- Loop control: overview, goto statement and loop formed by goto statement, while, do | while statement, for statement, loop nesting, comparison of several loops, break statement and continue statement, program example
- Array: definition and reference of one-dimensional array, definition and reference of two-dimensional array, character array
- Function: general form of function definition, function parameters and function values, function calls, nested calls of functions, recursive calls of functions, arrays as function parameters, local and global variables, storage categories of variables
- Preprocessing command: macro definition, "file contains" processing

- Pointer: concept of address and pointer, pointer to variable and pointer variable to variable, pointer to array and pointer variable to array, pointer to string and pointer variable to string, pointer to function and pointer variable to function, function to return pointer value, pointer array and pointer to pointer, summary of pointer data type and pointer operation
- Structure and common body: methods for defining structure type variables, reference of structure variables, initialization of structure variables, structure array, pointer to structure type data, pointer processing linked list, common body
- Practical projects:
  -Topic (optional)
  -System function module structure diagram
  -Data structure design and usage instructions
  -Program structure (draw flow chart)
  -Functions of each module
  -Test results (including input data and output results)
  -Reference
  -Appendix: Procedure List

Course	**Python Programming II**				
Type of course	lecture and practice	**Credit points**	3,0	**ECTS**	4,5
Workload : 135 hours (Weekly hours: 3)					
In Class	54 hours	Self-study after class		81 hours	

Contents of the lecture

- Start: build a programming environment, build a Python programming environment in different operating systems, solve installation problems, run Python programs from terminals
- Variables and simple data types: run hello_ What happens when world.py, variables, strings, numbers, comments
- List introduction: What is a list, modify, add and delete elements, organize the list, avoid index errors when using the list
- Operation list: traverse the entire list, avoid indentation errors, create a numeric list, use a part of the list, tuple, set code format
- If statement: a simple example, if statement, use if statement to process the list, set the format of if statement
- Python loop statements: while loop, for loop
- Dictionary: a simple dictionary, using dictionary, traversing dictionary, nesting

- User input and while loop: how the function input() works, an introduction to the while loop, using the while loop to process lists and dictionaries
- Functions: define functions, pass arguments, return values, pass lists, pass any number of arguments, store functions in modules, function writing guide
- Class: create and use classes, use classes and instances, inherit, import classes, Python standard library, class coding style
- File and exception: read data from file, write file, exception, store data
- Experiment:
  -Python code base
  -Python list and application
  -Python tuples, dictionaries, collections and applications
  -Python selection and loop structure
  -Python function design application
  -Python object-oriented programming
  -Python file operation
  -Python exception handling and debugging

4000 Inorganic and Analytical Chemistry Courses

Assigned modules: **4001** Inorganic and Analytical Chemistry
4002 Experimental Chemistry I + Experimental Chemistry II

Course	**Inorganic and Analytical Chemistry**				
Type of course	lecture and practice	**Credit points**	4,0	**ECTS**	6,0
Workload : 180 hours (Weekly hours: 4)					
In Class	72 hours	Self-study after class		108 hours	

Contents of the lecture

- Atomic structure and element periodic system: the motion characteristics of microscopic particles, the motion state of extranuclear electrons, the electronic layer structure of atoms and element periodic system, the relationship between atomic structure and element properties
- Molecular structure and intermolecular force: introduction to ionic bond theory, covalent bond theory, bond parameters and bond polarity, intermolecular force and hydrogen bond
- Crystal structure: crystal structure characteristics and types, ionic crystal, atomic crystal and molecular crystal, metal crystal, mixed crystal and crystal defects
- Aggregation state of substances: gas, liquid and solution, phase change and phase diagram
- Fundamentals of chemical thermodynamics: basic concepts and terms of thermodynamics, first law of thermodynamics, thermal effect of chemical reaction, direction of chemical reaction
- Chemical reaction rate and chemical balance: chemical reaction rate, brief introduction to chemical reaction rate theory, factors affecting chemical reaction rate, chemical balance
- Error and data processing in quantitative analysis: experimental error and its expression method, statistical processing of experimental data, significant figures and their operation rules
- Acid-base equilibrium and acid-base titration: brief introduction to the development of acid-base theory, proton acid-base theory, calculation of equilibrium concentration in acid-base solution, movement of acid-base dissociation equilibrium, acid-base titration analysis, application of acid-base titration
- Precipitation-dissolution equilibrium and precipitation analysis: precipitation-dissolution equilibrium, precipitation titration, gravimetric analysis
- Oxidation-reduction reaction and oxidation-reduction titration: oxidation-reduction reaction and its

balance, galvanic cell and electrode potential, application of electrode potential, standard electrode potential diagram of elements and its application, oxidation-reduction titration

- Coordination equilibrium and coordination titration: basic concept of coordination compounds, chemical bond theory of complexes, stability of complexes in aqueous solution, application of complexes, coordination titration
- Main group elements: s-zone elements, p-zone elements, main group element compound properties review
- Transition elements: general properties of transition elements, titanium and vanadium, chromium, manganese, iron, copper, zinc
- Experiment:

-Purification of sodium chloride
-Preparation of sodium thiosulfate
-Preparation of ammonium ferrous sulfate
-Analytical balance weighing exercise
-Titration operation exercise
-Preparation of pure water by ion exchange method
-Determination of molar mass by freezing point reduction method
-Determination of neutralization heat
-Determination of chemical reaction rate and activation energy
-Determination of standard dissociation constant and dissociation degree of acetic acid
-Dissociation equilibrium in aqueous solution
-Self-determination of solubility product and heat of dissolution of silver sulfate
-Redox reaction
-Determination of solubility product of silver halide by potentiometric method
-Formation and properties of complex

Course	**Experimental Chemistry I + Experimental Chemistry II**				
Type of course	lecture and practice	**Credit points**	2,5	**ECTS**	4,0
Workload : 112,5 hours (Weekly hours: 2,5)					
In Class	45 hours	Self-study after class		67,5 hours	
Contents of the lecture					
• Basic Chemistry Experiment -Basic Operations in Chemical Experiments					

-Preparation and concentration calibration of acid-base standard solution
-Calibration of volumetric vessels
-Balance and weighing
-Determination of chemical reaction rate and activation energy
-Determination of dissociation degree and dissociation constant of acetic acid
-Preparation and water quality analysis of deionized water
-Determination of heat of combustion of benzoic acid
-Determination of liquid viscosity
-Spectrophotometric determination of phosphorus with ammonium molybdate
-Determination of composition and stability constant of coordination compounds
-Determination of solubility product of $BaSO_4$ by conductivity method
-Determination of fluorine in water with fluorine ion selective electrode
-Determination of electrode potential
-Determination of calcium and magnesium in eggshell
-Identification and quantitative analysis of trace elements in tea
-Determination of total hardness of natural water

- Comprehensive Chemistry Experiment

-Determination of copper in copper salt by indirect iodometry
-Determination of Iron in Water Samples by o-Phenanthroline Spectrophotometry
-Determination of chlorine content in soluble chloride (design experiment)
-Determination of critical micelle concentration CMC of surfactants
-Adsorption of solid from solution
-Vapor-liquid equilibrium phase diagram of double liquid system
-Determination of saponification reaction rate constant of ethyl acetate
-Determination of distillation and boiling point
-Preparation of acetaldehyde
-Preparation of bromoethane
-Preparation of benzoic acid
-Preparation of ethyl acetate
-Reaction rate of hydrolysis of tert-butyl chloride
-Separation and identification of unknown ions
-Determination of iron, aluminum and calcium

5000 Organic and Environmental Chemistry Courses

Assigned modules: **5001** Organic Chemistry
5002 Environmental Chemistry

Course	**Organic Chemistry**				
Type of course	lecture and practice	**Credit points**	3,0	**ECTS**	4,5
Workload : 135 hours (Weekly hours: 3)					
In Class	54 hours	Self-study after class		81 hours	

Contents of the lecture

- Introduction: Research Objects of Organic Chemistry, Structural Features in Organic Compounds, Classification of Organic Compounds
- Saturated hydrocarbons: the general formula and structure of saturated hydrocarbons, the names of saturated hydrocarbons, the properties of saturated hydrocarbons, the sources of saturated hydrocarbons
- Unsaturated aliphatic hydrocarbons (olefins, alkynes, diolefins): the classification and structure of unsaturated aliphatic hydrocarbons, the names of unsaturated aliphatic hydrocarbons, the properties of unsaturated hydrocarbons, the sources and production methods of unsaturated aliphatic hydrocarbons
- Aromatic hydrocarbons: Classification and naming of aromatic hydrocarbons, structure of benzene, properties of aromatic hydrocarbons, localization of electrophilic substitution reactions on benzene rings, fused ring aromatic hydrocarbons, sources of aromatic hydrocarbons
- Halogenated hydrocarbons: Classification and naming of halogenated hydrocarbons, properties of halogenated hydrocarbons, halogenated olefins and halogenated aromatic hydrocarbons, methods for preparing halogenated hydrocarbons
- Alcohol, phenol, ether
- Aldehydes and Ketones: Classification and Nomenclature of Aldehydes and Ketones, Properties of Aldehydes and Ketones, Laboratory Preparation and Industrial Production of Aldehydes and Ketones
- Carboxylic acids and their derivatives: carboxylic acids, carboxylic acid derivatives, methods for preparing carboxylic acids
- Nitrogen-containing organic compounds: nitro compounds, amines, diazo compounds and azo compounds, nitriles

