

# Opasraportti

## LuTK - Chemistry 2007-2008 (2007 - 2008)

### Tutkintorakenteisiin kuulumattomat opintokokonaisuudet ja -jaksot

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781645S: Chemistry of Solid Fuels Ashes, 3 op  
781644S: Computational Inorganic Chemistry, 3 op  
784626S: Computer Analysis of NMR Spectra, 2 op  
780396A: Demonstrations in Physics and Chemistry, 2 op  
781632S: Determination of Trace Elements, 3 op  
780373A: Environmental Chemistry, 3 op  
781633S: Experimental Design, 4 op  
781600S: Final Examination in Inorganic Chemistry, 7 op  
783600S: Final Examination in Organic Chemistry, 7 op  
782600S: Final Examination in Physical Chemistry, 7 op  
784600S: Final Examination in Structural Chemistry, 7 op  
782618S: High Pressure Kinetics, 3 op  
781638S: ICP-MS Workshop, 3 op  
780341A: Industrial Training I, 2 op  
780342A: Industrial Training II, 4 op  
780343A: Industrial Training III, 6 op  
780344A: Industrial Training IV, 8 op  
780353A: Inorganic Chemistry I, 6 op  
781642S: Inorganic Chemistry II, 4 op  
780378A: Inorganic Ion Reactions and Qualitative Analysis, 2 op  
780328A: Instrumental Analysis, 4 - 5 op  
782629S: Interactions between Molecules, 4 op  
784627S: Interpretation of Mass Spectra and Workshop, 5 op

780111P: Introduction to Analytical Chemistry, 4 op  
780102P: Introduction to Inorganic Chemistry, 5 op  
780103P: Introduction to Organic Chemistry, 6 op  
780112P: Introduction to Organic Chemistry, 4 op  
780101P: Introduction to Physical Chemistry, 7 op  
780326A: Introduction to Polymer Chemistry, 2 op  
780122P: Introductory Laboratory Course in Chemistry, 3 op  
780697S: Laboratory Course (Teachers), 20 op  
780354A: Laboratory Course I in Inorganic Chemistry, 5 op  
780330A: Laboratory Course I in Inorganic Chemistry, 7 op  
780330A-01: Laboratory Course I in Inorganic Chemistry (1. part), 2 op  
780330A-02: Laboratory Course I in Inorganic Chemistry (2. part), 5 op  
780329A: Laboratory Course I in Organic Chemistry, 4 op  
780332A: Laboratory Course I in Organic Chemistry, 4 op  
780331A: Laboratory Course I in Physical Chemistry, 5 op  
780382A: Laboratory Course in Physical Chemistry (TECH), 2 op  
781641S: Laboratory Course in Synthetic Chemistry, 4 op  
783628S: Liquid Chromatography and MS Workshop, 4 op  
783605S: Literature Survey in Organic Chemistry, 9 op  
780085Y: Literature of Chemistry and Information Retrieval, 2 op  
781627S: Main Group Chemistry, 5 op  
781601S: Master's Thesis in Inorganic Chemistry, 38 op  
781602S: Master's Thesis in Inorganic Chemistry, 20 op  
783601S: Master's Thesis in Organic Chemistry, 38 op  
783602S: Master's Thesis in Organic Chemistry, 20 op  
782601S: Master's Thesis in Physical Chemistry, 38 op  
782602S: Master's Thesis in Physical Chemistry, 20 op  
784601S: Master's Thesis in Structural Chemistry, 38 op  
784602S: Master's Thesis in Structural Chemistry, 20 op  
780699S: Maturity Test, 0 op  
780087Y: Maturity test, 0 op  
782624S: Molecular Modelling, 3 - 4 op  
781626S: Molecular Modelling Workshop, 3 - 4 op  
781639S: Molecular Symmetry and Spectroscopy, 5 op  
784617S: Multinuclear NMR Spectroscopy in Structure Elucidation, 4 op  
784610S: NMR Spectroscopy in Organic Chemistry, 3 op  
784636S: NMR Spectroscopy of Polymers, 4 op  
784623S: NMR Workshop I, 4 op  
784624S: NMR Workshop II, 4 op  
784638S: NMR Workshop III, 4 op  
784639S: NMR Workshop IV, 4 op  
780389A: Organic Chemistry I, 6 op  
783643S: Organic Chemistry II, 4 op  
783639S: Organic Chemistry III, 5 op  
783614S: Organic Chemistry of Drug Compounds, 3 op  
783640S: Organometallic Chemistry, 3 op  
780078Y: Orientation Course for New Students, 1 op  
783638S: Paper Chemistry, 3 op  
783645S: Pericyclic chemistry, 3 op  
780347A: Physical Chemistry I, 6 op  
782631S: Physical Chemistry II, 4 op  
783620S: Polymer Chemistry, 3 op  
783636S: Polymer Chemistry in Materials Sciences, 3 - 4 op  
782630S: Quantum mechanics and Spectroscopy, 3 op  
781623S: Reaction Mechanisms in Inorganic Chemistry, 3 op  
780601S: Research Project, 12 op  
783634S: Research Seminar in Organic Chemistry, 2 op  
787602J: Research Seminar in Organic and Polymer Chemistry, 3 op  
780301A: Research Training, 9 op  
780301A-01: Research Training, 3 op  
780301A-03: Research Training, 3 op  
780301A-02: Research Training, 3 op  
781640S: Sampling and Sample Preparation, 4 op  
781647S: Scanning electron microscopy, 3 op

780690S: Seminar, 3 op  
 780086Y: Seminar for the Degree of B.Sc., 1 op  
 781630S: Seminar in Inorganic Chemistry, 2 op  
 782623S: Seminar in Physical Chemistry, 2 op  
 788602S: Seminar in Structural Chemistry, 2 op  
 781611S: Solid State Chemistry, 4 op  
 781631S: Statistical Methods in Analytical Chemistry, 4 op  
 780317A: Structural Chemistry I, 5 op  
 781614S: Structural Methods in Inorganic Chemistry, 3 op  
 782620S: Surface Chemistry I, 3 op  
 782633S: Surface chemistry II, 3 op  
 783642S: Synthetic Methods in Green Chemistry, 4 op  
 780300A: Thesis for the Degree of B.Sc., 6 op  
 780079Y: Tutoring, 1 op  
 783619S: Wood Chemistry, 3 op  
 781646S: X-Ray Crystallography, 6 op

## Opintojaksojen kuvaukset

### Tutkintorakenteisiin kuulumattomien opintokokonaisuuksien ja -jaksojen kuvaukset

#### 783633S: Adhesion Chemistry, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Hormi Osmo

**Opintokohteen oppimateriaali:**

**Skeits, I.,** , 1990

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 - 4 credits

**Timing:**

4th or 5th period, autumn. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with basics in adhesion theory, surfaces treatment methods as well as common glue line strength testing methods. The student is also familiar with the most commonly used polymers in adhesives such as thermoplastic block rubbers, polyurethane- polyisocyanate adhesives, polyvinylacetate, polyvinylalcohol based adhesives, polyacrylates as adhesives, basic theory and polymer types used in anaerobic adhesives as well as with the chemistry of cyanoacrylates.

**Contents:**

Short introduction to adhesion theory, surfaces treatment methods and testing methods. The thermoplastic block rubbers, polyurethane adhesives, polyvinylacetate, polyvinylalcohol, polyacrylates, anaerobic adhesives and cyanoacrylates. Others: silicones, pressure adhesives (tapes).

**Learning activities and teaching methods:**

24 h lectures, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Skeits, I.: Handbook of Adhesives, 3rd ed., Van Nostrand Reinhold, New York, 1990.

**Person responsible:**

Prof. Osmo Hormi

**Other information:**

Prerequisites: 780326A Introduction to Polymer Chemistry and 782620S Physical Chemistry of Surfaces.

## 781625S: Aquatic Chemistry, 4 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Leena Kaila

**Opintokohteen oppimateriaali:**

**Stumm, Werner** , , 1996

**Buffle, Jacques** , , 1988

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish.

**Timing:**

4th or 5th spring. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with aquatic chemistry of natural waters.

**Contents:**

Composition of natural waters, solubility equilibria, complex equilibria, oxidation-reduction equilibria, regulation mechanisms in natural waters, models of natural waters, a short survey on influences of pollution.

**Learning activities and teaching methods:**

32 h lectures, one final examination.

**Target group:**

Chemistry, optional.

**Recommended or required reading:**

Stumm, W. and Morgan, J.J.: Aquatic Chemistry - Chemical Equilibria and Rates in Natural Waters, 3rd ed., John Wiley & Sons, New York, 1995; Buffle, J.: Complexation Reactions In Aquatic Systems: An Analytical Approach, Ellis Horwood Limited, Chichester, 1988.

**Person responsible:**

Lecturer Leena Kaila.

## 782626S: Atmospheric Chemistry, 3 - 4 op

**Voimassaolo:** - 21.07.2010

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Laasonen Kari

**Opintokohteen oppimateriaali:**

**Seinfeld, John H.** , , 1998

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 - 4 credits

**Timing:**

4th period, autumn. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with the atmospheric chemistry.

**Contents:**

The course concentrates on atmospheric phenomena, especially the physics and chemistry that are related to atmospheric pollutions. Topics are: the chemical reaction on different parts of atmosphere (including ozone depletion), aerosoles, formation of small droplets and their impurities, acid rain and global warming.

**Learning activities and teaching methods:**

30 h lectures, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Seinfeld, J.H. and Pandis, S.N.: Atmospheric Chemistry and Physics, Willey-Interscience, 1998.

**Person responsible:**

Prof. Kari Laasonen.

**Other information:**

Prerequisites: 780347A Physical Chemistry I and 782631S Physical Chemistry II or P.W. Atkins, Physical Chemistry, part 3.

## 781637S: Atomic Spectrometric Methods, 4 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Paavo Perämäki

**Opintokohteen oppimateriaali:**

Lajunen, Lauri H. J. , , 2004

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 - 5,5 credits

**Language of instruction:**

Finnish.

**Timing:**

4th or 5th spring. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with a solid background theory of the various atomic spectrometric techniques as well as the current status of the modern instrumentation and analytical applications.

**Contents:**

Theoretical background for the different atomic spectrometric techniques (atomic absorption spectrometry and atomic emission spectrometry employing plasma sources), modern instrumentation and determination of various elements, interference effects and their correction, optimisation of the measurement procedures, instrument diagnostics.

**Learning activities and teaching methods:**

30 h lectures + seminar + practical exercise, one final examination.

**Target group:**

Chemistry, optional.

**Recommended or required reading:**

Lajunen, L.H.J. and Perämäki, P.: Spectrochemical Analysis by Atomic Absorption and Emission, 2nd Edition, The Royal Society of Chemistry, 2004.

**Person responsible:**

Prof. Paavo Perämäki.

## 780109P: Basic Principles in Chemistry, 4 op

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Minna Tiainen

**Opintokohteen oppimateriaali:**

**Petrucci, Ralph H.**, , 2002

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780120P	Basic Principles in Chemistry	5.0 op
ay780117P	General and Inorganic Chemistry A (OPEN UNI)	5.0 op
780115P	General and Inorganic Chemistry II	6.0 op
780114P	General and Inorganic Chemistry I	6.0 op
780113P	Introduction to Chemistry	12.0 op
780101P	Introduction to Physical Chemistry	7.0 op
780101P2	Physical Chemistry I	4.0 op
780107P	Basic Course in Inorganic and Physical Chemistry	7.5 op
780152P	Inorganic and Physical Chemistry I	7.5 op
780153P	General and Inorganic Chemistry	7.5 op
780154P	Basic Inorganic Chemistry	7.5 op

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish

**Timing:**

1st autumn.

**Learning outcomes:**

After this course the student is familiar with basic chemistry phenomenon; equilibrium of acids and bases, chemical equilibrium, redox reactions and stoichiometry.

**Contents:**

Introduction to chemistry, stoichiometry, redox reactions, chemical equilibrium, the equilibrium of acid and bases, buffer solutions, titration.

**Learning activities and teaching methods:**

36 hours of lectures, one final examination.

**Target group:**

Biology, Geology, Mechanical Engineering, Process Engineering, compulsory.

Geography, optional.

**Recommended or required reading:**

Petrucci, R.H., Harwood, W.S., and Herring, F.G.: General Chemistry: Principles and Modern Applications, Prentice Hall, 8th edition (2002) or a newer edition.

**Person responsible:**

Lecturer Minna Tiainen.

**Other information:**

This course is only for students who have chemistry as a minor subject.

## **780372A: Basic Principles of Green Chemistry, 4 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Toivo Kuokkanen, Minna Tiainen

**Opintokohteen oppimateriaali:**

**Lancaster, Mike**, , 2002

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780355A	Environmental Chemistry and Hazardous Wastes	4.0 op
780360A	Environmental Chemistry and Hazardous Wastes	5.5 op
780375A	Basic Principles of Green Chemistry	2.0 op

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish.

**Timing:**

Spring.

**Learning outcomes:**

After this course the student is familiar with the twelve principles of green chemistry.

**Contents:**

Environmental friendly chemistry. The principles of green chemistry with examples of real life. Utilization, refining and disposal of environmentally hazardous wastes, hazardous wastes.

**Learning activities and teaching methods:**

37 h lectures, one final examination.

**Target group:**

Chemistry.

**Recommended optional programme components:**

Introduction to Physical Chemistry (780101P) and Introduction to Inorganic Chemistry (780102P) or Basic Principles in Chemistry (780109P).

**Recommended or required reading:**

Lancaster M.: Green Chemistry: An introductory text, RSC, 2002. Material given in the lecture (hazardous wastes).

**Person responsible:**

Lecturer Minna Tiainen and Doc. Toivo Kuokkanen.

**782625S: Basic Principles of Quantum Chemistry, 3 - 4 op****Voimassaolo:** - 31.07.2010**Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Laasonen Kari**Opintokohteen oppimateriaali:****Cramer, Christopher J., , 2002****Opintokohteen kielet:** Finnish**ECTS Credits:**

3 - 4 credits

**Timing:**

4th period, autumn/spring. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with the modern quantum chemistry.

