



**RIGA TECHNICAL  
UNIVERSITY**

**Faculty of Materials Science and Applied Chemistry**

Study programme "Chemical Technology"

## **SPRING 2020 BACHELOR COURSES**

### **ĶVĶ360 Chromatography**

**2.0 CP (3.0 ECTS)**

Solvent extraction, chromatography, types of chromatography, planar chromatography, gas chromatography, sample preparation, calculation of the results.

### **ĶNF201 Inorganic Chemistry (basic course)**

**5.0 CP (7.5 ECTS)**

The subject provides the detailed review of physical and chemical properties of the groups of elements. The subject also introduces students to the practical acquaintance of chemical properties of elements using semimicro method.

### **ĶNF285 Physical Chemistry (basic course)**

**6.0 CP (9.0 ECTS)**

Chemical thermodynamics. The first law of thermodynamics. Reversible processes. Work of expansion of an ideal gas. Entropy. The third law of thermodynamics. Thermodynamic potentials. Nernst's heat theorem. Chemical equilibrium. Phase equilibria. Equilibrium between phases. The Clausius-Clapeyron equation. Raoult's law. Dalton law of partial pressure. Azeotropes. Phase diagrams of thermodynamics systems. Cryoscopy. Ebullioscopy. Thermal analysis. Physicochemical analysis. Three-component systems.

### **ĶOK222 Organic Chemistry (special course)**

## **6.0 CP (9.0 ECTS)**

Chemistry of elementorganic compounds, diazocompounds. Dicarbonyl compound chemistry and tautomerism. Carbohydrates: mono, oligo and polysaccharides. Hydroxycarboxylic acids and aminocarboxylic acids, their stereoisomerism and enantioselective synthesis. Peptides and proteins. Oxocarboxylic acids. Three and four membered heterocycles.

## **ĶOK315 Nuclear Magnetic Resonance Spectroscopy**

### **3.0 CP (4.5 ECTS)**

Nuclear magnetic resonance phenomenon.  $^1\text{H}$  and  $^{13}\text{C}$ -NMR. Spectral characteristics. Influence of structural factors on chemical shifts and spin-spin coupling constants. Interpretation of spin-spin coupling in first order spectra. Double resonance. Dynamic NMR. Exchange processes. Application of NMR spectroscopy to the determination of the structure of organic compounds as well as equilibrium and rate constants of chemical reactions.

## **ĶOS311 Management of Chemicals**

### **2.0 CP (3.0 ECTS)**

Chemical disasters and accidents. International and Latvian legislation (REACH and CLP Regulations, GHS, safety data sheets) in management of chemicals. Hazardous chemicals and their classification, labelling, compatibility, storage and transportation. Information retrieval about chemicals. Toxicology. Biocides.

Chemical weapons. Identification, neutralization, deactivation and disposal of dangerous chemicals and chemical waste. Scrubbing and neutralization of toxic and corrosive gases. Safety in chemical laboratory. Personal protective equipment, fire extinguishers. The first aid in chemical accidents.

## **ĶOS702 Biological Chemistry**

### **2.0 CP (3.0 ECTS)**

The first theme is overview on the cell structure, chemical composition, major classes of the biological macromolecules and their functions in cell and organism. Structural organization and biological functions of proteins, as well as enzyme classification, mechanism of enzyme catalyzed reactions will be overviewed. The important chapter is nucleic acids, their biological role and structure, storage and expression of genetic information. One topic includes the role of carbohydrates in nature, their structure and biological functions, as well as lipids, their classification. including membrane lipids and fats. Major metabolic pathways, metabolism of energy and substances, interconnection of metabolic pathways will be reviewed, including metabolism of carbohydrates, lipides, amino acids and nucleotides, regulation of metabolic pathways and signaling systems. One theme deals with the functions of inorganic substances in organism. biological functions of metal ions, ion transport and metalproteins.

## **᐀PI202 Polymer Materials**

### **3.0 CP (4.5 ECTS)**

Polymer materials; classification. Synthetic and natural polymers. Modification of polymer materials. High molecular compounds. Additives for polymers: plasticizers, dyes, fillers etc. Processing of polymer materials; characteristics of finished articles: films, sheets, pipes, fibres, coatings etc.

## **᐀ST305 Crystallography**

### **2.0 CP (3.0 ECTS)**

Crystals, their main properties: homogeneity, anisotropy, ability to form polyhedrons, symmetry. Groups of mode of point and spatial symmetry. Common forms and combinations. Crystallographic axis. Symbols of faces. Bravais lattices. X-ray metry. Cubic and hexagonal arrangement of close-packing beads. Atomic and ionic indexes. Isomorphism, polymorphism, morphotrophy.

## **᐀V᐀113 General chemistry (advanced course)**

### **10.0 CP (15.0 ECTS)**

General Chemistry encourages a complete understanding of different processes that take place with substances. Quantitative chemical laws, stoichiometric ratio, chemical bonding, thermodynamics, reaction speed and the chemical equilibrium processes are the grounds of in-depth understanding of the chemistry discipline based learning in succeeding related studies. Seeing interrelationships between the quantitative composition of the solution and its colligative properties, as well as between the acid and base balance, and redox processes, allows predicting and explaining the different properties of new materials and other transformations. For example, metal corrosion resistance. Electrochemical processes are applied creating new energy sources, but studying the basis of organic chemistry will allow understanding the natural processes, including in the living organisms.