- Heterocyclic compounds: classification and naming of heterocyclic compounds, five-membered heterocyclic compounds, six-membered heterocyclic compounds
- Carbohydrate amino acid protein nucleic acid: carbohydrate, amino acid, protein, nucleic acid
- Experiment

-Atmospheric distillation (ethanol and cyclohexanone)
-Recrystallization (benzoic acid and naphthalene)
-Determination of melting point and boiling point
-Determination of ethanol content in mixture by gas chromatography
-Qualitative analysis of benzoic acid and ethyl acetate by infrared spectroscope
-Preparation and qualitative identification of cyclohexene
-Synthesis and melting point determination of adipic acid
-Preparation of isobutyl acetate and its refractive index determination
-Synthesis of n-butyl ether
-Synthesis of ethyl acetate
-Synthesis and structure identification of aspirin
-Synthesis and structure identification of 2-methyl-2-hexanol
-Synthesis of ether
-Synthesis, structure identification and content determination of isoamyl acetate
-Extract caffeine from tea
-Vacuum distillation, synthesis and structure identification of cinnamic acid
-Preparation and property test of ethyl acetoacetate
-Application of Column Chromatography and Thin Layer Chromatography
-Synthesis of Methyl Orange
-Determination of the viscosity of absolute ethanol and calculation of flow activation energy
-Static method to determine the saturated vapor pressure of absolute ethanol and calculate the evaporation enthalpy
-Determination of the equilibrium constant of the decomposition reaction of ammonium carbamate and calculation of the reaction enthalpy change
-Determination of combustion heat of naphthalene and calculation of isobaric reaction heat
-Measurement of reversible electromotive force of primary battery
-Conductivity method to measure the ionization constant of weak electrolyte and the solubility product of insoluble electrolyte

Course	Environmental Chemistry				
Type of course	lecture and practice	**Credit points**	1,5	**ECTS**	2,5
Workload : 67,5 hours (Weekly hours: 1,5)					
In Class	27 hours	Self-study after class		40,5 hours	

Contents of the lecture

- Introduction: concept of environmental chemistry, research contents of environmental chemistry and its branches, characteristics and development trend of environmental chemistry
- Atmospheric pollution chemistry: the main pollutants of the atmosphere and the atmosphere, the basic principle of atmospheric photochemical reaction, the important free radical reaction in atmospheric pollution, the conversion of nitrogen oxides, the conversion of carbon oxides, the conversion of sulfur dioxide, photochemical smog, aerosol chemistry, acid rain, global pollution
- Water pollution: water and water pollutants, adsorption of pollutants by particles in water, conversion reaction of heavy metal pollutants, behavior of several heavy metals in water, water environmental chemistry of organic pollutants
- Soil pollution chemistry: formation, composition and properties of soil, soil pollution chemistry, land treatment system
- Pollution ecological chemistry: biological absorption and biological concentration mechanism of chemical substances, chemical mutagenesis, chemical teratogenicity and chemical carcinogenesis, biochemical effect of common toxic substances, elements and health, microbial transformation and degradation of compounds in the environment
- Chemical principles of environmental analysis: chemical principles of analysis of major air pollutants, chemical principles of analysis of major water pollutants, chemical principles of analysis of major soil pollutants
- Principles of pollution control chemistry: principles of air pollution control chemistry, water pollution control chemistry, solid waste control chemistry
- Experiment:
  -Photocatalytic oxidation of linear alkanes in ambient air
  -Daily variation of NO and NO content in the air near the main traffic line
  -Reaction of olefins with ozone in ambient air
  -Simulation of SO liquid-phase oxidation in ambient air
  -Measurement and evaluation of greenhouse gas effect
  -Main ionic composition of natural water

6000 Physical Chemistry Courses

Assigned modules: **6001** Physical Chemistry and Colloid Chemistry

Course	**Physical Chemistry and Colloid Chemistry**				
Type of course	lecture and practice	**Credit points**	2,0	**ECTS**	3,0
Workload : 90 hours (Weekly hours:2)					
In Class	36 hours	Self-study after class		54 hours	

Contents of the lecture

- The first law of thermodynamics: Introduction to thermodynamics, the establishment of the first law of thermodynamics and its mathematical expressions, calculation of work, calculation of enthalpy, heat, nutritional meals, energy saving and emission reduction, Joule-Thomson effect and throttling in refrigerator and air conditioning processes Expansion, non-isothermal reaction and fuel maximum combustion temperature estimation and rocket propellant
- The second law of thermodynamics: the establishment of the second law of thermodynamics and its mathematical expressions, the calculation of entropy changes and the application of entropy criteria, Gibbs free energy and Helmholtz free energy, ΔG calculation and Gibbs free energy criterion, the importance of thermodynamic functions Relationships, non-equilibrium thermodynamics and dissipative structures, multicomponent systems thermodynamics
- Phase Equilibrium: Phase Law, Phase Equilibrium of One-Component System——Clapeyron Equation, Phase Diagram of Two-Component System, Phase Diagram of Three-Component System and Its Applications
- Chemical equilibrium: Van't Hoff constant temperature formula for calculating the direction and limits of chemical reactions, a measure of the limits of chemical reactions—K, the influence of external factors on chemical equilibrium
- Statistical Thermodynamics: An Introduction, Boltzmann Statistics and Partition Functions and Their Relationship with Thermodynamic Functions, Application Examples
- Interface phenomena: interface and surface, surface work, specific surface Gibbs free energy or surface tension, curved surface phenomenon, solid surface adsorption phenomenon, solution surface adsorption phenomenon—Gibbs adsorption isotherm, surfactants and their effects

- Chemical kinetics: definition and determination of reaction rate, effect of concentration on chemical reaction rate, effect of temperature on reaction rate, compound reaction and approximate treatment method, determination of reaction mechanism, effect of catalyst on reaction rate, elementary reaction rate theory, Reaction in solution, photochemical reaction
- Electrochemistry: electrolyte solution, reversible battery emf and its application, irreversible electrode process
- Colloid Chemistry: Classification and Characteristics of Dispersion Systems, Preparation and Purification of Sols, Properties of Sols, Stability and Settling of Sols
- Introduction: colloid dispersion system, research content of colloid chemistry, preparation and purification of colloid, principle of coagulation method, purification of colloid
- Infiltration, diffusion and sedimentation: Brownian motion, osmotic pressure and Donnan equilibrium, diffusion, sedimentation
- Light scattering: Rayleigh light scattering theory, solution light scattering - Debye theory, RGD light scattering theory and its application
- Double-electric layer and electrokinetic theory: the reason for the charge on the solid surface, the classical theory of diffusion double-electric layer, the Stem double-electric layer theory, electrophoresis and potential theory, electroosmosis and flow potential, the measurement of electroosmosis parameters
- Stability and sedimentation of colloidal dispersion system: classical stability theory - DLVO theory, stability of adsorbed polymer to colloid - space stability theory, stability of free polymer to colloid - vacancy stability theory, sedimentation of colloidal dispersion system
- Experiments:
  -Determination of the relative molecular mass of a substance by the freezing point reduction method
  -Determination of combustion heat
  -Heat of solution
  -Drawing of two-liquid gas-liquid equilibrium phase diagram
  -Measurement and application of electromotive force of primary battery
  -Preparation of silver-silver chloride electrode and determination of its thermodynamic function
  -Measurement of potential-pH curve
  -Measurement and application of electrical conductivity
  -Determination of Rate Constant of Saponification of Ethyl Acetate by Conductivity Method
  -Determination of the rate constant of sucrose conversion by polarimetry
  -Combustion and Smoke Suppression of Fuel Additives and Determination of Fuel Combustion Tail Gas
  -Formulation and characterization of detergents
  -Anodizing and surface coloring of aluminum
  -Preparation, Structure Characterization and Photocatalytic Performance of Ni-Doped Ti02 Photocatalyst

7000 Biology and Microbiology Courses

Assigned modules: **7001** Fundamental Microbiology + Experiment in Basic Microbiology
7002 Environmental Engineering Microbiology + Experiment in Environmental Engineering I

Course	Fundamental Microbiology + Experiment in Basic Microbiology				
Type of course	lecture and practice	Credit points	2,5	ECTS	4,0
Workload : 112,5 hours (Weekly hours: 2,5)					
In Class	27 hours	Self-study after class		40,5 hours	