**Contents:**

The emphasis is on the many-electron methods like Hartree-Fock, configuration method and density functional theory. This course focuses on the theoretical aspects whereas the practical aspects will be dealt in the course 781626S Molecular modelling workshop.

**Learning activities and teaching methods:**

30 h lectures, one final examination.

**Target group:**

Chemistry.

**Recommended optional programme components:**

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**Recommended or required reading:**

Material given in the lectures and Cramer, C.J.: Essentials of Computational Chemistry, Willey, 2002.

**Person responsible:**

Prof. Kari Laasonen.

**Other information:**

Prerequisites: 782631S Physical Chemistry II.

**784634S: Biological Mass Spectrometry, 4 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Jalonen Jorma

**Opintokohteen oppimateriaali:**

Siuzdak, Gary , , 1996

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Timing:**

4th period. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with the mass spectrometric techniques used in the analysis and research of biological compounds. Applications in the research of peptides and proteins, glycoconjugates and nucleic acids will be presented

**Contents:**

Instrumentation, LC/MS, new methods of ionisation, derivatives, the strategies of analysing peptides and proteins, methods for analysing glycoconjugates, nucleic acid derivatives.

**Learning activities and teaching methods:**

24 h lectures + 6 h exercises + demonstration, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Siuzdak, G.: Mass Spectrometry for Biotechnology, Academic Press, 1996.

**Person responsible:**

Doc. Jorma Jalonen.

**Other information:**

Prerequisites: 784627S Interpretation of Mass Spectra or the textbook: Davis, R. and Fearson, M.: Mass Spectrometry, Wiley, 1987.

## 784637S: Biological NMR Spectroscopy, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mattila, Sampo Antero

**Opintokohteen oppimateriaali:**

Cavanagh, John, , 1996

**Opintokohteen kielet:** English

**ECTS Credits:**

3 - 7 credits

**Language of instruction:**

English.

**Timing:**

The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After the course the students are familiar with production of most common 2D, 3D and 4D double and triple resonance NMR spectra.

**Contents:**

During the course the students get hands on experience on setting up and acquiring multi dimensional spectra as well as processing and converting data to other formats and assigning protein backbones.

**Learning activities and teaching methods:**

14 h lectures + applications, 30 h exercises, one final examination.

**Target group:**



Chemistry.

**Recommended or required reading:**

Cavanagh: Protein NMR Spectroscopy, Academic Press, 1995, ISBN: 0121644901.

**Person responsible:**

Senior assistant Sampo Mattila.

**Other information:**

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## 784635S: Capillary Techniques in Organic and Bioanalysis, 4 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Jalonen Jorma

**Opintokohteen oppimateriaali:**

Schomburg, Gerhard , , 1990

Weinberger, Roger , , 2000

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Timing:**

4th or 5th period, spring. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with the modern separation methods, which use capillary techniques.

These methods include for instance capillary gas chromatography, capillary electrophoresis and capillary electrochromatography.

**Contents:**

Some applications in organic and bioanalysis will be presented.

**Learning activities and teaching methods:**

24 h lectures, demonstration, 6 h exercises, seminar or one final examination.

**Target group:**

Chemistry.

**Recommended optional programme components:**

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**Recommended or required reading:**

Schomburg, G.: Gas Chromatography, A practical Course, VCH; Weinheim, 1990 and Weinberger, R.: Practical Capillary Electrophoresis, 2nd Ed., Academic Press, 2000.

**Person responsible:**

Doc. Jorma Jalonen.

**Other information:**

Prerequisites: 780111P Introduction to Analytical Chemistry and 780328A Instrumental Analysis.

## 782621S: Catalysis, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Pursiainen Jouni

**Opintokohteen oppimateriaali:**

Gates, Bruce C. , , 1992

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 - 4 credits

**Timing:**

4th or 5th period, autumn. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with the theory of catalysis. Thermodynamic and kinetic background will be studied, including mechanisms of the most important catalytic reactions. Applications, preparation, characterisation and structure of homogenous, heterogeneous and enzymatic catalysts will be discussed.

**Contents:**

Principles of catalysis, homogeneous catalysis in solutions, polymer catalysis, zeolites, heterogeneous catalysis on surfaces and bioinorganic catalysis.

**Learning activities and teaching methods:**

30 h lectures, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Gates, B.C.: Catalytic Chemistry, John Wiley & Sons, 1992, partly.

**Assessment methods and criteria:**

Examination based on the lectures.

**Person responsible:**

Prof. Jouni Pursiainen.

**Other information:**

Prerequisites: 782631S Physical Chemistry II.

## 782627S: Chemical Applications in Hazardous Waste Management and Environmental Technology, 4 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Toivo Kuokkanen

**Opintokohteen oppimateriaali:**

Clark, J.H., , 1995

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Timing:**

4th or 5th period, spring. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with the theory and practice with chemical applications, especially new ones, in hazardous waste management and environmental technology.

**Contents:**

Principles and activities in hazardous waste management, new chemical methods and technologies in hazardous waste treatment, one practical work (alternative topics).

**Learning activities and teaching methods:**

30 h lectures + seminar + practical exercise, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Material given in the lecture and Clark, J.H.: Chemistry of Waste Minimization, Blackie Academic & Professional, Glasgow, 1995 (partly).

**Person responsible:**

Doc. Toivo Kuokkanen.

**Other information:**

Prerequisites: 780372A Basic Principles in Green Chemistry and 780347A Physical Chemistry I.

## 780321A: Chemical Legislation in Finland, 1 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Pentti Oksman

**Opintokohteen oppimateriaali:**

Raimo Luhtanen, , 2007

Sundquist Anna-Liisa, Koivumäki Tapani ja Aalto Asko, , 2007

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780681S Chemical Legislation in Finland 1.0 op

**ECTS Credits:**

1 - 2 credits

**Language of instruction:**

Finnish.

**Timing:**

3rd autumn.

**Learning outcomes:**

After the course the student is familiar with Finnish legislation concerning chemistry and occupational health. He /she is acquainted with the limitations of the use of dangerous chemicals and is able to find updated information of them. The student is also familiar with the main laws of pressure containers and tanks of compressed gases as well as of radiation.

**Contents:**

Safety at work, sanitarily and environmentally hazardous chemicals, explosive materials and combustible liquids, pressure containers and tanks of compressed gases.

**Learning activities and teaching methods:**

10 h lectures, one final examination.

**Target group:**

Chemistry, compulsory.

**Recommended or required reading:**

Työpaikan lakikirja 2007. Työpaikan kemikaalilainsäädäntö 2007.

**Person responsible:**

Senior Laboratory Manager Pentti Oksman.

## 780395A: Chemistry for Teachers, 4 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Leena Kaila

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

## 782634S: Chemistry in industrial applications, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Ulla Lassi

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Timing:**

4th or 5th period, spring.

**Learning outcomes:**

After this course the student is familiar with chemical applications in process and environmental technology. In particular, new applications of chemistry are considered.

**Contents:**

Catalytic applications in water purification, catalytic oxidation, preparation of biofuels from biomass, biomass gasification and the utilisation of biogas, chemistry and chemical reactions in mining processes etc. (visiting lecturers from the companies).

**Learning activities and teaching methods:**

30 h lectures, one final examinations.

**Target group:**

Chemistry.

**Recommended or required reading:**

Material given by the lecturer, scientific review papers.

**Assessment methods and criteria:**

Examination based on the lectures.

**Person responsible:**

Prof. Ulla Lassi.

**Other information:**

Prerequisites: Physical Chemistry I and II.

## 781610S: Chemistry of Metal Complexes, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Leena Kaila

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 - 4 credits

**Language of instruction:**

Finnish.

**Timing:**

4th or 5th autumn. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with complex compounds and their solution equilibria.

**Contents:**

Determination and concepts of metal complexes, solution chemistry of complexes, principal methods of studying complex equilibria, mathematical treatment of data, and applications.

**Learning activities and teaching methods:**

20 h lectures, one final examination.

**Target group:**

Chemistry, optional.

**Recommended or required reading:**

Material handed out by the lecturer.

**Person responsible:**

Lecturer Leena Kaila.

## 783627S: Chemistry of Natural Substances I, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Marja Lajunen

**Opintokohteen oppimateriaali:**

**Davis, Benjamin G.** , , 2002

**Dewick, Paul M.** , , 1997

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 - 4 credits

**Timing:**

4th or 5th period, autumn or spring. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with carbohydrates and lipids, their chemistry and role in life science.

**Contents:**

Carbohydrates and their reactions, primary and secondary metabolism, chemical formation of disaccharides, polysaccharides, chemical glycobiology. Lipids, eicosanoids, phospholipids and their biosynthesis.

**Learning activities and teaching methods:**

20 h lectures, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Davis, B.G. and Fairbanks, A.J.: Carbohydrate Chemistry, Oxford Chemistry Primers, 2002, partly; Dewick, Paul M.: Medicinal Natural Products, A Biosynthetic Approach, Wiley & Sons Ltd, 1998.

**Person responsible:**

Prof. Marja Lajunen.

**Other information:**

Prerequisites: 780389A Organic Chemistry I and 783643S Organic Chemistry II.

## 783641S: Chemistry of Natural Substances II, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Marja Lajunen

**Opintokohteen oppimateriaali:**

**Dewick, Paul M.** , , 1997

**Mann, J., Davidson, R.S., Hobbs, J.B., Banthorpe, D.V. ja Harborne, J.B.** , , 1994

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 - 4 credits

**Timing:**

4th or 5th period, spring. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with terpenoids, steroids, and alkaloids. He/she knows their biosynthetic background, properties and effects.

**Contents:**

Terpenoids, steroids, and alkaloids.

**Learning activities and teaching methods:**

20 h lectures, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Material handed out by the lecturer and Mann, J., Davidson, R.S., Hobbs, J.B., Banthorpe, D.V. and Harborne, J. B.: Natural Products, Their Chemistry and Biological Significance; Longman Scientific & Technical, 1995. Dewick, Paul M.: Medicinal Natural Products, A Biosynthetic Approach, Wiley & Sons Ltd, 1998.

**Person responsible:**

Prof. Marja Lajunen.

**Other information:**

Prerequisites: 780389A Organic Chemistry I and 783643S Organic Chemistry II.

## 781621S: Chemistry of Non-Metals, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Raija Oilunkaniemi

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 - 4 credits

**Language of instruction:**

Finnish or English.

**Timing:**

4th or 5th autumn. The course is lectured every other year.

**Learning outcomes:**

This course will give students an overview of the development of chemistry of non-metals by examining current literature of the field.

**Contents:**

New methods in the synthesis of non-metallic compounds, structural chemistry, and chemical properties of non-metallic compounds.

**Learning activities and teaching methods:**

18 h lectures + seminar, one final examination, attendance at the lectures.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Prerequisites: 780353A Inorganic Chemistry I.

**Recommended or required reading:**

Material handed out by the lecturer.

**Person responsible:**

Doc. Raija Oilunkaniemi.

## 783635S: Chemistry of Paints and Surface Coatings, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Hormi Osmo

**Opintokohteen oppimateriaali:**

Paul, Swaraj , , 1985

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 - 4 credits

**Timing:**

4th or 5th period, spring. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with the basic principles of colour theory and the most important polymers used as binders in paints: alkyd paints and polyesters, surface coatings based on formaldehyde, siloxanes and other silicon polymers, epoxy polymers and acrylate polymers. The student is also familiar with the most important inorganic and organic pigments used in paints as well as new painting technologies such as water soluble and water dilutable polymers used in surface coatings, systems that harden by radiation and polymer systems that have a high dry solids content.

**Contents:**

Binders: alkyd paints and polyesters, surface coatings based on formaldehyde, silicon and other silicon polymers, epoxy polymers, acrylic polymers. Pigments: inorganic, organic. Theory of color. Formation of film.. New technologies: water soluble or water dilutable surface coatings, systems that harden by radiation, systems that have a high dry solids content.

**Learning activities and teaching methods:**

24 h lectures, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Paul, S.: Surface Coatings Science and Technology, John Wiley & Sons, New York, 1986.

**Person responsible:**

Prof. Osmo Hormi.

**Other information:**

Prerequisites: 780326A Introduction to Polymer Chemistry.

## 781613S: Chemistry of Rare Earth Elements, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Laitinen Risto

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 - 4 credits

**Language of instruction:**

Finnish or English.

**Timing:**

4th or 5th autumn. The course is lectured every other year.

**Learning outcomes:**

This course will give students an overview of the development of chemistry of rare earth elements.

**Contents:**

Occurrence, isolation, chemical properties and coordination chemistry of rare earth elements.

**Learning activities and teaching methods:**

18 h lectures, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

780353A Inorganic Chemistry I and 781642S Inorganic Chemistry II.

**Recommended or required reading:**

Material handed out by the lecturer.

**Person responsible:**

Doc. Raija Oilunkaniemi.

## 781645S: Chemistry of Solid Fuels Ashes, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Minna Tiainen

**Opintokohteen oppimateriaali:**

Raiko, R., Saastamoinen, J., Hupa, M. & Kurki-Suonio, I., , 2002

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish.

**Timing:**

4th or 5th autumn. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with solid fuels and the formation mechanisms of ashes as well as the combustion technologies and the ash-related problems occurring in boilers.

**Contents:**

Ash forming material in solid fuels, thermal behaviour of ash forming material and ashes, combustion technologies, slagging, fouling, corrosion, bed material agglomeration and main analytical methods for chemical characterisation of fuels, ashes.

**Learning activities and teaching methods:**

20 h lectures + seminar, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

780353A Inorganic Chemistry I.

**Recommended or required reading:**

Raiko, R., Saastamoinen, J., Hupa, M. & Kurki-Suonio, I., Poltto ja palaminen, Gummerus Oy, Jyväskylä (in Finnish).

**Person responsible:**

Lecturer Minna Tiainen.

**781644S: Computational Inorganic Chemistry, 3 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Laitinen Risto

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish.

**Timing:**

4th or 5th year. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with review of computational methods in quantum inorganic chemistry.