## **᐀VT402 Environmental Engineering**

### **8.0 CP (12.0 ECTS)**

Environmental protection from industrial pollutants. Air pollution and Engineered systems for air pollution control. Water pollution and treatment unit processes. Engineered systems for wastewater treatment and disposal. Engineered systems for Solid-Waste management.

## **᐀VT351 Unit Operation of Chemical Engineering**

### **6.0 CP (9.0 ECTS)**

In this course attention is paid to the following topics: main processes of chemical technology. Evaporating processes, Calculation of evaporating devices. Distillation: elementary distillation, rectification of liquid compositions, calculation of rectification column. Drying processes in chemical technology, convective and contact dryers, and specific kinds of drying. Sorption processes in chemical technology, construction and calculation of sorption devices. Extraction of liquids and solids, construction of extractors. Distribution of non-homogenous systems – sedimentation, filtrations, centrifuging.

# SPRING 2020

## MASTER COURSES

### **ΚVΚ502 Molecular Spectroscopy**

**3.0 CP (4.5 ECTS)**

Electronic spectra of polyatomic molecules. Deactivation of electronically excited states. Spectroscopy of chromophores and dyes. Solvatochromy. Reflection (specular, diffuse and total internal reflection) spectroscopy and its application. NIR spectroscopy and its application.

### **ΚVΚ511 Chemometrics**

**3.0 CP (4.5 ECTS)**

Analytical measurement and data collection; One- and multidimensional dataset; Instrumental response and data processing; Mathematic software; One-dimensional signal processing techniques in chemistry; Two- dimensional signal processing techniques in chemistry; Vector and matrix operations and elementary MATLAB; Correct interpretation of analytical results; Numerical noise elimination; Measurement optimization; Application of chemometrics in planing chemical processes and analytical measurements.

### **ΚPI420 Material Ageing and Protection**

**2.0 CP (3.0 ECTS)**

General concepts of materials. Life-cycle of materials. General concepts of materials ageing. Corrosion of metals and corrosion prevention. Deterioration of wood and conservation. Deterioration and conservation of building materials. Ageing and stabilization of polymer materials.

### **ΚVΚ501 Chemistry and Technology of Fuels and Lubricants**

**3.0 CP (4.5 ECTS)**

Chemistry and tecnology of processing of fuels from fossil sources. Main characteristics of fuels and quality assesment. Alternative fues and hydrogen energetic. Biofuels. Lubricants. Motor oil.

### **ΚST559 Crystallography and Crystal Chemistry**

**2.0 CP (3.0 ECTS)**

Crystals, their main properties: homogeneity, anisotropy, ability to form polyhedrons, symmetry. Groups of mode of point and spatial symmetry. Common forms and combinations. Crystallographic axis. Symbols of faces. Bravais lattices. X-ray metry. Cubic and hexagonal

arrangement of close-packing beads. Atomic and ionic indexes. Isomorphism, polymorphism, morphotrophy.

### **ҚVT407 Chemical Processes Control and Automation**

**3.0 CP (4.5 ECTS)**

Introduction Devices and periferial systems. Inlet signals. Go No-Go date, analysis and troubleshooting. Control of outlet signals. Automaticprocess operating. Software application.

### **ҚVT416 Computer Aided Modeling**

**2.0 CP (3.0 ECTS)**

Modeling of the chemical processes and reactors using commercial software, for example SIMSCI or AspenPlus-laboratory praxis.

### **ҚVT420 Design of Production Unit**

**6.0 CP (9.0 ECTS)**

Definition of industry units, component parts, legal norms. Necessary information for designing. Content of designing and economic evaluation. Selection of production location. EU and LR legislation for production organization. Designing of industry units: stores, industry space, laboratories, auxiliary services, waste collection. Location of technological process in area. Principles of industry construction. Computer programmes of designing.

### **IDA700 Basics of Labour Protection**

**1.0 CP (1.5 ECTS)**

The study course provides basic knowledge about labour protection framework, legal acts for labour protection, taking into account the International Labour Organization conventions and requirements of the EU legal acts. Students acquire skills to create in-house basis for normative acts, taking into account the type of enterprise's activity. Students acquire basic understanding of the risks in the work environment and the methods of their elimination. Students acquire basic knowledge of labour protection monitoring system principles in enterprise or institution.

### **ҚVT571 Contaminated Site Assessment**

**4.0 CP (6 ECTS)**

In this course is examined and analysed order how to carry out the contaminated site assessment and how to determine the pollutant and level of pollution. The pathway and principles of contaminants migration are analysed.

## **KVT718 Methods of Solids Analysis**

4.0 CP (6.0 ECTS)

The course includes modern analytical methods (SEM, XRD, ATM, LA-ICP-MS, etc.); sample preparation methods and criteria for the interpretation of the data significance of results repeatability evaluation; introduction in solid state materials and their properties; analysis of porous materials and powder materials; the interaction radiation - solid; the problems of boron, carbon and oxygen quantitative analysis; measuring the thickness of coating using electron rays microprobe.