Contents of the lecture

- Prokaryotic microorganisms: bacteria, actinomycetes, archaea, wall-deficient bacteria, cyanobacteria
- Eukaryotic microorganism: yeast, mold, mushroom
- Virus: nature of virus, proliferation of virus, evolution of virus, sub-virus factors, detection and prevention principles of virus infection, application of virus
- Classification of microorganisms: overview of microbial taxonomy, classification system of microorganisms, classification units and grades of microorganisms, naming of microorganisms, qualified publication of new microbial species names, international preservation of new microbial species, polyphasic classification of prokaryotic microorganisms, classification methods of fungi
- Microbial nutrition: the nutritional needs of microorganisms, culture media, transportation of nutrients
- Microbial growth, reproduction and control: individual growth of bacteria, determination of microbial growth, colony growth and reproduction of bacteria, growth and reproduction of fungi, influence of environment on microbial growth, control of microbial growth and reproduction
- Microbial metabolism: microbial energy metabolism, microbial unique anabolism, microbial catabolism, microbial metabolic regulation
- Microbial genetics and breeding: material basis of genetic variation, gene mutation and mutation breeding, gene recombination and cross breeding, decline, rejuvenation and preservation of strains
- Microorganism and genetic engineering: overview of genetic engineering, microorganism and cloning vector, microorganism and genetic engineering tool enzyme, operation process of genetic engineering, microbial genome, prospect of genetic engineering

- Microbial ecology: microorganisms in the ecological environment, microbial molecular ecology, the relationship between microorganisms, the status and role of microorganisms in the ecosystem, microorganisms and environmental protection
- Infection and immunity: infection pathway and pathogenicity of microorganisms, non-specific immunity, specific immunity, immunological technology and application
- Experiment:
  -Isolation, purification and culture characteristics of microorganisms
  -Staining method and morphological observation of bacteria
  -Sugar Fermentation and Starch Hydrolysis Experiment
  -Preparation and transformation of Escherichia coli receptive cells
  -Immobilization of yeast cells and alcohol fermentation
  -Molecular biological identification of bacteria
  -Prokaryotic expression of foreign genes

Course	**Environmental Engineering Microbiology + Experiment in Environmental Engineering I**				
Type of course	lecture and practice	**Credit points**	3,0	**ECTS**	4,5
Workload : 135 hours (Weekly hours: 3)					
In Class	54 hours	Self-study after class		81 hours	

Contents of the lecture

- Introduction: formation and development of environmental microbiology, research objects and tasks of environmental microbiology, overview of microorganisms
- Viruses: characteristics and classification of viruses, morphology and structure of viruses, sub-viruses and emerging viruses, proliferation process of viruses, cultivation and counting of viruses, impact of environmental factors on viruses and survival of viruses
- Prokaryotic microorganisms: bacteria, archaea, actinomycetes, cyanobacteria, other prokaryotic microorganisms
- Eukaryotic microorganisms: protozoa, micro metazoa, eukaryotic algae, fungi
- Physiology of microorganisms: catalysts for biological activities - enzymes, microbial nutrition, microbial energy metabolism, microbial anabolism
- The growth of microorganisms and the impact of environmental factors: the growth of microorganisms, the environmental factors that affect the growth of microorganisms
- Microbial heredity and variation: phenomenon and significance of microbial heredity and variation, microbial heredity, microbial variation

- Microbial ecology: ecological principles, microorganisms in soil, air, water, the relationship between microorganisms and animals and plants
- The role of microorganisms in the environmental material cycle: the material cycle of nature, the microbial and carbon cycle, the microbial and nitrogen cycle,
- Microorganism and sulfur cycle, microorganism and phosphorus cycle
- Microbial and environmental pollution control and treatment: microorganisms in aerobic biological treatment of wastewater, microorganisms in anaerobic biological treatment,
- Denitrogenation and dephosphorization of wastewater, microorganism in organic solid waste treatment, microorganism in waste gas biological treatment, environmental monitoring and microorganism, environmental bioremediation technology and microorganism, microorganism and atmospheric CO2 fixation
- Application of new microbiological technology in the field of environmental science: immobilization technology, microbial flocculant, application of molecular biotechnology in the field of environmental science, principle and application of non-cultivation technology of microorganisms
- Environmental microbiology experiment: experimental instructions, use of optical microscope and observation of individual morphology of prokaryotic microorganisms, observation of individual morphology of eukaryotic microorganisms, identification of colony morphology of four major categories of microorganisms, direct counting of microbial cells and microscopic measurement of cells, simple staining and Gram staining of bacteria, preparation and sterilization of culture medium, pure separation and culture of bacteria in activated sludge,
- Observation of pure cultured bacteria and colony morphology, determination of bacterial amylase, determination of total bacterial colonies, detection of total coliform bacteria, detection of thermotolerant coliform bacteria, extraction of total DNA in environmental samples, 16S rDNA gene fragment in total DNA amplified by PCR and agarose gel electrophoresis
- Experiment:
  -Cultivation and operation of microorganisms
  -Observation of microorganisms
  -Simple staining and Gram staining of bacteria
  -Determination of growth curve of Escherichia coli
  -Isolation and purification of microorganisms in soil
  -Determination method of MLSS and MLVSS of activated sludge
  -Detection of microorganism quantity in air by sedimentation method

8000 Environmental Science and Engineering Courses

Assigned modules:

8001 Discipline Introduction
8002 Environmental Science
8003 Soil Science + Experiment in Soil Science
8004 Principles of Environmental Engineering
8005 Environmental Planning
8006 Environmental Monitoring + Experiment in Environmental Engineering II (Environmental Monitoring)
8007 Treatment, Disposal and Resource of Solid Wastes + Experiment in Environmental Engineering IV (Treatment, Disposal and Resource of Solid Wastes)
8008 Control and Remediation of Soil Pollution
8009 Environmental Supervision
8010 Engineering of Water Pollution Control + Experiment in Environmental Engineering III (Water Pollution Control Project)
8011 Environmental Impact Assessment
8012 Air Pollution Control Engineering
8013 Physical Pollution Control
8014 Productive Practice
8015 Air Pollution Control Design
8016 Water Pollution Control Design
8017 Solid Waste Control Design
8018 Practical Training in Environmental Monitoring
8019 Integrated Practical Training in Environmental Engineering

Course	**Discipline Introduction**				
Type of course	lecture	**Credit points**	1,0	**ECTS**	1,5
Workload : 45 hours (Weekly hours: 1)					
In Class	18 hours	Self-study after class		27 hours	
Contents of the lecture					

- Introduction: environment, overview of sustainable development, ecosystem and environment, man and environment, energy and environment, introduction to environmental pollution control methods
- Water pollution and control: overview, physical treatment, biological treatment, physical chemistry and chemical treatment, removal of nitrogen and phosphorus in wastewater, sludge treatment, water treatment system
- Air pollution and control: overview, diffusion of air pollutants, air pollution control engineering
- Solid waste treatment and application: overview, solid waste treatment principles and technologies, hazardous waste treatment, municipal waste treatment
- Noise pollution and thermal pollution: pollution sources, noise control methods, thermal pollution prevention

Course	**Environmental Science**				
Type of course	lecture	**Credit points**	1,0	**ECTS**	1,5
Workload : 45 hours (Weekly hours: 1)					
In Class	18 hours	Self-study after class		27 hours	

Contents of the lecture

- Introduction: environmental overview, environmental science
- Contemporary environmental issues: the relationship between environmental issues and socio-economic development, global environmental issues
- Ecological environment: ecological basis, ecology and environmental protection
- Population and environment: population growth and control, world population in the next 100 years, environmental protection and population control
- Energy and environment: relationship between energy and environment, exploration and development of new energy
- Atmospheric environmental pollution: atmospheric pollution, formation mechanism of global atmospheric environmental problems and countermeasures
- Water environmental pollution: basic concept of water resources, water pollution
- Soil pollution: composition and nature of soil, soil environmental pollution
- Noise pollution and microwave pollution: concept of noise, noise control standard, microwave pollution and human health
- Comprehensive utilization and disposal of solid waste: types of solid waste, comprehensive utilization of solid waste, treatment, treatment and utilization of hazardous waste, treatment, treatment and utilization of urban garbage

- Utilization and protection of resources: natural reserves, utilization and protection of land resources, utilization and protection of forest resources, utilization and protection of mineral resources
- Introduction to environmental economics: the origin, development and current situation of environmental economics, the discipline system of environmental economics, the frontier, characteristics and research methods of environmental economics
- Environmental planning: overview of environmental planning, role and purpose of environmental planning, basic methods and principles of environmental planning
- Environmental monitoring: the role and purpose of environmental monitoring, the characteristics of environmental pollutants, the characteristics of environmental pollution and pollutant analysis methods, environmental monitoring design and quality control
- Environmental quality assessment: environmental quality status assessment, environmental quality impact assessment
- Environmental law and environmental standards: environmental management system and environmental law, environmental standards, principles and methods for formulating environmental quality standards and pollutant discharge standards