**Contents:**

Review of computational methods in quantum chemistry (molecular mechanics, semiempirical methods, ab initio methods, DFT methods), basis sets, computation of molecular properties, transition states, spectroscopic properties. The application of the methods in inorganic chemistry will be illustrated by examples from current literature.

**Learning activities and teaching methods:**

28 h lectures, 14 h exercises.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

780353A Inorganic Chemistry I, 781642S Inorganic Chemistry II and 782630S Quantum Chemistry.

**Recommended or required reading:**

Recommended reading: Young, D.: Computational Chemistry: A Practical Guide for Applying Techniques to Real World Problems, Wiley-Interscience, 2001; Hinchliffe, A.: Molecular Modelling for Beginners, John Wiley & Sons Ltd, 2003.

**Person responsible:**

Prof. Risto Laitinen.

**784626S: Computer Analysis of NMR Spectra, 2 op**



**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mattila, Sampo Antero

**Opintokohteen oppimateriaali:**

**Günther, Harald** , , 1995

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

2 credits

**Timing:**

4th or 5th period, spring. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with computer aided NMR spectral processing and production, and assignment tools.

**Contents:**

The basic theory for analysing NMR spectra; the structure, function and use of simulating and iterating analysis programs.

**Learning activities and teaching methods:**

8 h lectures + 28 h exercises, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Günther, H.: NMR Spectroscopy, 2. painos, Wiley, 1995 (partly). Laatikainen, R. ja Niemitz, M.: Perch, An Integrated software for Analysis of NMR spectra on PC, University of Kuopio, 1994.

**Person responsible:**

Senior assistant Sampo Mattila.

## 780396A: Demonstrations in Physics and Chemistry, 2 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Leena Kaila

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

766309A Demonstrations in Physics and Chemistry 2.0 op

**ECTS Credits:**

2 credits

## 781632S: Determination of Trace Elements, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Paavo Perämäki

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 - 4 credits

**Language of instruction:**

Finnish.

**Timing:**

4th or 5th spring. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with special problems incoming in determination of ultra trace levels of various elements.

**Contents:**

Sample preparation: sampling, sample decomposition and storage. Loss of elements and contamination problems. Separation and preconcentration methods. Chromatographic techniques coupled to atomic spectrometry and ICP- mass spectrometry for speciation analysis.

**Learning activities and teaching methods:**

24 h lectures, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

780328A Instrumental Analysis.

**Recommended or required reading:**

Material handed out by the lecturer.

**Person responsible:**

Prof. Paavo Perämäki.

## 780373A: Environmental Chemistry, 3 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Minna Tiainen

**Opintokohteen oppimateriaali:**

VanLoon, Gary W. , , 2000

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780359A	Environmental Chemistry	4.0 op
780355A	Environmental Chemistry and Hazardous Wastes	4.0 op
780316A	Environmental Chemistry	2.0 op
780360A	Environmental Chemistry and Hazardous Wastes	5.5 op

**ECTS Credits:**

3 - 4 credits

**Timing:**

3rd autumn.

**Learning outcomes:**

After this course the student is familiar with chemistry of atmosphere, hydrosphere and terrestrial environment.

**Contents:**

Fundamentals of environmental chemistry; chemistry of the soil, natural and waste waters and atmosphere, circulation of chemical compounds in the nature, chemical releases, environmentally toxic and other noxious compounds, environmental analytics and basics of physical measurements.

**Learning activities and teaching methods:**

30 h lectures, one final examination.

**Target group:**

Chemistry, compulsory.

**Recommended optional programme components:**

Introduction to Physical Chemistry (780101P) and Introduction to Inorganic Chemistry (780102P) or Basic Principles in Chemistry (780109P).

**Recommended or required reading:**

van Loon, G.W. & Duffy, S.J.: Environmental Chemistry, A Global Perspective, Oxford, 2000.

**Person responsible:**

Lecturer Minna Tiainen.

**781633S: Experimental Design, 4 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Paavo Perämäki**Opintokohteen oppimateriaali:****Massart, D.L., Vandeginste, B.G.M., Buydens, L.M.C., De Jong, S., Lewi, P.J. ja Smeyers-Verbeke, J., , 1997****Opintokohteen kielet:** Finnish**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish.

**Timing:**

4th or 5th spring. The course is lectured every other year.

**Learning outcomes:**

After this course the student understands the importance of experimental design and is familiar with the most common applications of computer aided statistical experimental design.

**Contents:**

Factorial designs, D-optimal designs, mixture designs and response surface methodology. Computer programmes are applied during the course in the design and analysis of the experiments.

**Learning activities and teaching methods:**

30 h lectures, practical exercise, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

781631S Statistical Methods in Analytical Chemistry.

**Recommended or required reading:**

Massart, D.L., Vandeginste, B.G.M., Buydens, L.M.C., De Jong, S., Lewi, P.J. and Smeyers-Verbeke, J.: Handbook of Chemometrics and Qualimetrics: Part A, Elsevier, 1997.

**Person responsible:**

Prof. Paavo Perämäki.

**781600S: Final Examination in Inorganic Chemistry, 7 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opintokohteen oppimateriaali:****Cotton, F. Albert , , 1995****Huheey, James E. , , 1993****Clayden, J., Greeves, N., Warren, S. ja Wothers, P., , 2001****Opintokohteen kielet:** Finnish**ECTS Credits:**

7 - 7,5 credits

**Timing:**

4th or 5th period.

**Target group:**

Chemistry.

**Recommended or required reading:**

Inorganic Chemistry: Huheey, J.E., Keiter, E.A. and Keiter, R.L., Inorganic Chemistry: Principles of Structure and Reactivity, 4th ed., Harper Collins College Publishers, 1993.

**Assessment methods and criteria:**

Texts for the final examination in the chosen subject in chemistry are given by the professor of the field. The final examination may be an oral and/or written examination. There are two teachers present in the oral examinations. The grade of the Final Examination may be improved by taking the examination again.

**Person responsible:**

Prof.

## 783600S: Final Examination in Organic Chemistry, 7 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen oppimateriaali:**

**Clayden, J., Greeves, N., Warren, S. ja Wothers, P.,** , 2001

**Cotton, F. Albert** , , 1995

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

7 - 7,5 credits

**Timing:**

4th or 5th period.

**Target group:**

Chemistry.

**Recommended or required reading:**

Organic Chemistry: Clayden, J., Greeves, N., Warren, S. and Wothers, P.: Organic Chemistry, Oxford University Press, 2001 and one book by separate agreement.

**Assessment methods and criteria:**

Texts for the final examination in the chosen subject in chemistry are given by the professor of the field. The final examination may be an oral and/or written examination. There are two teachers present in the oral examinations. The grade of the Final Examination may be improved by taking the examination again.

**Person responsible:**

Prof.

## 782600S: Final Examination in Physical Chemistry, 7 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen oppimateriaali:**

**Clayden, J., Greeves, N., Warren, S. ja Wothers, P.,** , 2001

**Cotton, F. Albert** , , 1995

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

7 - 7,5 credits

**Timing:**

4th or 5th period.

**Target group:**

Chemistry.

**Recommended or required reading:**

Physical Chemistry: by separate agreement.

**Assessment methods and criteria:**

Texts for the final examination in the chosen subject in chemistry are given by the professor of the field. The final examination may be an oral and/or written examination. There are two teachers present in the oral examinations. The grade of the Final Examination may be improved by taking the examination again.

**Person responsible:**

Prof.

## 784600S: Final Examination in Structural Chemistry, 7 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen oppimateriaali:**

**Clayden, J., Greeves, N., Warren, S. ja Wothers, P.**, , 2001

**Cotton, F. Albert** , , 1995

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

7 - 7,5 credits

**Timing:**

4th or 5th period.

**Target group:**

Chemistry.

**Recommended or required reading:**

Structural Chemistry: by separate agreement.

**Assessment methods and criteria:**

Texts for the final examination in the chosen subject in chemistry are given by the professor of the field. The final examination may be an oral and/or written examination. There are two teachers present in the oral examinations. The grade of the Final Examination may be improved by taking the examination again.

**Person responsible:**

Prof.

## 782618S: High Pressure Kinetics, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Toivo Kuokkanen

**Opintokohteen oppimateriaali:**

**Porter G.**, , 1970

**Van Eldik, R.**, , 1986

**Reichardt, Christian** , , 2003

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 - 4 credits

**Timing:**

4th or 5th period. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with the effect of high pressure on reactions of a different type.

**Contents:**

Chemical applications of high pressure, determination and calculation of activation volumes, pressure effect on activation volumes of different reaction classes, reaction kinetics by UV/Vis spectrometric methods.

**Learning activities and teaching methods:**

20 h lectures + two home works, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Material given in the lecture and partly, Porter, G.: Progress in Reaction Kinetics, Pergamon Press, Oxford, 1970., Van Eldik, R.: Inorganic High Pressure Chemistry, 1986 and Reichardt, C.: Solvents and Solvent Effects in Organic Chemistry, 2003.

**Person responsible:**

Doc. Toivo Kuokkanen.

**Other information:**

Prerequisites: 780347A Physical Chemistry I and 782631S Physical Chemistry II.

### **781638S: ICP-MS Workshop, 3 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Paavo Perämäki

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 - 4 credits

**Language of instruction:**

Finnish.

**Timing:**

4th or 5th spring. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with modern (quadrupole) ICP-MS devices and knows the advantages and limitations of the ICP-MS technique.

**Contents:**

Inductively coupled plasmas as ion sources, properties of modern ICP-MS instruments, matrix and other interference effects, laser ablation and other special techniques.

**Learning activities and teaching methods:**

20 h lectures and demonstrations, and practical exercise, one final examination.

**Target group:**

Chemistry, optional.

**Recommended or required reading:**

Material handed out by lecturer.

**Person responsible:**

Prof. Paavo Perämäki.

### **780341A: Industrial Training I, 2 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Practical training

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

2 credits

**Learning activities and teaching methods:**

2nd or 3rd year.

**Target group:**

Chemistry, optional.

### **780342A: Industrial Training II, 4 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Practical training

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Learning activities and teaching methods:**

2nd or 3rd year.

**Target group:**

Chemistry, compulsory.

**780343A: Industrial Training III, 6 op****Opiskelumuoto:** Intermediate Studies**Laji:** Practical training**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish**ECTS Credits:**

6 credits

**Learning activities and teaching methods:**

2nd or 3rd period.

**Target group:**

Chemistry, compulsory.

**780344A: Industrial Training IV, 8 op****Opiskelumuoto:** Intermediate Studies**Laji:** Practical training**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish**ECTS Credits:**

8 credits

**Learning activities and teaching methods:**

2nd or 3rd period.

**Target group:**

Chemistry, compulsory.

**780353A: Inorganic Chemistry I, 6 op****Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opintokohteen oppimateriaali:**

Atkins, P., Overton, T., Rourke, J., Weller, M. ja Armstrong, F., , 2006

**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

780356A Inorganic Chemistry 9.0 op

**Voidaan suorittaa useasti:** Kyllä**ECTS Credits:**

5,5 - 6 credits

**Language of instruction:**

Finnish.

**Timing:**

2nd spring.

**Learning outcomes:**

After this course the student is familiar with most important basic principles of modern inorganic chemistry.

**Contents:**

Atomic structure, chemical bond and molecular structure, solid state chemistry, acid-base theories, oxidation-reduction reactions, overview of main group chemistry.

**Learning activities and teaching methods:**

40 h lectures + 16 h exercises, (8 home assignments), one final examination.

**Target group:**

Chemistry, compulsory.

**Recommended optional programme components:**

780101P Introduction to Physical Chemistry and 780102P Introduction to Inorganic Chemistry or 780109P Basic Principles in Chemistry.

**Recommended or required reading:**

Atkins, P., Overton, T., Rourke, J., Weller, M., and Armstrong, F., Inorganic Chemistry, 4th ed., Oxford University Press, 2006.

**Person responsible:**

Prof. Risto Laitinen.

**781642S: Inorganic Chemistry II, 4 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen oppimateriaali:**

Atkins, P., Overton, T., Rourke, J., Weller, M. ja Armstrong, F., , 2006

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780391A Inorganic Chemistry II 4.0 op

780361A Inorganic Chemistry II 4.0 op

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish.

**Timing:**

4th autumn.

**Learning outcomes:**

After this course the student is familiar with basic concepts of coordination chemistry of transition metal complexes.

**Contents:**

Structure and bonding of complexes of transition metals and their chemical and spectroscopic properties, organometallic chemistry, catalysis, introduction to bioinorganic chemistry.

**Learning activities and teaching methods:**

22 h lectures + 16 h exercises, (8 home assignments), one final examination.

**Target group:**

Chemistry, compulsory.

**Recommended optional programme components:**

780353A Inorganic Chemistry I.

**Recommended or required reading:**

Atkins, P., Overton, T., Rourke, J., Weller, M., and Armstrong, F., Inorganic Chemistry, 4th ed., Oxford University Press, 2006.

**Person responsible:**

Prof. Risto Laitinen.

**780378A: Inorganic Ion Reactions and Qualitative Analysis, 2 op**



**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

2 credits

**Contents:**

Introduction to inorganic ion reactions.

**Learning activities and teaching methods:**

45 h laboratory works, 10 h work reports + final examination.

**Target group:**

Subject teachers in Physical Sciences and Mathematical Sciences.

**Grading:**

75 % laboratory work 25 % final examination.

**Person responsible:**

Lecturer Minna Tiainen.

**Other information:**

Prerequisites: Lecture courses of basic studies in chemistry.

## 780328A: Instrumental Analysis, 4 - 5 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Paavo Perämäki, Jalonen Jorma

**Opintokohteen oppimateriaali:**

Kellner, R., Mermet, J.-M., Otto, M., , 2004

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780324A Analytical Chemistry II 4.0 op

**ECTS Credits:**

5 - 5,5 credits

**Language of instruction:**

Finnish.

**Timing:**

3rd autumn.

**Learning outcomes:**

After this course the student is familiar with the modern methods of instrumental analysis used both in research laboratories and in industry.