Course	**Soil Science + Experiment in Soil Science**				
Type of course	lecture and practice	**Credit points**	2,0	**ECTS**	3,0
Workload : 90 hours (Weekly hours: 2)					
In Class	36 hours	Self-study after class		54 hours	

Contents of the lecture

- Soil formation and classification: basic concepts, soil formation process and classification, soil texture and composition
- Basic characteristics of soil: soil acid-base reaction, soil exchange and absorption performance, soil nutrients, soil structure and porosity, soil aeration, soil thermal status
- Soil moisture: soil moisture type, soil moisture energy state, soil moisture movement, soil moisture and field moisture monitoring
- Soil cultivation and management: regional and seasonal changes of farmland soil moisture, relationship between cultivation and soil moisture, relationship between fertilization and soil moisture, conservation tillage technology
- Improvement and rational utilization of low-yield fields: saline-alkali soil improvement, aeolian sandy soil and desert soil improvement, low-yield red soil improvement, waterlogged paddy soil improvement
- Crop and water relationship: crop water physiology, crop and water ecological relationship, crop water

demand law and requirements for irrigation and drainage

- Irrigation technology for main crops: rice, wheat, soybean, cotton and sugar beet
- Water-saving farming system: the biological basis for saving water and increasing yield of crops, developing water-saving farming system
- Experiment:

-Observation and record of soil profile
-Collection, treatment and preservation of soil samples
-Determination of soil pH, conductivity and soluble salt
-Determination of soil moisture content
-Determination of soil moisture constant
-Determination of soil moisture characteristic curve
-Determination of saturated hydraulic conductivity of soil (ring knife method)
-Determination of water content in plant tissue
-Determination of water potential of plant tissue
-Determination of crop transpiration intensity by rapid weighing method

Course	**Principles of Environmental Engineering**				
Type of course	lecture and practice	**Credit points**	2,0	**ECTS**	3,0
Workload : 90 hours (Weekly hours: 2)					
In Class	36 hours	Self-study after class		54 hours	

Contents of the lecture

- Fundamentals of Environmental Engineering
- Mass balance and energy balance: commonly used physical quantities, mass balance, energy balance
- Fluid flow: balance equation of pipe flow system, internal friction of fluid flow, boundary layer theory, resistance loss of fluid flow, pipeline calculation, fluid measurement
- Heat transfer: the way of heat transfer, heat conduction, convection heat transfer, radiation heat transfer, heat exchanger
- Mass transfer: Mass transfer process in environmental engineering, basic principles of mass transfer, molecular mass transfer, convective mass transfer
- Settlement
- Filter
- Absorb
- Adsorption

- Other separation processes
- Basics of Reaction Kinetics
- Analytical method of reaction kinetics
- Homogeneous chemical reactor
- Heterogeneous chemical reactor
- Microbial reactor
- Experiment:

  -Common indicators and analysis methods in water treatment experiments

  -Common indicators and analysis methods in air pollution control experiments

  -Common indicators and analysis methods in solid waste treatment and disposal experiments

  -Coagulation sedimentation process experiment

  -Bacterial growth curve measurement experiment

  -Design experiment of biological treatment scheme for industrial wastewater

  -Measurement experiment of kinetic coefficient of activated sludge method

Course	**Environmental Planning**				
Type of course	lecture	**Credit points**	1,0	**ECTS**	1,5
Workload : 45 hours (Weekly hours: 1)					
In Class	18 hours	Self-study after class		27 hours	

Contents of the lecture

- Overview of environmental planning and management: foundation of management science, environmental management, environmental planning and its specific content, theoretical basis of environmental management
- Technical support for environmental planning management: environmental monitoring, environmental standards, environmental prediction, environmental decision-making, environmental statistics, environmental audit, environmental management information system
- Environmental management system and functions: environmental management system, responsibilities of environmental management departments, responsibilities of environmental protection departments at all levels, problems and countermeasures of China's environmental management system
- Environmental management policy and system: environmental management policy, environmental management policy, environmental management system
- Laws and regulations on environmental management: principles and systems of environmental protection law, environmental legal responsibilities, legal provisions on resources and environmental protection

- Regional environmental planning: procedures and contents of regional environmental planning, regional air pollution control planning, regional water environment planning, solid waste management planning, noise pollution control planning
- Ecological planning: the concept and content of ecological planning, the concept of ecological planning, the objectives of ecological planning

Course	**Environmental Monitoring + Experiment in Environmental Engineering II (Environmental Monitoring)**				
Type of course	lecture and practice	**Credit points**	3,5	**ECTS**	5,5
Workload : 157,5 hours (Weekly hours: 3,5)					
In Class	63 hours	Self-study after class		94,5 hours	

Contents of the lecture

- Introduction: Purpose and classification of environmental monitoring, characteristics of environmental monitoring and overview of monitoring technology, environmental standards
- Water and wastewater monitoring: water pollution and water quality monitoring, water quality monitoring plan formulation, water sample collection and storage, water sample pretreatment, physical index inspection, determination of metal compounds, determination of non-metallic inorganic substances, determination of organic pollutants, bottom Determination of quality and activated sludge properties
- Air and waste gas monitoring: basic knowledge of air pollution, formulation of air pollution monitoring plans, air sample collection methods and samplers, determination of gaseous and vaporous pollutants, determination of particulate matter, air quality index, precipitation monitoring, indoor ambient air quality monitoring , Pollution source monitoring, standard gas preparation
- Solid waste monitoring: overview of solid waste, collection and preparation of solid waste samples, monitoring methods of hazardous characteristics, monitoring of domestic waste, toxicological research methods of hazardous substances
- Soil quality monitoring: basic soil knowledge, soil environmental quality monitoring plan, soil sample collection, processing and management, soil sample pretreatment, soil pollutant determination
- Environmental pollution biological monitoring: water environmental pollution biological monitoring, air pollution biological monitoring, soil pollution biological monitoring, ecological monitoring
- Physical pollution monitoring: noise and vibration pollution monitoring, nuclear and electromagnetic radiation monitoring, light and thermal pollution monitoring
- Remote sensing monitoring: basic remote sensing, atmospheric environment remote sensing monitoring, water environment remote sensing monitoring, ecological environment remote sensing monitoring, "3S" application in environmental monitoring

- Automatic monitoring of environmental pollution: continuous automatic monitoring system for ambient air quality, automatic monitoring system for surface water quality, automatic environmental noise monitoring system, continuous automatic monitoring system for pollution sources, environmental monitoring network, environmental emergency monitoring, simple monitoring
- Environmental monitoring management and quality assurance: environmental monitoring management, result presentation and statistical inspection of monitoring data, laboratory quality assurance, standard analysis methods and analysis method standardization, environmental reference materials, quality assurance checklists and environmental quality maps
- Experiment and Practice:
  -Determination of color, turbidity, acidity and alkalinity of water samples
  -Determination of Dissolved Oxygen in Water by Iodometry
  -Determination of ammonia nitrogen, nitrite nitrogen and nitrate nitrogen in water
  -Valence state analysis of chromium in industrial wastewater
  -Determination of sulfur dioxide in the atmosphere
  -Gas Chromatographic Determination of Benzene Compounds in the Air
  -Determination of mercury in soil by cold atomic absorption method
  -Catalytic Polarography Determination of Molybdenum in Crops

Course	**Treatment, Disposal and Resource of Solid Wastes + Experiment in Environmental Engineering IV (Treatment, Disposal and Resource of Solid Wastes)**				
Type of course	lecture and practice	**Credit points**	4,0	**ECTS**	6,0
Workload : 180 hours (Weekly hours: 4)					
In Class	72 hours	Self-study after class		108 hours	

Contents of the lecture

- Introduction: Knowledge about solid waste disposal, treatment and sustainable use, content of solid waste disposal, treatment and sustainable use, development trends of solid waste disposal, treatment and sustainable use, solid waste disposal, treatment and venous industry
- The main separation technology basis for solid waste disposal, treatment and sustainable use
- Physical unit operation technology: solid-solid separation technology, solid-liquid separation technology, solid-gas separation technology, molding granulation technology
- Physical and chemical treatment technologies for solid waste disposal, treatment and sustainable utilization: thermal stability and pyrolysis separation technology, solid waste recycling technology
- Biotechnology for solid waste disposal, treatment and sustainable use: Overview of biotechnology for

solid waste disposal, treatment and sustainable resource utilization, biological recovery and utilization of environmental resources polluted by petroleum solid waste, microbial desulfurization technology for petroleum solid waste, solid waste resources Utilized biological flotation, adsorption and special material degradation, biological reuse of mineral resources, biological deodorization technology of the environment in the solid waste treatment process, agricultural resource utilization of industrial waste, biological recovery technology of solid waste resources

- The application and practice of metal solid waste disposal, treatment and sustainable utilization technology: the recycling of precious metals, the recycling of catalysts, the treatment technology of electroplating sludge, the recycling of magnetic materials, the recycling of rare metals, the recycling of scrap cars Recycling, recycling and utilization of aluminum, recycling of waste batteries
- Application and practice of non-metallic and nuclear waste disposal, treatment and sustainable utilization technology
- Final disposal of solid waste
- Experiment:

-Sampling and preparation of solid waste
-Characteristic analysis of domestic waste
-Determination and analysis experiment of solid, dissolved solid and suspended solid
-Determination of chloride in landfill leachate
-Determination of total phosphorus in municipal solid waste
-Determination of organic matter in solid waste -- Volumetric method and combustion method
-Sludge dewatering experiment
-Analysis of organic matter in solid waste
-Determination of pH value of solid waste
-Leaching experiment of landfill leachate
-Determination of available phosphorus in solid waste
-Analysis of alkali-hydrolyzed nitrogen content of solid waste
-Identification of leaching toxicity (heavy metals) of solid waste
-Comprehensive utilization of plant residues

Course	**Control and Remediation of Soil Pollution**				
Type of course	lecture	**Credit points**	1,0	**ECTS**	1,5
Workload : 45 hours (Weekly hours: 1)					
In Class	18 hours	Self-study after class		27 hours	

Contents of the lecture
• Introduction: the importance of soil environment, the problem of soil pollution, the content and task of soil pollution prevention • Basic characteristics of soil: basic composition of soil, soil properties, material cycle and energy conversion of soil environment • Overview of soil pollution: soil environmental pollution, soil environmental background value and environmental capacity, soil pollutants and pollution sources, migration and transformation characteristics of soil pollutants • Inorganic pollution of soil environment: heavy metal pollution of soil, non-metallic pollution of soil, radioactive element pollution of soil • Organic pollution of soil environment: pesticide pollution of soil, oil pollution of soil, polycyclic aromatic hydrocarbon pollution of soil, hormone pollution of soil environment, sludge pollution of soil environment, impact of fly ash on soil environment, agricultural solid waste pollution of soil environment • Soil environment and agricultural non-point source pollution: overview of agricultural non-point source pollution, soil phosphorus and agricultural non-point source pollution • Monitoring and assessment of soil environmental pollution • Overview of soil pollution remediation • Remediation and prevention of heavy metal pollution in soil • Remediation and prevention of soil organic pollution

Course	Environmental Supervision				
Type of course	lecture	Credit points	1,0	ECTS	1,5
Workload : 45 hours (Weekly hours: 1)					
In Class	18 hours	Self-study after class		27 hours	

Contents of the lecture
• General: environmental issues and environmental supervision, organization of environmental supervision, environmental supervision and law enforcement • Implementation of environmental protection law: system of environmental protection law, legal system of environmental protection, legal responsibility of environmental protection • Pollution source supervision and management: concept of pollution source supervision, pollution source supervision and management, methods of on-site pollution source supervision, environmental supervision of construction projects and pollution prevention facilities, ecological environment supervision

- Technical methods of pollution source monitoring: selection and sampling methods of industrial waste water monitoring projects, selection and sampling methods of industrial waste gas monitoring projects, environmental noise monitoring methods
- Environmental standards: formation of environmental standard system, brief introduction of main environmental standards
- Collection and management of pollution charge: pollution charge system, pollution charge collection procedure, pollution charge collection standard and calculation method
- Administrative acts of environmental supervision: administrative acts in environmental supervision, procedures for administrative punishment of environmental protection, administrative reconsideration and administrative litigation of environmental protection
- Investigation and handling of environmental pollution accidents and pollution disputes: investigation and handling of environmental pollution accidents, investigation and handling of environmental pollution disputes, China's legal system of environmental tort relief, matters needing attention in handling environmental pollution accidents and pollution disputes, environmental complaint reporting system and environmental protection reporting system
- Case analysis of environmental supervision: punishment for violation of environmental protection regulations of construction projects, violation of the Regulations on the Administration of the Collection and Use of Pollutant Discharge Fees, violation of the regulations on the management of pollutant discharge, violation of the on-site inspection system, compensation for damage caused by environmental pollution accidents

Course	**Engineering of Water Pollution Control + Experiment in Environmental Engineering III (Water Pollution Control Project)**				
Type of course	lecture and practice	**Credit points**	5,0	**ECTS**	7,5
Workload : 225 hours (Weekly hours: 5)					
In Class	90 hours	Self-study after class		135 hours	

Contents of the lecture

- Introduction: water resources and water cycle, water quality and water quality standards, water pollution, water pollution prevention
- Physical treatment method: homogenization method, interception method, gravity separation method
- Physical and chemical treatment methods: adsorption method, ion exchange method, air flotation method, membrane separation method, other physical and chemical treatment methods

- Activated sludge method: basic principle, parameters of activated sludge method, aeration principle and aeration system, process type of activated sludge method, process design of activated sludge method
- Biofilm method: basic principle, biological filter, biological contact oxidation method, other forms of biofilm reactor
- Integrated sewage treatment and reclaimed water recycling equipment: integrated sewage treatment equipment, integrated reclaimed water recycling equipment
- Sewage treatment plant design: design procedure and site selection, sewage treatment process selection, sewage treatment plant plane and elevation layout, urban sewage treatment plant design example
- Sewage quality and water self-purification: sewage quality indicators, migration and transformation of pollutants in water environment, water self-purification
- Basic concepts of wastewater biological treatment and basis of biochemical reaction kinetics: aerobic biological treatment and anaerobic biological treatment of wastewater, growth law and growth environment of microorganisms, reaction speed and reaction order, Michaelis-Menten equation, Monod equation, basic mathematical model of wastewater biological treatment engineering
- Land treatment of stabilization pond and sewage
- Aerobic biological treatment of sewage - biofilm method: biological filter, biological rotary table, biological contact oxidation method, biological fluidized bed
- Aerobic biological treatment of sewage - activated sludge method: gas transfer principle and aeration tank, development and evolution of activated sludge method, design and calculation of activated sludge method, secondary sedimentation tank
- Anaerobic biological treatment of sewage: basic principle of anaerobic biological treatment, anaerobic biological treatment method of sewage, design of anaerobic biological treatment method, combined application of anaerobic and aerobic technology
- Advanced treatment of urban sewage: removal of nitrogen and phosphorus, tertiary treatment of urban sewage
- Sludge treatment and disposal: source, nature and quantity of sludge, sludge disposal and pretreatment, sludge concentration, sludge stabilization, sludge dewatering, sludge drying and incineration
- Experiment:
  -Coagulation and sedimentation experiment
  -Orthogonal experiment of heavy metal wastewater treatment by chemical precipitation
  -Orthogonal experiment on treatment of high nitrogen and phosphorus wastewater by chemical precipitation
  -Activated carbon adsorption experiment
  -Ammonia nitrogen adsorption experiment on zeolite
  -Experiment on chemical oxidation of organic wastewater with Fenton reagent
  -Aeration and oxygenation experiment
  -Determination of activated sludge evaluation index
  -Experiment of aerobic biological treatment of domestic sewage by activated sludge process
  -SBR biological nitrification and denitrification experiment
  -Membrane separation experiment

Course	Environmental Impact Assessment				
Type of course	lecture	Credit points	2,0	ECTS	3,0
Workload : 90 hours (Weekly hours: 2)					
In Class	36 hours	Self-study after class		54 hours	

Contents of the lecture

- Introduction: overview of environmental quality assessment, development of environmental quality assessment, environmental quality assessment and sustainable development
- Environmental regulations and environmental standards: environmental regulatory system, environmental standard system
- Pollution source evaluation and engineering analysis: pollution source investigation and evaluation, content and methods of engineering analysis, total control
- Environmental status evaluation: evaluation of air environment status, water environment status evaluation, soil environment status evaluation, acoustic environment status evaluation, ecological environment status evaluation
- Environmental impact assessment of construction projects
- Regional development environmental impact assessment
- Planning environmental impact assessment
- Ecological environmental impact assessment
- Socio-economic environmental impact assessment
- Cleaner production evaluation
- Environmental risk assessment and management
- Preparation of environmental quality report

Course	Air Pollution Control Engineering				
Type of course	lecture and practice	Credit points	2,5	ECTS	4,0
Workload : 112,5 hours (Weekly hours: 2,5)					