**Contents:**

Atomic absorption end emission spectrometry; X-Ray fluorescence spectrometry; Molecular fluorescence, phosphorescence and chemiluminescence; NMR spectrometry; Mass spectrometry; Chromatographic methods; Electroanalytical methods; Thermal analysis.

**Learning activities and teaching methods:**

40 h lectures + 6 h exercises, two intermediate examinations or one final examination.

**Target group:**

Chemistry, compulsory.

**Recommended optional programme components:**

Introduction to Analytical Chemistry (780111P).

**Recommended or required reading:**

Kellner, R., Mermet, J.-M., Otto, M., Valcárcel, M. and Widmer, H. M.: Analytical Chemistry, A Modern Approach to Analytical Science, Wiley-VCH, 2004, partly.

**Person responsible:**

Prof. Paavo Perämäki and Doc. Jorma Jalonen.

## 782629S: Interactions between Molecules, 4 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Pursiainen Jouni

**Opintokohteen oppimateriaali:**

**Atkins, P. W.** , , 1998

**Reichardt, Christian** , , 1988

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 - 5,5 credits

**Timing:**

4th or 5th period, spring. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with the principles and applications of intermolecular interactions. Non-covalent intermolecular interactions have fundamental effects in practically all the applications of modern chemistry, including solvent interactions, surface chemistry, catalysis and supramolecular chemistry.

**Contents:**

The physical background of intermolecular interactions and their applications in solution chemistry and supramolecular chemistry.

**Learning activities and teaching methods:**

40 h lectures, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Atkins, P.W.: Physical Chemistry, Oxford University Press, Oxford, 6th ed.(1998) or 7th ed. (2002), Chapters 21-22. Reichart, C.: Solvents and Solvent Effects in Organic Chemistry, 2nd ed., VCH, 1990 partly.

**Person responsible:**

Prof. Kari Laasonen and Prof. Jouni Pursiainen.

**Other information:**

Prerequisites and completing: 780347A Physical Chemistry I and 782631S Physical Chemistry II.

## 784627S: Interpretation of Mass Spectra and Workshop, 5 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Jalonen Jorma

**Opintokohteen oppimateriaali:**

**McLafferty, Fred W.** , , 1993

**Hoffmann, Edmond de** , , 2002

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 - 5,5 credits

**Timing:**

4th period, spring. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with the basics of the interpretation of mass spectra.

**Contents:**

Ionisation methods, fragmentation mechanisms, and basics of the interpretation of mass spectra. Applications in organic and biological chemistry.

**Learning activities and teaching methods:**

24 h lectures + 10 h exercises + seminar, one final examination.

**Target group:**

Chemistry.

**Recommended optional programme components:**

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**Recommended or required reading:**

Selected parts from the books; de Hoffmann, E and Stroobant, V.: Mass Spectrometry. Principles and Applications, 2nd Ed. Wiley, 2001; McLafferty, F.W and Turecek, F.: Interpretation of Mass Spectra, 4. ed., University Science Books, Mill Valley Cal., 1993.

**Person responsible:**

Doc. Jorma Jalonen.

**Other information:**

Prerequisites: 780328A Instrumental Analysis and 780317A Structural Chemistry I.

## 780111P: Introduction to Analytical Chemistry, 4 op

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Paavo Perämäki

**Opintokohteen oppimateriaali:**

Saarinen, Heikki (1) , , 2004

Kellner, R., Mermet, J.-M., Otto, M., , 2004

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780110P Analytical Chemistry I 5.5 op

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish.

**Timing:**

1st spring.

**Learning outcomes:**

After this course the student is familiar with the main principles of analytical chemistry and classical methods of chemical analysis.

**Contents:**

Steps in quantitative analysis; statistical evaluation of analytical data, aqueous-solution chemistry; gravimetry, titrimetry, spectrophotometry.

**Learning activities and teaching methods:**

30 hours of lectures plus 10 hours of exercises, two intermediate examinations or one final examination.

**Target group:**

Biochemistry, Chemistry, compulsory.

Mathematical Sciences, Physical Sciences, optional.

**Recommended optional programme components:**

Prerequisites: Introduction to Physical Chemistry (780101P) and Introduction to Inorganic Chemistry (780102P); or Basic Principles in Chemistry (780109P).

**Recommended or required reading:**

Saarinen, H. & Lajunen, L.H.J.: Analyttisen kemian perusteet, Oulun yliopistopaino, 2004; Kellner, R., Mermet, J.-M., Otto, M., Valcárcel, M. and Widmer, H. M.: Analytical Chemistry, A Modern Approach to Analytical Science, Wiley-VCH, 2004, partly.

**Person responsible:**

Prof. Paavo Perämäki.

## 780102P: Introduction to Inorganic Chemistry, 5 op

**Voimassaolo:** - 03.06.2013

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Leena Kaila

**Opintokohteen oppimateriaali:**

**Petrucci, R.H., Harwood, W.S., Herring, F.G. and Madura, J.D., , 2007**

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay780117P	General and Inorganic Chemistry A (OPEN UNI)	5.0 op
ay780118P	General and Inorganic Chemistry B (OPEN UNI)	5.0 op
780113P	Introduction to Chemistry	12.0 op
780102P2	Inorganic Chemistry I	4.0 op
780107P	Basic Course in Inorganic and Physical Chemistry	7.5 op
780152P	Inorganic and Physical Chemistry I	7.5 op
780153P	General and Inorganic Chemistry	7.5 op
780154P	Basic Inorganic Chemistry	7.5 op

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

1st autumn.

**Learning outcomes:**

After this course the student is familiar with basic concepts of atomic structure, chemical bonding and descriptive chemistry of elements.

**Contents:**

Atoms and their structure, chemical bond, descriptive chemistry of elements.

**Learning activities and teaching methods:**

30 hours of lectures plus 24 hours of exercises, one final examination.

**Target group:**

Biochemistry, Chemistry, compulsory.

Physical Sciences, Mathematical Sciences, optional.

**Recommended optional programme components:**

Upper secondary school chemistry.

**Recommended or required reading:**

Petrucci, R.H., Harwood, W.S., Herring, F.G. ja Madura, J.D.: General Chemistry: Principles and Modern Applications, 9. ed. (also 7. or 8. ed.), Pearson Prentice Hall, New Jersey, 2007.

**Person responsible:**

Lecturer Leena Kaila.

## **780103P: Introduction to Organic Chemistry, 6 op**

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Koskela, Juha Pekka, Marja Lajunen

**Opintokohteen oppimateriaali:**

**Hart, Harold , , 1999**

**Hart, Harold , , 1999**

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780112P	Introduction to Organic Chemistry	4.0 op
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780103P2 Organic Chemistry I 6.0 op  
 780108P Basic Course in Organic Chemistry 6.0 op

**Voidaan suorittaa useasti:** Kyllä

**ECTS Credits:**

6 credits

**Language of instruction:**

Finnish

**Timing:**

1st autumn-spring.

**Learning outcomes:**

After this course the student is familiar with basics of organic chemistry: structure and properties of organic compounds, basic reactions and basic types of mechanisms.

**Contents:**

Basic reactions of organic compounds, basic principles of stereochemistry and reaction mechanisms, applications.

**Learning activities and teaching methods:**

52 hours of lectures and applications plus 5 hours of exercises, three intermediate examinations or one final examination.

**Target group:**

Biochemistry, Chemistry, compulsory.

Physical Sciences, Mathematical Sciences, optional.

**Recommended optional programme components:**

Upper secondary school chemistry.

**Recommended or required reading:**

Hart, H.: Organic Chemistry: A Short Course, 10th or the newer edition, Houghton Mifflin, Boston, 1999; Hart, H. and Hart, D.: Study Guide & Solutions Book, Organic Chemistry: A Short Course, 10th edition, Houghton Mifflin, Boston, 1999.

**Person responsible:**

Prof. Marja Lajunen and Senior assistant Juha Koskela.

## 780112P: Introduction to Organic Chemistry, 4 op

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Koskela, Juha Pekka

**Opintokohteen oppimateriaali:**

Hart, Harold , , 1999

Hart, Harold , , 1999

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay780112P Introduction to Organic Chemistry (OPEN UNI) 4.0 op  
 780103P Introduction to Organic Chemistry 6.0 op  
 780103P2 Organic Chemistry I 6.0 op  
 780108P Basic Course in Organic Chemistry 6.0 op

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish

**Timing:**

1st autumn-spring.

**Learning outcomes:**

After this course the student is familiar with basics of organic chemistry: structure and properties of organic compounds, basic reactions and some mechanisms.

**Contents:**

Basic reactions of organic compounds, applications, basic principles of stereochemistry and some mechanisms.

**Learning activities and teaching methods:**

32 hours of lectures and applications, two intermediate examinations or one final examination.

**Target group:**

Biology, Process Engineering, compulsory.

Physical Sciences, Geology, Geopraphy, Mathematical Sciences, optional.

**Recommended or required reading:**

Hart, H.: Organic Chemistry: A Short Course, 10th or the newer edition, Houghton Mifflin, Boston, 1999; Hart, H. and Hart, D.: Study Guide & Solutions Book, Organic Chemistry: A Short Course, 10th edition, Houghton Mifflin, Boston, 1999.

**Person responsible:**

Senior assistant Juha Koskela.

**Other information:**

Students attend the lectures of 780103 P Introduction of Organic Chemistry, 6 credits.

**780101P: Introduction to Physical Chemistry, 7 op**

**Voimassaolo:** - 31.12.2010

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Pikkarainen, Liisa Marjatta

**Opintokohteen oppimateriaali:**

**Petrucci, Ralph H.**, , 2002

**Petrucci, R.H., Harwood, W.S., Herring, F.G. and Madura, J.D.**, , 2007

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay780117P	General and Inorganic Chemistry A (OPEN UNI)	5.0 op
ay780118P	General and Inorganic Chemistry B (OPEN UNI)	5.0 op
780113P	Introduction to Chemistry	12.0 op
780109P	Basic Principles in Chemistry	4.0 op
780101P2	Physical Chemistry I	4.0 op
780107P	Basic Course in Inorganic and Physical Chemistry	7.5 op
780152P	Inorganic and Physical Chemistry I	7.5 op
780153P	General and Inorganic Chemistry	7.5 op
780154P	Basic Inorganic Chemistry	7.5 op

**ECTS Credits:**

7 credits

**Language of instruction:**

Finnish

**Timing:**

1st autumn.

**Learning outcomes:**

After this course the student is familiar with basic concepts of chemical reactions and equations, stoichiometric calculations, thermodynamics, chemical kinetics and equilibria.

**Contents:**

Basic concepts of chemistry, chemical formula, chemical reaction, chemical equation, oxidation-reduction reactions, stoichiometry, gases, thermodynamics, phase equilibria, reaction kinetics, chemical equilibrium, acid-base equilibria, equilibria in water solutions of slightly soluble salts.

**Learning activities and teaching methods:**

52 hours of lectures and applications plus 30 hours of exercises, two intermediate examinations or one final examination.

**Target group:**

Biochemistry, Chemistry, compulsory.

Physical sciences, Mathematical sciences, optional.

**Recommended optional programme components:**

Upper secondary school chemistry.

**Recommended or required reading:**

Petrucci, R.H., Harwood, W.S., Herring, F.G. ja Madura, J.D.: General Chemistry: Principles and Modern Applications. 9th (also 8th and 7th) edition, Prentice Hall, New Jersey, 2007.

**Person responsible:**

Lecturer Liisa Pikkarainen.

## 780326A: Introduction to Polymer Chemistry, 2 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Hormi Osmo

**Opintokohteen oppimateriaali:**

Stevens, Malcolm P. , , 1999

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

783650S Introduction to Chemistry 2.0 op

**ECTS Credits:**

2 credits

**Language of instruction:**

Finnish.

**Timing:**

1st spring.

**Learning outcomes:**

After this course the student is familiar with basic classification principles of polymeric materials, their nomenclature, their basic properties such as glass transition temperature ( $T_g$ ), expected stability of polymers as well as the chemistry of main polymerization methods to obtain commodity plastics.

**Contents:**

Basic principles,  $T_g$ , stability, polymerization of vinylic compounds (radical, ion, Ziegler-Natta) to give commodity plastics.

**Learning activities and teaching methods:**

20 h lectures, one final examination.

**Target group:**

Chemistry.

**Recommended optional programme components:**

Introduction to Organic Chemistry (780103P or 780112P).

**Recommended or required reading:**

Stevens, M.P.: Polymer Chemistry, An Introduction, 3rd ed., Oxford University Press, Oxford, 1999.

**Person responsible:**

Prof. Osmo Hormi.

## 780122P: Introductory Laboratory Course in Chemistry, 3 op

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 - 4 credits

**Timing:**

1st autumn or spring.

**Learning outcomes:**

After this course the student is familiar with basic laboratory tools and experiments.

**Contents:**

Laboratory safety, general laboratory tools and equipment, gravimetric, titrimetric and spectrophotometric analysis, inorganic and organic synthesis, TLC analysis.

**Learning activities and teaching methods:**

40 hours of laboratory works plus demonstrations, one final examination.

**Target group:**

Biochemistry, Biology, Chemistry, Biophysics, Process engineering, compulsory. Physical Sciences, Geology, Mathematical Sciences, optional.

**Recommended optional programme components:**

Previous or simultaneous participation in the course 780101P Introduction to Physical Chemistry or 780109P Basic Principles in Chemistry.

**Recommended or required reading:**

Instruction book (in Finnish): Kemian perustyöt.

**Assessment methods and criteria:**

-

**Grading:**

Pass/fail

**Person responsible:**

Lecturer L. Pikkarainen and teaching assistants.

**Other information:**

-

## 780697S: Laboratory Course (Teachers), 20 op

**Voimassaolo:** - 31.07.2010

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.

## 780354A: Laboratory Course I in Inorganic Chemistry, 5 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Leena Kaila

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780330A-02 Laboratory Course I in Inorganic Chemistry (2. part) 5.0 op

**ECTS Credits:**

5 credits

**Timing:**

2nd period, spring.