In Class	45 hours	Self-study after class	67,5 hours

Contents of the lecture

- Introduction: Air and air pollution, air pollutants and their sources, effects of air pollution, comprehensive prevention and control of air pollution, environmental air quality control standards
- Combustion and air pollution: fuel properties, fuel combustion process, calculation of flue gas volume and pollutant emissions, formation of sulfur oxides during combustion, formation of particulate pollutants during combustion, formation of other pollutants during combustion
- Atmospheric pollution meteorology: atmospheric structure and meteorological elements, atmospheric thermal process, atmospheric movement and wind
- Atmospheric diffusion concentration estimation model: basic theory of turbulence diffusion, Gaussian diffusion model, estimation of pollutant concentration, diffusion model under special meteorological conditions, diffusion model in cities and mountains, regional air environmental quality model, chimney height design, plant site selection
- Technical basis of particle pollutant control: particle size and size distribution, physical properties of dust, performance of purification device, theoretical basis of particle capture
- Dust removal device: mechanical dust collector, electric dust collector, bag filter, wet dust collector, selection and development of dust collector
- Technical basis of gaseous pollutants control: absorption method to purify gaseous pollutants, adsorption method to purify gaseous pollutants, catalytic method to purify gaseous pollutants
- Sulfur oxide pollution control: sulfur cycle and sulfur emissions, fuel desulfurization before combustion, fluidized bed combustion desulfurization, recovery and purification of high-concentration sulfur dioxide tail gas, low-concentration sulfur dioxide flue gas desulfurization
- Stationary source nitrogen oxide pollution control: the nature and source of nitrogen oxides, the formation mechanism of nitrogen oxides in the combustion process, low nitrogen oxide combustion technology, flue gas denitrification technology, flue gas simultaneous desulfurization and denitrification technology, the economy of nitrogen oxide control Evaluation
- VOC pollution control: definition and emission source, vapor pressure and evaporation, prevention of VOCs pollution, combustion method to control VOCs pollution
- Urban motor vehicle pollution control: the environmental impact of motorized traffic, the formation and control of pollutant emissions from gasoline vehicles, the formation and control of diesel engine pollutants, new power vehicles
- Air pollution and global climate: greenhouse gases and climate change, ozone layer destruction, acid precursors and acid rain, atmospheric brown clouds
- Experiment:
  -Process flow determination: selection of process flow, description of process flow
  -Selection and design calculation of dust collector: determination of bag filter type, size design of bag filter, selection of filter material of bag filter, selection of accessories (pulse valve and ash discharge valve), summary of dust collector design
  -Pipeline design calculation and fan selection: pipeline design calculation, system resistance calculation, fan selection

Course	Physical Pollution Control				
Type of course	lecture	Credit points	2,0	ECTS	3,0
Workload : 90 hours (Weekly hours: 2)					
In Class	36 hours	Self-study after class		54 hours	

Contents of the lecture

- Noise control theory: the generation, transmission and acceptance of noise, the main physical parameters of noise, the subjective measurement and main evaluation of noise, the propagation characteristics of noise, the harm of noise and the allowable standard of noise, the basic principles of noise prevention and control
- Noise measurement: measuring instruments, measurement of sound power, noise measurement of industrial enterprises, vibration and its measurement methods
- Sound absorption and noise reduction: sound absorption principle, porous sound absorption material, sound absorption structure, sound absorption and noise reduction design
- Sound insulation technology: characteristics of sound insulation structure, principle of sound insulation wall panel, sound insulation door and window, sound insulation cover
- Vibration isolation technology: vibration hazard and evaluation, vibration isolation design, vibration isolator and isolation pad, damping materials
- Muffler: resistance muffler, resistance muffler, broadband muffler, exhaust jet muffler
- Introduction to radioactivity: atoms and nuclei, radioactivity and isotopes, types of radioactive decay, general laws of radioactive decay, nuclear reaction, nuclear fission and nuclear fusion, interaction between nuclear radiation and matter, radiation intensity and radiation amount
- Radioactivity in the environment: natural radiation source, artificial radioactive pollution source, the way of environmental radioactive substances entering the human body, the radiation dose caused by environmental radiation to the population
- Sample collection and pretreatment: air collection, water sample collection, soil collection, biological sample collection and preparation, sample pretreatment
- Physical measurement of radioactivity: preparation of radioactive source, measurement of total radioactivity, measurement of environmental radiation dose rate
- Thermal environment: natural resources of the environment, main influencing factors of solar radiation intensity, heat balance and heat exchange equation, impact of thermal environment on human body, high temperature environment, impact of human activities on thermal environment, environmental temperature measurement methods and physiological and thermal indexes

- Thermal pollution: the formation and impact of thermal pollution, water thermal pollution and its prevention, the impact and prevention of atmospheric thermal pollution
- Physical concepts of electromagnetic field: electric field and magnetic field, electromagnetic field and electromagnetic radiation, radio frequency electromagnetic field
- Electromagnetic radiation pollution: electromagnetic pollution source, transmission path of electromagnetic pollution, hazards of electromagnetic radiation, safety and health standards for electromagnetic radiation in the workplace, environmental safety standards for electromagnetic radiation
- Measurement technology of electromagnetic radiation: investigation of electromagnetic pollution sources, monitoring methods of electromagnetic pollution, electromagnetic pollution measuring instruments and use
- Control of electromagnetic radiation pollution: main protective measures of electromagnetic radiation, shielding protection of high-frequency radiation, safety protection of microwave radiation

Course	**Productive Practice**				
Type of course	practice	**Credit points**	1,0	**ECTS**	1,5
Workload : 45 hours (Weekly hours: 1)					
In Class	18 hours	Self-study after class		27 hours	

Contents of the lecture

- Visit the treatment process of major water supply and sewage plants
- Visit the architectural water supply and drainage design in a large hotel
- Design of urban water intake head and pump room
- Design of water supply and drainage system for high-rise buildings
- Operation and management of large city waterworks

Course	**Air Pollution Control Design**				
Type of course	practice	**Credit points**	1,0	**ECTS**	1,5

Workload : 45 hours (Weekly hours: 1)			
In Class	18 hours	Self-study after class	27 hours

Contents of the lecture

- Preliminary design of flue gas dust removal process for coal-fired boiler
- Requirements for raw data and operating conditions
- Design principles
- Design goal
- Design parameters: main parameters of boiler equipment, flue gas density (under standard conditions), industrial analysis value of coal, applied base ash content, executive standard
- Design calculation: calculation of flue gas volume, smoke dust and sulfur dioxide concentration of coal-fired boiler, actual flue gas volume under standard state, dust concentration of flue gas, sulfur dioxide concentration in flue gas under standard state
- Selection of dust remover: dust removal efficiency, selection of dust remover, location of chimney and pipeline layout

Course	Water Pollution Control Design				
Type of course	practice	Credit points	1,0	ECTS	1,5
Workload : 45 hours (Weekly hours: 1)					
In Class	18 hours	Self-study after class	27 hours		

Contents of the lecture

- Site selection: environmental protection requirements in site selection
- Process flow design and general layout: selection of process route and process flow design, methods and requirements of general layout
- Layout design of various treatment structures: architectural drawing design and layout of various structures
- Pipeline layout and design: selection and design of pipeline system and its accessories, principles and requirements of pipeline layout and drawing of pipeline diagram
- Technical and economic analysis of selection and application of treatment equipment: selection principles

of treatment equipment, selection and calculation of pumps and fans, budget estimate of engineering projects

Course	**Solid Waste Control Design**				
Type of course	practice	**Credit points**	1,0	**ECTS**	1,5
Workload : 45 hours (Weekly hours: 1)					
In Class	18 hours	Self-study after class		27 hours	
Contents of the lecture					
• Design basis: design specifications and requirements, design scale, design principles • Process plan selection: the source and characteristics of sludge, the existing sludge treatment technology and process, determine the process flow • Sludge thermal drying (carbonization) process description: feeding device, dryer (carbonization furnace), hot air generator/burner, cyclone dust removal device • Design and calculation of sludge thermal drying and carbonization process: design and calculation of feeding device size, design and calculation of dryer/carbonization furnace size, selection of hot air generator/burner, size design of cyclone dust removal device • Summary table of design results: analysis of sludge treatment compliance, main equipment size, selection list, benefit analysis (economic benefits and environmental benefits)					

Course	**Practical Training in Environmental Monitoring**				
Type of course	practice	**Credit points**	1,0	**ECTS**	1,5
Workload : 45 hours (Weekly hours: 1)					
In Class	18 hours	Self-study after class		27 hours	

Contents of the lecture
• Environmental monitoring laboratory management: environmental monitoring personnel management system, laboratory rules and regulations, environmental monitoring quality assurance and quality control • Water quality monitoring: surface water monitoring, groundwater monitoring, water pollution source monitoring, sediment monitoring, water quality monitoring instruments, data processing and result report, surface water monitoring examples • Air and exhaust gas monitoring: ambient air routine monitoring, atmospheric precipitation monitoring, fixed pollution source monitoring, noise monitoring instrument • Soil monitoring: formulation of soil monitoring plan, collection of soil samples, preparation and preservation of soil samples, dissolution and determination methods of soil samples, examples of soil monitoring • Biological pollution monitoring: examples of determination of organophosphorus pesticides in food crops and fluorine content in plants

Course	Integrated Practical Training in Environmental Engineering				
Type of course	practice	Credit points	2,0	ECTS	3,0
Workload : 90 hours (Weekly hours: 2)					
In Class	36 hours	Self-study after class		54 hours	
Contents of the lecture					
• Understanding of environment and environmental issues, environmental ecology and environmental management • Investigation and observation of pollution status • Production and control process of industrial environmental pollutants					

9000 Fluid Mechanics Courses

Assigned modules: **9001** Fluid Mechanics

Course	**Fluid Mechanics**				
Type of course	lecture	**Credit points**	3,0	**ECTS**	4,5
Workload : 135 hours (Weekly Hours: 3)					
In Class	54 hours	Self-study after class		81 hours	

Contents of the lecture

- Physical properties of fluid: continuous medium model of fluid, volume force and surface force acting on fluid, viscosity and compressibility of fluid, interface phenomena and properties of fluid
- Fluid kinematics: two methods to describe fluid motion, the geometric description of the flow field, the acceleration formula and particle derivative of the particle, the motion analysis of the fluid micro-cluster, the rotation of the flow field, the calculation of the velocity field given the divergence and rotation of the flow field
- Basic principles of fluid dynamics: integral equation of fluid dynamics, application of Bernoulli formula, application of steady flow control volume control volume fraction conservation equation, differential control equation of fluid dynamics, hydrostatics
- Ideal fluid dynamics: basic equations and initial boundary value conditions of ideal fluid motion, main properties of ideal fluid motion in force field, Lamb type equation and several integrals of ideal fluid motion, mathematical formulation and main properties of ideal incompressible irrotational flow problem, superposition method of basic solutions of incompressible irrotational flow velocity potential equation, additional inertia of object motion in incompressible ideal fluid, Vortex dynamics in an ideal incompressible fluid
- Fundamentals of aerodynamics: basic equations of aerodynamics, sound propagation equation and Mach number, main properties of isentropic flow of ideal gas, shock theory and application, steady supersonic flow around a convex corner
- Fundamentals of viscous fluid mechanics: constitutive equation of viscous fluid, motion equation of Newtonian fluid, Navier-Stokes equation, similarity law of viscous fluid motion, analytical solution of incompressible viscous fluid, approximate solution of small Reynolds number viscous fluid motion
- Turbulence: occurrence of turbulence, analysis of flow stability, statistical theory of turbulence, closed

turbulence model, steady turbulence in circular tube, coherent structure of shear turbulence coherent structure

- Theoretical basis of boundary layer: steady flow around Newtonian fluid with large Reynolds number, similarity solution of incompressible fluid laminar boundary layer, similarity solution, Karman momentum integral equation, flow and separation in boundary layer

10000 Engineering Oriented Courses

Assigned modules:

10001 Introduction to Horticulture
10002 Engineering Drawing + Experiment in Engineering Drawing
10003 CAD Drawing + CAD Drawing Experiment
10004 Civil Engineering Foundation and Management
10005 Feedwater Treatment
10006 Metalworking Practice
10007 Feedwater and Wastewater Pipe Networks

Course	**Introduction to Horticulture**				
Type of course	lecture	**Credit points**	2,0	**ECTS**	3,0
Workload : 90 hours (Weekly hours: 2)					
In Class	36 hours	Self-study after class		54 hours	

Contents of the lecture

- Classification of horticultural plants: botany classification, fruit tree classification, vegetable classification, ornamental plant classification
- Biological principles of horticultural plants: vegetative growth of horticultural plants, reproductive growth of horticultural plants, formation and development of vegetative storage organs of horticultural plants, dormancy of horticultural plants, relationship between various organs of horticultural plants, growth and development cycle of horticultural plants
- Variety selection and breeding of horticultural plants: tasks and main objectives of horticultural plant variety selection, germplasm resources of horticultural plants, introduction and selection, hybrid breeding and utilization of heterosis, other breeding methods, breeding of improved varieties
- Seedling raising technology of horticultural plants: seeding, cutting, grafting, layering and splitting, tissue culture
- Cultivation and management of horticultural plants: planting system of the plantation, planting and planting of horticultural plants, soil management of the plantation, nutrition of horticultural plants and fertilization of the plantation, irrigation and drainage of the plantation, plant management, management of product organs, disasters and prevention of horticultural plants

- Protected cultivation: the significance of protected cultivation, the types of facilities, soilless cultivation, the application of new technologies in protected horticulture production
- Harvesting and post-harvest treatment: harvesting, storage, warehousing and transportation of garden products, processing of horticultural products
- Garden art: the characteristics of garden art and the main forms of gardens, garden green space, garden layout, greening design of factories and residential areas, bonsai, cut flowers and flower arrangement art
- Horticultural products market: brief introduction of horticultural products market, price of horticultural products, circulation and marketing of horticultural products, market research, prediction and decision-making, international market development of horticultural products

Course	**Engineering Drawing + Experiment in Engineering Drawing**				
Type of course	lecture and practice	**Credit points**	3,0	**ECTS**	4,5
Workload : 135 hours (Weekly hours: 2)					
In Class	54 hours	Self-study after class		81 hours	

Contents of the lecture

- Point, line and plane projection: point projection, line projection, plane projection, line-to-plane, plane-to-plane relative relationship, face change method, rotation method
- Three-dimensional view: the view of the basic body, the drawing of the intersection of the surface of the basic body, the drawing and reading of the combined body view
- Axonometric and perspective views: overview of axonometric, positive isometric, positive biaxial and oblique biaxial, selection of axonometric, perspective
- Representation of drawing of machine parts: view, sectional view, sectional view, simplified drawing and other prescribed drawing methods, axonometric sectional view, third-angle projection
- Dimensioning basics: basic requirements for dimensioning, dimensioning of assemblies, clear layout of dimensions, dimensioning of arc-connected graphics, dimensioning of axonometric drawings
- Basic knowledge of mechanical manufacturing: materials commonly used in mechanical manufacturing, commonly used processing methods in mechanical manufacturing, technical requirements for mechanical parts
- Standard structure, standard parts and common parts: threads and threaded fasteners, keys, splines and pins, gears, springs, rolling bearings
- Part drawing: basic knowledge of part drawing, part analysis, view selection of part, annotation of part size and technical requirements, legend of typical part, steps and methods of reading part drawing
- Assembly drawings: basic knowledge of assembly drawings, selection of views of assembly drawings,

annotation of dimensions and technical requirements in assembly drawings, arrangement of parts lists and serial numbers of components and parts in assembly drawings, methods for drawing assembly drawings and steps, read assembly drawings and disassemble parts drawings, part configuration design, axonometric assembly drawings

- Computer-aided drawing basics: AutoCAD2006 drawing basics, two-dimensional graphics drawing, drawing auxiliary tools, layers and management, graphic editing, pattern filling (hatching), text, dimension
- Basics of computer-aided 3D solid modeling: creating basic volumes, creating complex 3D solids, 3D solid display control, 3D solid editing
- Computer-aided 3D modeling and engineering drawing of mechanical parts: 3D modeling examples of mechanical parts, 3D assembly examples of mechanical parts, 2D drawing examples of mechanical parts
- Experiment:
  -Iso commands, 3D Shapes, User Coordinate System,
  -Elevation, Thickness, Viewpoint, Viewports,
  -3D Polylines, 3D Face, 3D Surfaces of Revolution,
  -World Coordinate System, X/Y/Z Filters
  -Plotter Hardware and Plotting Exercises
  -Advanced Display Modes
  -AutoCAD Rendering and Material Attachment

Course	**CAD Drawing + CAD Drawing Experiment**				
Type of course	lecture and practice	**Credit points**	2,0	**ECTS**	3,0
Workload : 90 hours (Weekly hours: 2)					
In Class	36 hours	Self-study after class		54 hours	

Contents of the lecture

- Basic knowledge of computer graphics: introduction to computer graphics and common computer graphics software
- Some basic provisions of CAD drawing standards: drawing size and format, title block and list, scale, font, drawing line, dimension annotation
- AutoCAD2012 operation basis: AutoCAD2012 working interface, AutoCAD drawing file management, command input and termination, AutoCAD coordinate system and data input, AutoCAD drawing display control, setting drawing environment and drawing boundary
- AutoCAD2012 common drawing commands: overview of common drawing commands, use of common drawing commands

- Common modification commands in AutoCAD: method of selecting objects, modification commands
- Text and dimension: text, dimension, geometric tolerance
- Layer setting and precise positioning tools
- AutoCAD drawing plane graphics: drawing method and dimension of plane graphics, drawing plane graphics with AutoCAD
- Drawing of three views of composite body: key points of knowledge of three views of composite body, drawing of three views of composite body, drawing of three views of composite body with AutoCAD
- Drawing method: view, section view and section view, section view, drawing section view and section view with AutoCAD
- Block application: block creation, block attribute definition
- Draw part drawing: the function and content of part drawing, use AutoCAD to draw part drawing
- Draw assembly drawing: the function and content of assembly drawing, the specified drawing of assembly drawing, the assembly drawing of threaded connector, the leader marking, the drawing of assembly drawing with AutoCAD
- Experiment:
  -Draw the isometric drawing of the support frame: analyze the functions and ideas, draw the outer contour of the base of the support frame, draw the upper plate of the support frame, draw the rib plate of the support frame and edit the base
  -Draw connecting rod: realize simple analysis of functions and ideas, create 3D wireframe of shaft hole and connecting arc, draw and edit 3D wireframe, use 3D surface to create model