**Learning outcomes:**

-

**Contents:**

Classical quantitative inorganic analysis and basic inorganic synthesis.

**Learning activities and teaching methods:**

80 h laboratory works, 45 h work reports + one final examination.

**Target group:**

Chemistry.



**Grading:**

75 % laboratory work 25 % final examination.

**Person responsible:**

Lecturer Leena Kaila.

**Other information:**

Prerequisites: Lecture courses of basic studies in chemistry.

**780330A: Laboratory Course I in Inorganic Chemistry, 7 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Leena Kaila

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

7 - 9 credits

**Timing:**

Part 1 (780330A-01): 1st period, spring.

Part 2 (780330A-02): 2nd period, spring.

**Learning outcomes:**

After this course the student is familiar with basic qualitative inorganic chemistry, classical quantitative inorganic chemistry and basic inorganic synthetic chemistry.

**Contents:**

Part 1: Introduction to inorganic ion reactions.

Part 2: Classical quantitative inorganic analysis and basic inorganic synthesis.

**Learning activities and teaching methods:**

Part 1: 45 h laboratory work, 10 h work reports + final examination.

Part 2: 80 h laboratory work, 45 h work reports + final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Part 1: Material handed out in the laboratory.

Part 2: Material handed out in the laboratory.

**Grading:**

75 % laboratory work 25 % final examination.

**Person responsible:**

Part 1. Lecturer M. Tiainen and part 2. Lecturer L. Kaila.

**Other information:**

Lecture courses of basic studies in chemistry.

**780330A-01: Laboratory Course I in Inorganic Chemistry (1. part), 2 op**

**Voimassaolo:** 01.08.2005 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Partial credit

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Minna Tiainen

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

2 credits

**780330A-02: Laboratory Course I in Inorganic Chemistry (2. part), 5 op**

**Voimassaolo:** 01.08.2005 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Partial credit

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Leena Kaila

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

### **780329A: Laboratory Course I in Organic Chemistry, 4 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Timing:**

2nd period, autumn.

**Learning outcomes:**

After this course the student is familiar with basic techniques of organic chemistry such as distillation, extraction, crystallization, TLC, as well as safety issues, glassware and equipment, laboratory notebooks and written reporting of laboratory experiments. Student familiarises with practical laboratory work by carrying out reactions in aromatic substitution with protective group strategy, organometallic chemistry, Aldol condensation, elimination and disproportionation.

**Contents:**

Review of methods in organic chemistry and TLC analysis. Producing of spectra, and GC analysis, Aldol condensation, Cannizzaro reaction, preparation of benzoic acid, preparation of cyclohexene, and preparation of 2-nitroresorcinol.

**Learning activities and teaching methods:**

22 h/week laboratory works.

**Target group:**

Chemistry.

**Recommended or required reading:**

Clayden, J., Greeves, N., Warren, S. and Wothers, P.: Organic Chemistry, Oxford University Press, 2001.  
Laboratory Course Manual.

**Person responsible:**

Senior assistant Juha Koskela.

**Other information:**

Prerequisites: Courses 780101, 780102, 780103, and 780122 passed. Simultaneous participation in the lecture course 780389A.

### **780332A: Laboratory Course I in Organic Chemistry, 4 op**

**Voimassaolo:** - 31.07.2013

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Koskela, Juha Pekka

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Timing:**

2nd period, autumn.

**Learning outcomes:**

After this course the student is familiar with basic techniques of organic chemistry such as distillation, extraction, crystallization, TLC, as well as safety issues, glassware and equipment, laboratory notebooks and written reporting of laboratory experiments. Student familiarises with practical laboratory work by carrying out reactions in aromatic substitution with protective group strategy, organometallic chemistry, Aldol condensation, elimination and disproportionation.

**Contents:**

Review of methods in organic chemistry and TLC analysis. Producing of spectra, and GC analysis, Aldol condensation, Cannizzaro reaction, preparation of benzoic acid, preparation of cyclohexene, and preparation of 2-nitroresorcinol.

**Learning activities and teaching methods:**

22 h/week laboratory works.

**Target group:**

Biochemistry.

**Recommended or required reading:**

Clayden, J., Greeves, N., Warren, S. and Wothers, P.: Organic Chemistry, Oxford University Press, 2001.  
Laboratory Course Manual.

**Person responsible:**

Senior assistant Juha Koskela.

**Other information:**

Prerequisites: Courses 780101, 780102, 780103, and 780122 passed. Simultaneous participation in the lecture course 780389A.

**780331A: Laboratory Course I in Physical Chemistry, 5 op****Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Toivo Kuokkanen**Opintokohteen kielet:** Finnish**ECTS Credits:**

5 - 5,5 credits

**Timing:**

2nd period, autumn.

**Learning outcomes:**

After this course the student is familiar with practical applications of the topics learned in 780347A Physical Chemistry I.

**Contents:**

Calorimetric studies, distribution law, vapour pressure of solvent, partial mole volume, distillation of a mixture of liquids, crystallization of a liquid mixture, potentiometric acid-base titration, determination of equilibrium constant by UV-Vis spectrometry, electromotive force, rate of chemical reaction.

**Learning activities and teaching methods:**

80 h (7 weeks) laboratory experiments and 45 h reports, one final examination in the beginning.

**Target group:**

Chemistry.

**Recommended or required reading:**

Practical work handout. Atkins, P. W.: Physical Chemistry, 7th ed. 2002, Oxford University Press, partly.

**Assessment methods and criteria:**

Experiments and reports passed.

**Person responsible:**

Doc. Toivo Kuokkanen and Assistants.

**Other information:**

Prerequisites: Courses 780101P, 780122P and a preliminary test of the Laboratory course passed. Simultaneous participation in the course 780347A Physical Chemistry I.

## 780382A: Laboratory Course in Physical Chemistry (TECH), 2 op

**Voimassaolo:** - 31.07.2010

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Toivo Kuokkanen

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

2 credits

**Timing:**

2nd period, autumn.

**Learning outcomes:**

After this course the student is familiar with the practise of the theory learned in course 780347A Physical Chemistry I.

**Contents:**

Four experiments of the following topics: Calorimetric studies, determination of equilibrium constant by UV-Vis spectrometry, vapour pressure of solvent, distillation of a mixture of liquids, crystallization of a liquid mixture, adsorption in solution.

**Learning activities and teaching methods:**

4 laboratory works.

**Target group:**

Process Engineering.

**Recommended or required reading:**

Practical work handout; Atkins, P. W.: Physical Chemistry, 7th ed. 2002, Oxford University Press, partly.

**Assessment methods and criteria:**

Experiments and reports.

**Person responsible:**

Doc. Toivo Kuokkanen and Assistants.

**Other information:**

Prerequisites: Courses 780109P, 780122P and a preliminary test of the Laboratory course passed. Simultaneous participation in the course 780347A Physical Chemistry I.

## 781641S: Laboratory Course in Synthetic Chemistry, 4 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish.

**Timing:**

4th or 5th spring. The courses is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with most important techniques in modern inorganic and organic synthetic chemistry.

**Contents:**

Selected syntheses, characterization of products.

**Learning activities and teaching methods:**

6 h lectures, 60 h laboratory courses, written report, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Laboratory courses in Inorganic Chemistry, Physical Chemistry, and Organic Chemistry, and 780317A Structural Chemistry I.

**Person responsible:**

Prof. R. Laitinen, Prof. M. Lajunen and Prof. J. Pursiainen.

**783628S: Liquid Chromatography and MS Workshop, 4 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen oppimateriaali:**

Meyer, Veronica R. , , 1999

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

784625S High Performance Liquid Chromatography and LC/MS Workshop 2.0 op

**ECTS Credits:**

4 credits

**Timing:**

4th or 5th period, autumn. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with basics of liquid chromatography.

**Contents:**

Separation mechanisms. Columns, equipments, detectors. Applications in organic analysis.

**Learning activities and teaching methods:**

24 h lectures + demonstrations + 5 h exercises + report + seminar, one final examination.

**Target group:**

Chemistry

**Recommended optional programme components:**

-

**Recommended or required reading:**

Snyder, L.R., Kirkland, J.J., Glajch, J.L.: Practical HPLC Method Development, 2nd Ed., Wiley, 1997 and Meyer, V.R.: Practical High-Performance Liquid Chromatography, 3rd Ed. Wiley, 1999.

**Person responsible:**

Doc. Jorma Jalonen.

**Other information:**

Prerequisites: 780111P Introduction to Analytical Chemistry and 780328A Instrumental Analysis.

**783605S: Literature Survey in Organic Chemistry, 9 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

9 - 11 credits

**Timing:**

Beginning 5h period, autumn.

**Contents:**

The student is required to write a survey of literature on a topic which will be decided together with the student's advisor. The survey can be, but does not necessarily have to be, on the same topic as the research project. The length of the survey should be about 40-60 pages with approximately 50 references.

**Target group:**

Chemistry.

**Grading:**

1 - 5.

**Person responsible:**

Prof., Doc. and Senior assistants and Lecturers.

**Other information:**

-

**780085Y: Literature of Chemistry and Information Retrieval, 2 op****Voimassaolo:** - 31.07.2008**Opiskelumuoto:** General Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Marja Lajunen**Opintokohteen kielet:** Finnish**ECTS Credits:**

2 credits

**Timing:**

3. period, autumn.

**Learning activities and teaching methods:**

22 h lectures + exercises, poster.

**Target group:**

Chemistry.

**Person responsible:**

Prof. Marja Lajunen.

**781627S: Main Group Chemistry, 5 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Laitinen Risto**Opintokohteen oppimateriaali:****Atkins, P., Overton, T., Rourke, J., Weller, M. ja Armstrong, F., , 2006****Opintokohteen kielet:** Finnish**ECTS Credits:**

5 - 5,5 credits

**Timing:**

4th or 5th period, autumn. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with recent progress in modern main group chemistry.

**Contents:**

Periodic system, hydrogen, alkali and alkaline earth metals, half- and non-metals.

**Learning activities and teaching methods:**

28 h lectures, 14 h exercises, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Atkins, P., Overton, T., Rourke, J., Weller, M. ja Armstrong, F.: Inorganic Chemistry, 4th ed., Oxford University Press, Oxford 2006.

**Person responsible:**

Prof. Risto Laitinen

**Other information:**

Prerequisites: 780353A Inorganic Chemistry I.

## 781601S: Master's Thesis in Inorganic Chemistry, 38 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Diploma thesis

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

38 credits

**Timing:**

Beginning, 5th period, autumn.

**Contents:**

The thesis for the degree of M.Sc. consists of two parts: a research project (Master's Thesis) with a written report and a survey of literature. The completion of the laboratory work and the research report is expected to take approximately four months of full-time work. Together, they are worth 38 credits. In addition, the student is required to write a survey of literature on a topic which will be decided together with the student's advisor. The survey can be, but does not necessarily have to be, on the same topic as the research project. The length of the survey should be about 40-60 pages with approximately 50 references. It is worth of 9 credits. The completion of the whole thesis requires about six months of full-time work.

**Target group:**

Chemistry.

**Assessment methods and criteria:**

-

**Grading:**

Approbatu,..., laudatur.

**Person responsible:**

Prof., Doc., and Senior assistants and lecturers.

**Other information:**

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## 781602S: Master's Thesis in Inorganic Chemistry, 20 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Diploma thesis

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** A,B,N,C,M,EX,L

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

20 credits

**Timing:**

Beginning 5th period, autumn.

**Contents:**

The student is required to write a survey of literature on a topic which will be decided together with the student's advisor. The length of the survey should be about 40-60 pages with approximately 50 references.

**Target group:**

Teacher in the Chemistry.

**Assessment methods and criteria:**

-

**Grading:**

Approbatu,..., laudatur.

**Person responsible:**

Prof., Doc. and Senior assistants and Lecturers.

**783601S: Master's Thesis in Organic Chemistry, 38 op****Opiskelumuoto:** Advanced Studies**Laji:** Diploma thesis**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** A,B,N,C,M,EX,L**Opintokohteen kielet:** Finnish**ECTS Credits:**

38 credits

**Timing:**

Beginning, 5th period, autumn.

**Contents:**

The thesis for the degree of M.Sc. consists of two parts: a research project (Master's Thesis) with a written report and a survey of literature. The completion of the laboratory work and the research report is expected to take approximately four months of full-time work. Together, they are worth 38 credits. In addition, the student is required to write a survey of literature on a topic which will be decided together with the student's advisor. The survey can be, but does not necessarily have to be, on the same topic as the research project. The length of the survey should be about 40-60 pages with approximately 50 references. It is worth of 9 credits. The completion of the whole thesis requires about six months of full-time work.

**Target group:**

Chemistry.

**Assessment methods and criteria:**

-

**Grading:**

Approbatur, ..., laudatur.

**Person responsible:**

Prof., Doc. and Senior assistants and Lecturers.

**Other information:**

-

**783602S: Master's Thesis in Organic Chemistry, 20 op****Opiskelumuoto:** Advanced Studies**Laji:** Diploma thesis**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** A,B,N,C,M,EX,L**Opintokohteen kielet:** Finnish**ECTS Credits:**

20 credits

**Timing:**

Beginning 5th period, autumn.

**Contents:**

The student is required to write a survey of literature on a topic which will be decided together with the student's advisor. The length of the survey should be about 40-60 pages with approximately 50 references.

**Target group:**

Teacher in the Chemistry.

**Assessment methods and criteria:**

-

**Grading:**

Approbatur, ..., laudatur.

**Person responsible:**

Prof., Doc. and Senior assistants and Lecturers.

**782601S: Master's Thesis in Physical Chemistry, 38 op****Opiskelumuoto:** Advanced Studies



**Laji:** Diploma thesis

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

38 credits

**Timing:**

Beginning, 5th period, autumn.

**Contents:**

The thesis for the degree of M.Sc. consists of two parts: a research project (Master's Thesis) with a written report and a survey of literature. The completion of the laboratory work and the research report is expected to take approximately four months of full-time work. Together, they are worth 38 credits. In addition, the student is required to write a survey of literature on a topic which will be decided together with the student's advisor. The survey can be, but does not necessarily have to be, on the same topic as the research project. The length of the survey should be about 40-60 pages with approximately 50 references. It is worth of 9 credits. The completion of the whole thesis requires about six months of full-time work.