Course	**Civil Engineering Foundation and Management**				
Type of course	lecture	**Credit points**	2,0	**ECTS**	3,0
Workload : 90 hours (Weekly hours: 2)					
In Class	36 hours	Self-study after class		54 hours	

Contents of the lecture

- Introduction: overview of civil construction engineering, water supply and drainage engineering and its relationship with civil construction engineering
- Engineering materials: definition and classification of engineering materials, basic properties of common engineering materials, cement, concrete, construction mortar, block materials, construction steel, asphalt waterproof materials, thermal insulation materials
- Construction of buildings and structures: foundations, walls, floor and ground floors, stairs, doors and windows, roofs, deformation joints, structures

- Structure and component design: the main physical and mechanical properties of reinforced concrete materials, the basic principle of structure calculation according to the limit state, the calculation of normal section bearing capacity of reinforced concrete flexural members, the calculation of oblique section bearing capacity of reinforced concrete flexural members, the concept of crack width and deformation of reinforced concrete flexural members, the calculation of reinforced concrete compression members, the calculation of reinforced concrete tensile members, the design of reinforced concrete beam and slab structure, Reinforced concrete pool design, masonry structure design
- Foundation and foundation: physical properties and classification of soil, stress and deformation in foundation soil, foundation design, soft foundation, special soil foundation
- Application examples: concrete mix design, reinforced concrete pool top design, reinforced concrete circular pool design
- Flow construction of building engineering: the way and characteristics of organizing building construction, the main parameters of building flow construction and their relationship, the organization classification and organization method of flow construction, flow construction example – a high-rise residential project
- Construction network planning technology: network planning technology overview, double-code network plan, single-code network plan, double-code time-scale network plan, optimization, inspection and adjustment of network plan
- Construction preparation, meaning, content and requirements of construction preparation, preparation of original data, preparation of technical data, preparation of construction site
- Construction organization design: overview of construction organization design, project overview and construction characteristics, selection of construction scheme, preparation of construction schedule, design of unit project construction plan, proposed construction measures and main technical and economic indicators
- Construction engineering technology management: concept, function, task and requirement of technology management, content and system of technology management
- Construction project quality management: basic concept of quality management, total quality management assurance system, statistical analysis methods commonly used in quality management, introduction to ISO9000 series standards

Course	**Feedwater Treatment**				
Type of course	lecture	**Credit points**	1,0	**ECTS**	1,5
Workload : 45 hours (Weekly hours: 1)					
In Class	18 hours	Self-study after class		27 hours	

Contents of the lecture

- Water supply system: classification of water supply system, composition and layout of water supply system, influencing factors of water supply system layout, urban water supply system planning
- Design water consumption: water consumption quota, water consumption calculation, water consumption change
- Working conditions of water supply system: flow relationship of water supply system, water pressure relationship of water supply system, volume calculation of water tower and clean water tank
- Layout of water conveyance pipe and pipe network: alignment of water conveyance pipe and pipe network, pipe network layout, pipe network alignment
- Thinking questions
- Calculation of pipe section flow, pipe diameter and head loss: pipe network calculation steps, pipe network graphics and simplification, flow along the line and node flow, pipe section calculation flow, pipe diameter calculation, head loss calculation
- Hydraulic calculation of pipe network: basic equation of pipe network calculation, pipe network calculation principle, pipe network calculation method classification, tree network calculation, ring network calculation, multi-source pipe network calculation, pump characteristic equation in pipe network calculation
- Optimization calculation of pipe network: annual cost conversion value of pipe network, optimization calculation of water transmission pipe, optimization calculation of pipe network, approximate optimization calculation
- Zone water supply system: water supply energy analysis of zone water supply, design of zone water supply system
- Water pipes, pipe network accessories and auxiliary structures: water pipe materials and accessories, pipe network accessories, pipe network auxiliary structures, regulating structures
- Technical management of pipe network: technical data of pipe network, water pressure and flow measurement of pipe network, leak detection, corrosion prevention of water pipe, scale removal and coating, maintenance of water quality of pipe network, dispatching management
- Introduction to water intake project: overview of water resources and tasks of water intake project, water supply source
- Underground water intake structures: overview of underground water sources and classification of water intake structures, structure, construction and management of tube wells, design and hydraulic calculation of tube wells, mutual resistance calculation of well groups and sectional water intake well groups
- Surface water intake structures: the relationship between the characteristics of surface water bodies and the water intake structures, the selection of the location of the water intake structures, the basic forms of the water intake structures, the water intake methods of various surface water bodies, the brief introduction to the construction methods of the water intake structures

Course	Metalworking Practice				
Type of course	practice	Credit points	1,0	ECTS	1,5
Workload : 45 hours (Weekly Hours: 1)					
In Class	18 hours	Self-study after class		27 hours	

Contents of the lecture

- Heat treatment of engineering materials and steel: basic knowledge of metal materials, properties of metal materials, overview of carbon steel and alloy steel, overview of other engineering materials, heat treatment of steel, material selection methods
- Casting: Overview, sand casting, special casting, common casting methods
- Forging: metal heating and forging cooling, free forging, die forging and tire die forging, sheet metal stamping, extrusion, rolling, drawing and other new forging processes
- Welding: basic concepts of welding, electrode arc welding, gas welding and gas cutting, other commonly used welding methods, welding defects, deformation and improvement methods
- Fundamentals of metal cutting processing: metal cutting principles, cutting tools, cutting fluids, measuring tools
- Fitter and assembly: scribing, filing, sawing and chiseling, drilling, reaming, countersinking, reaming, tapping and threading, assembly
- Turning: horizontal lathes, common accessories and workpiece clamping of horizontal lathes, turning tools, turning faces, outer circles and steps, drilling and turning inner circles, grooving and cutting, turning tapers, threading, turning forming surfaces and knurled
- Milling: horizontal milling machine, milling cutter and its installation, milling processing
- Planing and boring
- Grinding: grinding process, grinding machine, grinding wheel, grinding process, introduction to high-efficiency and high-precision grinding

Course	Feedwater and Wastewater Pipe Networks				
Type of course	lecture	Credit points	2,0	ECTS	3,0

Workload : 90 hours (Weekly Hours: 2)			
In Class	36 hours	Self-study after class	54 hours

Contents of the lecture

- Function and type of fluid transmission and distribution network: function and type of gas transmission and distribution network, function and type of liquid transmission and distribution network, function and type of phase change flow or multiphase flow network, basic function, basic composition and basic type of fluid transmission and distribution network
- Hydraulic characteristics and hydraulic calculation of gas pipeline network: hydraulic characteristics of gas pipeline, basic principles and methods of hydraulic calculation of fluid transmission and distribution network, hydraulic calculation of gas transmission and distribution network
- Hydraulic characteristics and hydraulic calculation of liquid pipe network: hydraulic characteristics and hydraulic calculation of closed liquid pipe network, hydraulic characteristics and hydraulic calculation of open liquid pipe network
- Hydraulic characteristics and hydraulic calculation of multiphase flow pipe network: hydraulic characteristics and hydraulic calculation of liquid-gas two-phase flow pipe network, hydraulic characteristics and hydraulic calculation of vapor-liquid two-phase flow pipe network, hydraulic characteristics and hydraulic calculation of gas-solid two-phase flow pipe network, general method of hydraulic commonality and hydraulic calculation of branch pipe network
- Theoretical basis of pump and fan: basic structure of centrifugal pump and fan, working principle and performance parameters of centrifugal pump and fan, basic equation of centrifugal pump and fan - Euler equation, loss and efficiency of pump and fan, effect of performance curve and blade shape on performance, similarity law and specific speed
- Matching of pump, fan and pipe network system: working state point of pump and fan in pipe network system, working condition adjustment of pump and fan, installation position of pump and fan, selection of pump and fan
- Hydraulic condition analysis and regulation of branch pipe network: pressure distribution of pipe network system, throttling principle and flow characteristics of regulating valve, selection of regulating valve, hydraulic condition analysis of pipe network system, hydraulic balance regulation of pipe network system
- Hydraulic calculation and hydraulic condition analysis of annular pipe network: pipe network diagram and its matrix representation, constant flow pipe network characteristic equation group and its solution method, hydraulic calculation of annular pipe network, hydraulic condition analysis and adjustment of annular pipe network, flow stability of corner pipe network and its discriminant

11000 Graduation Thesis

Assigned modules: **11001** Graduation Thesis

Course	**Graduation Thesis**				
Type of course	lecture and practice	**Credit points**	10,0	**ECTS**	15,0
Workload : 450 hours (Weekly hours:10)					
In Class	180 hours	Self-study after class		270 hours	
Contents of the lecture					
• **Dissertation Title: 1000m3/d Leather Wastewater Treatment Engineering Design** • Grading: -Instructor's evaluation 30% -Review by faculty member 30% -Presentation: 40% • Colloquium (30 min): -Presentation of the bachelor thesis -Proof of a comprehensive qualification achieved by the study					