**Target group:**

Chemistry.

**Assessment methods and criteria:**

-

**Grading:**

Approbatur, ..., laudatur.

**Person responsible:**

Prof., Doc. and Senior assistants and Lecturers.

**Other information:**

-

## 782602S: Master's Thesis in Physical Chemistry, 20 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Diploma thesis

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** A,B,N,C,M,EX,L

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

20 credits

**Timing:**

Beginning 5th period, autumn.

**Contents:**

The student is required to write a survey of literature on a topic which will be decided together with the student's advisor. The length of the survey should be about 40-60 pages with approximately 50 references.

**Target group:**

Teacher in the Chemistry.

**Assessment methods and criteria:**

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**Grading:**

Approbatur, ... laudatur.

**Person responsible:**

Prof., Doc. and Senior assistants and Lecturers.

## 784601S: Master's Thesis in Structural Chemistry, 38 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Diploma thesis

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish**ECTS Credits:**

38 credits

**Timing:**

Beginning, 5th period, autumn.

**Contents:**

The thesis for the degree of M.Sc. consists of two parts: a research project (Master's Thesis) with a written report and a survey of literature. The completion of the laboratory work and the research report is expected to take approximately four months of full-time work. Together, they are worth 38 credits. In addition, the student is required to write a survey of literature on a topic which will be decided together with the student's advisor. The survey can be, but does not necessarily have to be, on the same topic as the research project. The length of the survey should be about 40-60 pages with approximately 50 references. It is worth of 9 credits. The completion of the whole thesis requires about six months of full-time work.

**Target group:**

Chemistry.

**Assessment methods and criteria:**

-

**Grading:**

Approbatur, ..., laudatur.

**Person responsible:**

Prof., Doc. and Senior assistants and Lecturers.

**Other information:**

-

**784602S: Master's Thesis in Structural Chemistry, 20 op****Opiskelumuoto:** Advanced Studies**Laji:** Diploma thesis**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** A,B,N,C,M,EX,L**Opintokohteen kielet:** Finnish**ECTS Credits:**

20 credits

**Timing:**

Beginning 5th period, autumn.

**Contents:**

The student is required to write a survey of literature on a topic which will be decided together with the student's advisor. The length of the survey should be about 40-60 pages with approximately 50 references.

**Target group:**

Teacher in the Chemistry.

**Assessment methods and criteria:**

-

**Grading:**

Approbatur, ..., laudatur.

**Person responsible:**

Prof., Doc. and Senior assistants and Lecturers.

**780699S: Maturity Test, 0 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish**Voidaan suorittaa useasti:** Kyllä

**ECTS Credits:**

0 credits

**780087Y: Maturity test, 0 op****Voimassaolo:** - 31.07.2008**Opiskelumuoto:** General Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish**ECTS Credits:**

0 credits

**782624S: Molecular Modelling, 3 - 4 op****Voimassaolo:** - 31.07.2010**Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Laasonen Kari**Opintokohteen oppimateriaali:****Leach, Andrew R.** , , 1996**Leach, Andrew R.** , , 2001**Opintokohteen kielet:** Finnish**ECTS Credits:**

3 - 4 credits

**Timing:**

4th period, autumn/spring. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with the principles of molecular modelling, modelling programmes and their use. The emphasis is on the understanding of the theory of molecular dynamics.

**Contents:**

Theoretical principles of molecular dynamics, mainly classical mechanics and modelling of interactions between molecules.

**Learning activities and teaching methods:**

30 h lectures + 8 h exercises, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Material given by the lecturer and Leach, A.R.: Molecular Modelling, Longman, 1996 or 2nd ed.

**Person responsible:**

Prof. Kari Laasonen.

**Other information:**

Prerequisites: 782631S Physical Chemistry II and 782630S Quantum Chemistry.

**781626S: Molecular Modelling Workshop, 3 - 4 op****Voimassaolo:** - 31.07.2010**Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Laasonen Kari

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 - 4 credits

**Timing:**

4th or 5th period, spring. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with the most common programs in molecular modelling and their use.

**Contents:**

Basic principles of MO methods and their application in the examination of the structures and reactions of chemical compounds. Introduction to molecular modelling programs and their use.

**Learning activities and teaching methods:**

8 h lectures, demonstration, practical exercise.

**Target group:**

Chemistry.

**Recommended or required reading:**

Material handed out by the lecturer.

**Person responsible:**

Prof. Kari Laasonen.

**Other information:**

Prerequisites: 782631S Physical Chemistry II, 782624S Molecular Modelling, 782625S Advanced Quantum Chemistry.

## 781639S: Molecular Symmetry and Spectroscopy, 5 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Raija Oilunkaniemi

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780327A Structural Chemistry II 5.5 op

**ECTS Credits:**

5 credits

**Timing:**

4th period, spring.

**Learning outcomes:**

After this course the student is familiar with molecular symmetry and the application of molecular symmetry in vibration spectroscopy and electronic absorption spectroscopy.

**Contents:**

Molecular symmetry, group theory, vibrational spectroscopy, electronic absorption spectroscopy.

**Learning activities and teaching methods:**

34 h lectures, 3 home assignments, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Material handed out by lecturer.

**Person responsible:**

Doc. Raija Oilunkaniemi.

**Other information:**

Prerequisites: 780353A Inorganic Chemistry I.

## 784617S: Multinuclear NMR Spectroscopy in Structure Elucidation, 4 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mattila, Sampo Antero

**Opintokohteen oppimateriaali:**

Mason, J. (ed), , 1987

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Timing:**

4th or 5th period, spring. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with the NMR characteristics and use of various magnetic isotopes.

**Contents:**

The correlation of structural factors to spin-spin coupling constants and relaxation times of the nuclei in  $^{14}\text{N}$ ,  $^{15}\text{N}$ ,  $^{17}\text{O}$ ,  $^{19}\text{F}$ ,  $^{29}\text{Si}$ ,  $^{31}\text{P}$ ,  $^{77}\text{Se}$  and  $^{195}\text{Pt}$ . A practical exercise and a report.

**Learning activities and teaching methods:**

20 h lectures + applications + demonstration, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Mason, J. (ed.): Multinuclear NMR, Plenum Press, New York, 1987.

**Person responsible:**

Senior assistant Sampo Mattila.

## 784610S: NMR Spectroscopy in Organic Chemistry, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mattila, Sampo Antero

**Opintokohteen oppimateriaali:**

Breitmaier, Eberhard , , 1993

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 - 7 credits

**Timing:**

4th period, autumn. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with the principles, methods, techniques and practise of structure elucidation of organic compounds by NMR spectroscopy.

**Learning activities and teaching methods:**

14 h lectures + applications, 60 h exercises, one final examinations.

**Target group:**

Chemistry.

**Recommended or required reading:**

Breitmaier, E.: Structure Elucidation by NMR in Organic Chemistry, A Practical Guide, Wiley, 1993.

**Person responsible:**

Senior assistant Sampo Mattila.

## 784636S: NMR Spectroscopy of Polymers, 4 op

**Voimassaolo:** - 31.07.2011

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Väänänen, Taito Lauri Johannes

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Timing:**

The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with basic principles of NMR spectroscopy of polymers.

**Contents:**

Preparation of liquid and solid state sample, the effect of concentration and temperature. Chemical shift and nit's anisotropy. Dipole-dipole interaction, relaxation time and crosspolarisation and their connection to microstructure of polymers. Identification and quantification. A practical exercise and a report.

**Learning activities and teaching methods:**

20 h lectures + demonstration + practical exercise + one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Alan E. Tonelli: NMR spectroscopy and polymer microstructure: The conformational connection, VCH, New York (1989). Richard A. Komoroski (ed.): High Resolution NMR Spectroscopy of Synthetic Polymers in Bulk, Methods in Stereochemical Analysis vol. 7, VCH, Florida (1986). P. Diehl et al. (ed.): NMR Basic Principles and Progress 29, Springer-Verlag, Berlin (1993). Colin A. Fyfe: Solid State NMR for Chemists, C.F.C. Press, Guelph (1983). S. Braun et al.: 150 and More Basic NMR experiments: A Practical Course - Second Expanded Edition, VCH, Weinheim (1998).

**Grading:**

-

**Person responsible:**

Doc. Taito Väänänen.

**Other information:**

Prerequisites: 784610 NMR Spectroscopy of Organic Chemistry and 784623S NMR workshop I.

## 784623S: NMR Workshop I, 4 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mattila, Sampo Antero

**Opintokohteen oppimateriaali:**

Derome, Andrew E. , , 1987

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Timing:**

4th period, autumn or spring. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with production of commonly used 1D and 2D NMR spectra, the set up of the acquisitions and the processing of acquired spectra.

**Contents:**

A practical exercise and a report.

**Learning activities and teaching methods:**

20 h lectures + demonstration, 80 h exercises, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Derome, A. E., Modern NMR Techniques for Chemistry Research, Pergamon Press (partly).

**Person responsible:**

Senior assistant Sampo Mattila.

**784624S: NMR Workshop II, 4 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mattila, Sampo Antero

**Opintokohteen oppimateriaali:**

Derome, Andrew E. , , 1987

Levitt, Malcolm H. , , 2001

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Timing:**

4th period, spring. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with production of commonly used 1D and 2D NMR spectra, the set up of the acquisitions and the processing of acquired spectra.

**Contents:**

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**Learning activities and teaching methods:**

20 h lectures + demonstration, 80 h exercises, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Levitt, M.: Spin Dynamics: Basics of Nuclear Magnetic Resonance, John Wiley & Sons, 2001 (partly), Derome, A. E., Modern NMR Techniques for Chemistry Research, Pergamon Press (partly).

**Person responsible:**

Senior Assistant Sampo Mattila.

**Other information:**

Prerequisites: 784623S NMR-workshop I.

**784638S: NMR Workshop III, 4 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mattila, Sampo Antero

**Opintokohteen oppimateriaali:**

Derome, Andrew E. , , 1987

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Timing:**

4th period, spring. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

-

**Contents:**

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**Learning activities and teaching methods:**

20 h lectures + demonstrations, 80 h exercises, one final examination.

**Target group:**

Chemistry.

**Recommended optional programme components:**

-

**Recommended or required reading:**

Derome, A. E., Modern NMR Techniques for Chemistry Research, Pergamon Press (partly).

**Person responsible:**

Senior assistant Sampo Mattila.

**Other information:**

Prerequisites: 784623S NMR workshop I.

**784639S: NMR Workshop IV, 4 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mattila, Sampo Antero

**Opintokohteen oppimateriaali:**

Levitt, Malcolm H. , , 2001

Cavanagh, John, , 1996

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Timing:**

4th period, spring. The advanced courses lectured every year varies year by year.

**Contents:**

-

**Learning activities and teaching methods:**

20 h lectures + demonstration, 80 h exercises, one final examination.

**Target group:**

Chemistry.

**Recommended optional programme components:**

-

**Recommended or required reading:**

Levitt, M.: Spin Dynamics: Basics of Nuclear Magnetic Resonance, John Wiley & Sons, 2001 (osittain) ja

Cavanagh: Protein NMR Spectroscopy, Academic Press, 1995, ISBN: 0121644901.

**Person responsible:**

Senior assistant Sampo Mattila.

**Other information:**

Prerequisites: 784623S NMR workshop I.

**780389A: Organic Chemistry I, 6 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Hormi Osmo

**Opintokohteen oppimateriaali:**

Clayden, J., Greeves, N., Warren, S. ja Wothers, P., , 2001

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780385A Organic Chemistry I 9.0 op



**ECTS Credits:**

6 credits

**Language of instruction:**

Finnish.

**Timing:**

2nd autumn.

**Learning outcomes:**

After this course the student is familiar with the nature of chemical bonds in organic compounds and the basic principles of the bonding molecular orbitals in small organic compounds. The student familiarizes also with how HOMO-LUMO concepts can be used to anticipate organic reactivity. Other important items are also conformational analysis, basics in physical organic chemistry, especially the Hammett plot approach to reaction mechanisms. The student is also familiar with details in nucleophilic substitution reactions and stereochemistry with emphasis on stereoselective reactions.

**Contents:**

Chemical bond, conformation analysis, reaction mechanisms, nucleophilic substitution, stereochemistry.

**Learning activities and teaching methods:**

50 h lectures, two intermediate examinations or one final examination.

**Target group:**

Chemistry, compulsory.

**Recommended optional programme components:**

Introduction to Organic Chemistry (780103P) and Physical Chemistry I (780347A).

**Recommended or required reading:**

Clayden, J., Greeves, N., Warren, S. and Wothers, P.: Organic Chemistry, Oxford University Press, 2001.

**Person responsible:**

Prof. Osmo Hormi.

**783643S: Organic Chemistry II, 4 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Marja Lajunen

**Opintokohteen oppimateriaali:**

Clayden, J., Greeves, N., Warren, S. ja Wothers, P., , 2001

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780393A Organic Chemistry II 4.0 op

780390A Organic Chemistry II 4.0 op

**ECTS Credits:**

4 credits

**Timing:**

4th period, autumn.

**Learning outcomes:**

After this course the student has a good knowledge of selected mechanisms and reasons affecting them.

**Contents:**

Polar addition and elimination reactions, chemistry of enols and enolates, aromatic heterocyclic compounds and their reactions.

**Learning activities and teaching methods:**

30 h lectures + 6 h exercises, two intermediate examinations or one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Clayden, J., Greeves, N., Warren, S. ja Wothers, P.: Organic Chemistry, Oxford University Press, 2001 (partly).

**Person responsible:**

Prof. Marja Lajunen.

**Other information:**

Prerequisites: 780389A Organic Chemistry I.

**783639S: Organic Chemistry III, 5 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Hormi Osmo**Opintokohteen oppimateriaali:****Corey, E. J. , , 1989****Opintokohteen kielet:** Finnish**ECTS Credits:**

5 - 5,5 credits

**Timing:**

5th period, autumn.

**Learning outcomes:**

After this course the student is familiar with the modern organic chemistry involved in challenging organic synthetic endeavours published in current chemical literature and journals.

**Contents:**

Synthetic strategies based on transformation, strategies based on structure, typological strategies, stereochemical strategies, strategies based on functional groups, multistrategies, oxidation and reduction methods, protection of functional groups, multistep synthesis.

**Learning activities and teaching methods:**

26 h lectures + seminar.

**Target group:**

Chemistry.

**Recommended optional programme components:**

-

**Recommended or required reading:**

Corey, E.J. ja Chen, X-M.: The Logic of Chemical Synthesis, John Wiley &amp; Sons, New York, 1989, p. 1 - 100.

**Assessment methods and criteria:**

Written report on the synthesis of a complex target molecule and an oral presentation of the synthesis.

**Person responsible:**

Prof. Osmo Hormi.

**Other information:**

Prerequisites: 780389A Organic Chemistry I and 783643S Organic Chemistry II.

**783614S: Organic Chemistry of Drug Compounds, 3 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Marja Lajunen**Opintokohteen oppimateriaali:****Patrick, Graham L. , , 2001****Opintokohteen kielet:** Finnish**ECTS Credits:**

3 - 4 credits

**Learning outcomes:**

After this course the student is familiar with basic principles and techniques of medicinal chemistry, tactics and tools used in drug design and development.

**Learning activities and teaching methods:**

20 h lectures, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Patrick, G.L.: An Introduction to Medicinal Chemistry, Oxford University Press, 2001 (partly).

**Person responsible:**

Prof. Marja Lajunen.

**Other information:**

Prerequisites: 780389A Organic Chemistry I and 783643S Organic Chemistry II.

**783640S: Organometallic Chemistry, 3 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Marja Lajunen

**Opintokohteen oppimateriaali:**

Clayden, J., Greeves, N., Warren, S. ja Wothers, P., , 2001

Jenkins, Paul R. , , 1992

Thomas, Susan E. , , 1991

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 - 5 credits

**Timing:**

4th period, autumn. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with essential organometallic compounds and reagents and their use in synthetic applications.

**Contents:**

Bonding of metals with organic ligands, transition metals in organic synthesis, metal carbenoids, homogeneous catalysis, ligand design for metal complexes, asymmetric reactions.

**Learning activities and teaching methods:**

24 h lectures, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Clayden, J., Greeves, N., Warren, S., and Wothers, P., Organic Chemistry, Oxford University Press, 2001 (partly);

Jenkins, P.: Organometallic Reagents in Synthesis, Oxford Science Publications, 1997 (partly). Thomas, S.E.:

Organic Synthesis, The Role of Boron and Silicon, Oxford Science Publications, 1997 (partly).

**Person responsible:**

Prof. Marja Lajunen.

**Other information:**

Prerequisites: 783643S Organic Chemistry II.

**780078Y: Orientation Course for New Students, 1 op**

**Opiskelumuoto:** General Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Kopsa-Moilanen, Vieno Maria

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

1 - 2 credits

**Timing:**

1. period, autumn-spring.

**Target group:**

Chemistry.

## 783638S: Paper Chemistry, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Hormi Osmo

**Opintokohteen oppimateriaali:**

Eklund, Dan , , 1991

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 - 4 credits

**Timing:**

4th or 5th period, spring. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with most important chemicals used in papermaking. The student is also familiar with the basics in colloid and surface chemistry which is important to understand the behaviour of pulp substances during papermaking.

**Contents:**

Fibre and its behaviour during the process of paper making. Chemicals affecting dry strength. Chemicals affecting wet strength. Stability of colloids. Water chemistry of aluminium. Retention and dewatering. Permeation of water. Hydrofobication. Fillers and pigments. Organic pigments and optical bleaches. Substances preventing foaming. Substances preventing the growth of microbes.

**Learning activities and teaching methods:**

24 h lectures, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Eklund, D. ja Lindström, T.: Paper Chemistry, An Introduction, DT Paper Science Publication, Grankulla, 1991.

**Person responsible:**

Prof. Osmo Hormi.

**Other information:**

Prerequisites: 780326A Introduction to Polymer Chemistry.

## 783645S: Pericyclic chemistry, 3 op

**Voimassaolo:** 01.01.2008 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Marja Lajunen

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Timing:**

4th or 5th period, spring.

**Learning outcomes:**

After this course unit the student is familiar with a nature and types of pericyclic reactions. He/she understands the occurrence of separate pericyclic reactions, basics of click chemistry and synthetic uses of pericyclic reactions.

**Contents:**

Pericyclic reaction types: cycloadditions, sigmatropic rearrangements, group transfer and electrocyclic reactions. The Woodward-Hoffman rules, thermal, photochemical, 1,3-dipolar cycloaddition and basics of click chemistry alike.

**Learning activities and teaching methods:**

20 h lectures, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Fleming, I.: Pericyclic Reactions, Oxford University Press, 2002 and Clayden, J., Greeves, N., Warren, S. ja Wothers, P.: Organic Chemistry, Oxford University Press, 2001, partly.

**Person responsible:**

Prof. Marja Lajunen.

**Other information:**

Prerequisites: 780389A Orgaaninen kemia I ja 783643S Organic Chemistry II.

**780347A: Physical Chemistry I, 6 op****Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Pursiainen Jouni**Opintokohteen oppimateriaali:****Atkins, P.W.**, , 2002**Atkins, P. W.**, , 1998**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

780318A Physical Chemistry II 6.5 op

**ECTS Credits:**

5,5 - 6 credits

**Language of instruction:**

Finnish.

**Timing:**

2nd autumn.

**Learning outcomes:**

After this course the student is familiar with the main topics of chemical thermodynamics and kinetics. During the course such concepts are introduced that are needed for the discussion of equilibria in chemistry. Much emphasis is in enthalpy, entropy and Gibbs energy. A unified view of equilibrium and the directions of spontaneous change are obtained in terms of chemical potentials of substances. Chemical kinetics shows how the systems can reach equilibrium.

**Contents:**

Properties of gases, the first and second laws of thermodynamics, physical transformations of pure substances, properties of simple mixtures, chemical equilibrium.

**Learning activities and teaching methods:**

56 h lectures + applications + 14 h exercises, two intermediate examinations or one final examination.

**Target group:**

Chemistry, compulsory.

**Recommended optional programme components:**

Introduction to Physical Chemistry (780101P) and Introduction to Inorganic Chemistry(780102P).; or Basic Principles in Chemistry(780109P). Laboratory Course I in Physical Chemistry (780331A) has to be taken simultaneously with this course.

**Recommended or required reading:**

Atkins, P.W.: Physical Chemistry, 7th ed., 2002, Oxford University Press, Chapters 1-10 and 25-26.

**Person responsible:**

Prof. Jouni Pursiainen.

**782631S: Physical Chemistry II, 4 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Laasonen Kari

**Opintokohteen oppimateriaali:**

**Atkins, Peter** , , 2006

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780392A Physical Chemistry II 4.0 op

780349A Physical Chemistry II 4.0 op

**ECTS Credits:**

4 credits

**Timing:**

4th period, autumn.

**Learning outcomes:**

After this course the student is familiar with quantum mechanics and molecular level phenomena.

**Contents:**

Basic principles of quantum mechanics, statistical thermodynamics, molecules in motion.

**Learning activities and teaching methods:**

36 h lectures + 8 h assignment exercises, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

P. Atkins and J. De Paula, Atkins' Physical Chemistry, 8th edition. Chapters 8-11, 16,17, 21 (also 6th ed., 1998, or 7th ed., 2002).

**Person responsible:**

Prof. Kari Laasonen.

**Other information:**

Prerequisites and completion: 780347A Physical Chemistry I. 782632S Laboratory Course II in Physical Chemistry has to be taken simultaneously with this course.

## 783620S: Polymer Chemistry, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Hormi Osmo

**Opintokohteen oppimateriaali:**

**Elias, Hans-Georg** , , 1993

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 - 4 credits

**Timing:**

4th period, autumn. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with the most usual molecular weights of polymers, the structure of polymers including theoretical aspects of end to end distances, thermal properties of polymers, rheology and visco-elastic behaviour of polymers and electrical properties of polymeric materials.

**Contents:**

Molecular weights of polymers, the structure of polymers and theoretical aspects of end to end distances, thermal properties of polymers, rheology and visco-elastic behaviour of polymers including both practical and theoretical aspects, electrical properties of polymer.

**Learning activities and teaching methods:**

28 h lectures, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Elias, H-G: An Introduction to Plastics, VCH, Weinheim, 1993.

**Person responsible:**

Prof. Osmo Hormi.

**Other information:**

Prerequisites: Introduction to polymer chemistry 780326A.

## 783636S: Polymer Chemistry in Materials Sciences, 3 - 4 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Hormi Osmo

**Opintokohteen oppimateriaali:**

**Fawcett, A.H. (toim.),** , 1991

**Metals Park,** , 1988

**Joseph N. Epel. (et al.),** , 1988

**Flinn, Richard A. ,** , 1990

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 - 4 credits

**Timing:**

4th or 5th period, spring. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with the most important technical properties of industrially important polymer materials. Main emphasis is placed on polymeric materials that can be used in supporting structures and must therefore have a high modulus and high strength. The student becomes familiar with polymers in composite structures as well as with lightweight high modulus and high strength carbon and Kevlar fibres and liquid crystalline main chain polyesters. The chemistry of high temperature polymers becomes also familiar as well as some methods to fabricate strengthened materials such as strengthened tape.

**Contents:**

Technically important features of polymers, the chemistry of carbon fibres, Kevlar fibres main chain liquid crystal polymers, heat stable polymers, epoxy polymers, composites, chemistry of wet lay-up resins, filament winding resins and prepreg resins.

**Learning activities and teaching methods:**

24 h lectures, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Flinn, R.A. and Trojan, P.K., Engineering Materials and Their Applications, International Student Edition, Houghton Mifflin Comp., 4th ed., Boston 1990 (partly); Fawcett, A.H. (Editor): High Value Polymers, The Royal Society of Chemistry, Redwood Press Ltd., Melksham, 1991; Engineered Materials handbook, Part 1 and Part 2, ASM International, Metals Park, OH, 1993 (Part 1) and 1988 (Part 2).

**Person responsible:**

Prof. Osmo Hormi.

**Other information:**

Prerequisites: 780326A Introduction to Polymer Chemistry.

## 782630S: Quantum mechanics and Spectroscopy, 3 op

**Voimassaolo:** - 31.07.2010

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Laasonen Kari

**Opintokohteen oppimateriaali:**

**Atkins, Peter** , , 2006

**Atkins, P. W.,** , 1997

**Opintokohteen kielet:** Finnish**ECTS Credits:**

3 credits

**Timing:**

4th period, spring.

**Learning outcomes:**

After this course the student is familiar with the application of quantum mechanics to molecular structure and spectroscopy.

**Contents:**

Schrödinger equation for molecules, LCAO-theory. The interaction between light and matter – IR and Raman spectroscopy. Matter in magnetic field – NMR spectroscopy.

**Learning activities and teaching methods:**

30 h lectures + 6 h assignment exercises, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

P. Atkins and J. De Paula. Atkins' Physical Chemistry, 8th ed. Chapters 13-15 (also 6th ed., 1998 or 7th ed., 2002, and Atkins, P.W. ja Friedman, R.S., Molecular Quantum Mechanics, 3th ed., Oxford University Press.

**Person responsible:**

Prof. Kari Laasonen.

**Other information:**

Prerequisites: 782631S Physical Chemistry II.

**781623S: Reaction Mechanisms in Inorganic Chemistry, 3 op**

**Voimassaolo:** - 31.07.2012

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Laitinen Risto

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 - 4 credits

**Timing:**

4th or 5th period, spring. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with present state of inorganic reaction mechanisms.

**Contents:**

Mechanistic implications of reaction kinetics, collision theory, transition state theory, study of reaction mechanisms, molecular structure and mechanisms, orbital symmetry, substitution reactions, electron transfer reactions, catalysis, photochemical reactions.

**Learning activities and teaching methods:**

24 h lectures + 2 home assignments, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Material handed out by the lecturer.

**Person responsible:**

Prof. Risto Laitinen.

**Other information:**

Prerequisites: 780353A Inorganic Chemistry I and 781642S Inorganic Chemistry II.

**780601S: Research Project, 12 op**

**Opiskelumuoto:** Advanced Studies



**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

12 credits

**Timing:**

Beginning 4th period, autumn.

**Learning activities and teaching methods:**

240 h laboratory works.

**Target group:**

Chemistry.

**Person responsible:**

Prof., Doc., Senior assistants and Lecturers.

### **783634S: Research Seminar in Organic Chemistry, 2 op**

**Voimassaolo:** 01.08.2012 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 - 4 credits

**Timing:**

Autumn + spring.

**Learning outcomes:**

After taking part in seminars the student is familiar with scientific reporting and oral presentation of results.

**Contents:**

Design and following of projects in organic chemistry.

**Target group:**

Chemistry.

**Person responsible:**

Prof. Osmo Hormi and Prof. Marja Lajunen.

### **787602J: Research Seminar in Organic and Polymer Chemistry, 3 op**

**Voimassaolo:** - 31.07.2012

**Opiskelumuoto:** Post-graduate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 - 4 credits

**Timing:**

Autumn + spring.

**Learning outcomes:**

After this course the student is familiar with current projects in the research laboratory of polymer chemistry and can present own research results in English.

**Contents:**

Weekly english seminar to students. Compulsory attendance and oral presentation of own projects during a period of one year.

**Learning activities and teaching methods:**

30 h.

**Target group:**

Chemistry.

**Person responsible:**

Prof. Osmo Hormi and Prof. Marja Lajunen.

**780301A: Research Training, 9 op****Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Toivo Kuokkanen, Leena Kaila**Opintokohteen kielet:** Finnish**ECTS Credits:**

9 credits

**Timing:**

3rd autumn-spring.

**Learning outcomes:**

After this course the student is able to work on laboratory independently and will be able to produce formal written laboratory reports.

**Contents:**

Laboratory works in inorganic, physical and organic chemistry 80 h/laboratory. Additionally, written laboratory reports, one per practical.

**Learning activities and teaching methods:**

240 h laboratory works.

**Target group:**

Chemistry, compulsory.

**Recommended optional programme components:**

The compulsory courses of chemistry in the first and second year.

**Person responsible:**

Assistants.

**780301A-01: Research Training, 3 op****Voimassaolo:** 01.08.2006 -**Opiskelumuoto:** Intermediate Studies**Laji:** Partial credit**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Leena Kaila**Opintokohteen kielet:** Finnish**ECTS Credits:**

3 credits

**780301A-03: Research Training, 3 op****Opiskelumuoto:** Intermediate Studies**Laji:** Partial credit**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Person responsible:**

Senior assistant Juha Koskela + assistants.

**780301A-02: Research Training, 3 op****Voimassaolo:** 01.08.2006 -**Opiskelumuoto:** Intermediate Studies**Laji:** Partial credit**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish**ECTS Credits:**

3 credits

**781640S: Sampling and Sample Preparation, 4 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Paavo Perämäki**Opintokohteen oppimateriaali:**

Dean, John R. , , 2003

**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

781335A Sampling and Sample Preparation 4.0 op

**ECTS Credits:**

4 credits

**Timing:**

4th or 5th period, spring. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with the different phases and special tasks between sampling and sample preparation both in inorganic and organic analytics.

**Contents:**

Sampling, sample storage and pre-treatment. Sample preparation for inorganic and organic analysis.

**Learning activities and teaching methods:**

24 h lectures + seminar, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Dean, J.R.: Methods for Environmental Trace Analysis, Wiley, 2003.

**Person responsible:**

Prof. Paavo Perämäki and Doc. Jorma Jalonen.

**781647S: Scanning electron microscopy, 3 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Minna Tiainen

**Opintokohteen oppimateriaali:**

Goodhew, Peter J. , , 2001

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Timing:**

4th or 5th period, spring. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with function of scanning electron microscope and applications.

**Contents:**

Microscope and function, interactions between electrons and the sample, scanning electron microscope, chemical characterisation with electron microscope.

**Learning activities and teaching methods:**

20 h lectures, learning dairy and essay, presence in the lectures.

**Target group:**

Chemistry.

**Recommended or required reading:**

Goodhew P.J.: Humphreys J. and Beanland R., Electron Microscopy and Analysis, 3rd ed., Taylor & Francis, 2000.

**Person responsible:**

Lecturer Minna Tiainen.

**Other information:**

Prerequisites: Inorganic Chemistry I (780353A).

## 780690S: Seminar, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Timing:**

5th period, spring.

**Contents:**

The student gives one presentations on a given scientific subject and distributes an abstract to the audience. One of the presentations is given in English.

**Target group:**

Chemistry.

## 780086Y: Seminar for the Degree of B.Sc., 1 op

**Voimassaolo:** - 31.07.2008

**Opiskelumuoto:** General Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

1 credits

**Timing:**

3rd spring.

**Contents:**

The student gives one presentation on a given scientific subject related to B.Sc. thesis (20 min.) and distributes an abstract to the audience.

**Target group:**

Chemistry, compulsory.

**Other information:**

-

**781630S: Seminar in Inorganic Chemistry, 2 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Paavo Perämäki, Laitinen Risto

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 - 4 credits

**Timing:**

4th and 5th period.

**Learning outcomes:**

After this course the student is familiar with recent development in inorganic chemistry.

**Contents:**

Varies from year by year.

**Learning activities and teaching methods:**

20 h. Presence in the lectures and two seminar.

**Target group:**

Chemistry.

**Person responsible:**

Prof. Risto Laitinen and prof. Paavo Perämäki.

**782623S: Seminar in Physical Chemistry, 2 op**

**Voimassaolo:** 01.08.2012 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**Voidaan suorittaa useasti:** Kyllä

**ECTS Credits:**

4 credits

**788602S: Seminar in Structural Chemistry, 2 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mattila, Sampo Antero

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

2 credits

**Timing:**

Spring and autumn.

**Learning activities and teaching methods:**

20 h seminars.

**Target group:**

Chemistry.

**Person responsible:**

Senior assistants Sampo Mattila.

## 781611S: Solid State Chemistry, 4 op

**Voimassaolo:** - 31.07.2015

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Laitinen Risto

**Opintokohteen oppimateriaali:**

West, Anthony R. , , 1988

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Timing:**

4th or 5th period, spring. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with synthesis, structures, spectroscopic properties, reactions, and applications of solid materials.

**Contents:**

Preparation of solid materials, structures of solids, crystal defects, thermodynamics and reaction kinetics, the effect of outer conditions on some reactions, phase diagrams and their applications, optical, magnetic and electric properties of solid materials, and industrial applications.

**Learning activities and teaching methods:**

28 h lectures, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

West, A. R.: Basic Solid State Chemistry, 2nd Ed., John Wiley & Sons, Norwich, 1989.

**Person responsible:**

Prof. Risto Laitinen.

**Other information:**

Prerequisites: 780347A Physical Chemistry I and 780353A Inorganic Chemistry I.

## 781631S: Statistical Methods in Analytical Chemistry, 4 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Paavo Perämäki

**Opintokohteen oppimateriaali:**

Massart, D.L., Vandeginste, B.G.M., Buydens, L.M.C., De Jong, S., Lewi, P.J. ja Smeyers-Verbeke, J., , 1997

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 - 5,5 credits

**Timing:**

4th or 5th period, spring. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with the basic statistical methods used for data handling and analysis in analytical chemistry (including calibration and validation of analytical methods).

**Contents:**

Introduction to statistical methods, significance tests, analysis of variance, methods of regression, concepts of instrument analysis, planning of experiments and optimisation of analytical chemical methods.

**Learning activities and teaching methods:**

30 h lectures + 10 h exercises and practical exercise, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Massart, D. L., Vandeginste, B.G.M., Buydens, L.M.C., De Jong, S., Lewi, P.J. and Smyers-Verbeke, J.: Handbook of Chemometrics and Qualimetrics: Part A, Elsevier, 1997.

**Person responsible:**

Prof. Paavo Perämäki.

**Other information:**

Prerequisites: 780111P Introduction to Analytical Chemistry.

**780317A: Structural Chemistry I, 5 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Jalonen Jorma, Mattila, Sampo Antero

**Opintokohteen oppimateriaali:**

Williams, Dudley H. , , 1995

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

784640S Structural Chemistry I 5.0 op

**ECTS Credits:**

5 - 5,5 credits

**Language of instruction:**

Finnish.

**Timing:**

3rd autumn.

**Learning outcomes:**

After this course the student is familiar with the basics of interpretation of IR, NMR and mass spectra.

**Contents:**

Principles of the interpretation of IR, NMR and mass spectra and methods of problem solving with the aid of IR, NMR and mass spectra.

**Learning activities and teaching methods:**

40 h lectures, 20 h demonstrations and exercises, one final examination.

**Target group:**

Chemistry, compulsory.

**Recommended optional programme components:**

Physical Chemistry I (780347A) and Introduction to Analytical Chemistry (780111P).

**Recommended or required reading:**

Williams, D.H. & Fleming, I.: Spectroscopic Methods in Organic Chemistry, 5th ed., McGraw-Hill, Avon, 1995.

**Person responsible:**

Doc. Jorma Jalonen and Senior Assistant Sampo Mattila.

**781614S: Structural Methods in Inorganic Chemistry, 3 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Raija Oilunkaniemi

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 - 4 credits

**Timing:**

4th or 5th period. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with applications of multinuclear NMR spectroscopy in inorganic chemistry.

**Contents:**

Applications of NMR Spectroscopy in inorganic chemistry.

**Learning activities and teaching methods:**

20 h lectures + seminar, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Material handed out by the lecturer.

**Person responsible:**

Doc. Raija Oilunkaniemi.

**Other information:**

Prerequisites: 780353A Inorganic Chemistry I and 780317A Structural Chemistry I.

## 782620S: Surface Chemistry I, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Laasonen Kari

**Opintokohteen oppimateriaali:**

Adamson, Arthur W. , , 1997

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 - 4 credits

**Timing:**

4th or 5th period, autumn. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with properties of surfaces (liquid-gas, solid-gas, and solid-liquid).

**Contents:**

Introduction to the properties of surfaces (liquid-gas, solid-gas and solid-liquid). Some applications will be discussed, for example friction, lubrication, emulsion, foams, flotation, chemisorption, and catalysis.

**Learning activities and teaching methods:**

30 h lectures, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Adamson, A.W.: Physical Chemistry of Surfaces, 6th ed., John Wiley & Sons, New York, 1997, partly.

**Assessment methods and criteria:**

Examination based on the lectures.

**Person responsible:**

Prof. Kari Laasonen.

**Other information:**

Prerequisites: 782631S Physical Chemistry II.



**782633S: Surface chemistry II, 3 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Ulla Lassi**Opintokohteen oppimateriaali:****Adamson, Arthur W.** , , 1997**Somorjai, Gabor A.** , , 1994**Opintokohteen kielet:** Finnish**ECTS Credits:**

3 credits

**Timing:**

4th or 5th period, spring.

**Learning outcomes:**

After the course the student is familiar with interfaces (solid-gas, solid-liquid), properties of surfaces and surface phenomena. Student knows the most important surface structures and methods used in surface science studies. Surface phenomena are significant in several industrial applications, and those applications are theoretically studied during the course.

**Contents:**

Properties of solid-gas and solid-liquid interfaces, Surface structures, Surface phenomena and Surface analytical methods. Heterogeneous catalysis at solid surfaces is studied as an application.

**Learning activities and teaching methods:**

30 h lectures, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Adamson, A.W.: Physical Chemistry of Surfaces, 6th edition, John Wiley and Sons, New York, 1997 (to the appropriate extent); Somorjai, G.A.: Introduction to Surface Chemistry and Catalysis, John Wiley and Sons, New York, 1994 (to the appropriate extent). Lecture notes (in English).

**Assessment methods and criteria:**

Examination based on the lectures.

**Person responsible:**

Prof. Ulla Lassi.

**Other information:**

Prerequisites: Physical Chemistry I and II.

**783642S: Synthetic Methods in Green Chemistry, 4 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Marja Lajunen, Jalonen Jorma**Opintokohteen kielet:** Finnish**ECTS Credits:**

4 credits

**Timing:**

4th or 5th period. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with basics of ionic liquids and their use in synthetic applications. Student knows fundamentals of microwave technique, organic reactions in water, supercritical liquids as solvents, syntheses in fluoruous, two-phase systems.

**Contents:**

Ionic liquids and their properties and use in synthetic applications. Introduction to microwave technique and microwave-assisted organic synthesis. Organic reactions in water. Supercritical liquids as solvents. Syntheses in fluoruous, two-phase systems.

**Learning activities and teaching methods:**

20 h lectures, 2 h demonstrations, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Material given by the lecturer.

**Person responsible:**

Prof. Marja Lajunen and Doc. Jorma Jalonen.

**Other information:**

Prerequisites: 780389A Organic Chemistry I and 783643S Organic Chemistry II.

## 780300A: Thesis for the Degree of B.Sc., 6 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

6 credits

**Timing:**

3rd autumn (beginning).

**Contents:**

A thesis of approximately 20-40 pages including about 30 references. In addition, the student takes a maturity examination on the subject of the B.Sc. thesis in order to show a perfect command of either Finnish or Swedish (Finnish students) and a good knowledge of the subject of the thesis.

**Target group:**

Chemistry, compulsory.

**Grading:**

Pass/fail.

**Person responsible:**

Professors, Docents, Lecturers and Senior assistants.

## 780079Y: Tutoring, 1 op

**Opiskelumuoto:** General Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Kopsa-Moilanen, Vieno Maria

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

1 - 2 credits

## 783619S: Wood Chemistry, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Hormi Osmo

**Opintokohteen oppimateriaali:**

Sjöström, Eero , , 1981

**Opintokohteen kielet:** Finnish**ECTS Credits:**

3 - 4 credits

**Timing:**

4th or 5th period, autumn or spring. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with macroscopic structure of wood and their most important cell types used in the papermaking and in the production other cellulose based materials. The student is also familiar with basics of carbohydrate chemistry in order to understand the chemistry of cellulose and hemicelluloses as well as the chemistry of lignin. The student is also familiarized with the chemistry of sulphite and sulphate pulping as well as with the chemistry of ligning removing bleaching, chemistry of extractives as well as with the chemistry of the most important compounds in bark.

**Contents:**

The macroscopic structure of wood, introduction to carbohydrate chemistry. Polysaccharides of wood: cellulose and hemicelluloses. Lignins. Extractives. Bark. Chemistry of the pulping processes: sulphite and sulphate pulping. Chemistry of bleaching.

**Learning activities and teaching methods:**

24 h lectures, one final examination.

**Target group:**

Chemistry.

**Recommended or required reading:**

Sjöström, E.: Wood Chemistry: Fundamentals and Applications, Academic Press, New York 1981.

**Person responsible:**

Prof. Osmo Hormi.

**Other information:**

Prerequisites: Introduction to Organic Chemistry (780103P)

**781646S: X-Ray Chrystallography, 6 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Laitinen Risto**Opintokohteen kielet:** Finnish**ECTS Credits:**

6 credits

**Timing:**

4th or 5th period, spring. The advanced courses lectured every year varies year by year.

**Learning outcomes:**

After this course the student is familiar with basic concepts of crystal symmetry, the fundamentals of crystal structure determination, and has some hands-on experience in the structure determination.

**Contents:**

Crystal classes, crystal symmetry, scattering of X-rays in crystalline material, determination of the crystal structure from single crystals.

**Learning activities and teaching methods:**

36 h lectures + 8 h demonstrations + practical exercise with a written report, one final examination.

**Target group:**

Chemistry.

**Person responsible:**

Prof. J. Valkonen (University of Jyväskylä) and Prof. R. Laitinen.

**Other information:**

Prerequisites: 780353A Inorganic Chemistry I and 781639S Molecular Symmetry and Spectroscopy.

