



## DEPARTMENT OF CHEMISTRY AND MOLECULAR BIOLOGY

### **KEM840 NMR Spectroscopy for Students of Pharmacy, 7.5 credits**

NMR-spektroskopi för apotekarstuderande, 7,5 högskolepoäng

*Second Cycle*

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#### **Confirmation**

This course syllabus was confirmed by Department of Chemistry and Molecular Biology on 2016-03-02 and was last revised on 2019-03-26 to be valid from 2019-03-26, spring semester of 2019.

*Field of education:* Science 100%

*Department:* Department of Chemistry and Molecular Biology

#### **Position in the educational system**

Course is given in pharmacy programme as an elective course on semester 8. Course can furthermore read as a freestanding course.

The course can be part of the following programmes: 1) Programme in Pharmacy (F2APP) and 2) Programme in Pharmacy (F2APO)

#### *Main field of studies*

Chemistry with Specialization in Organic and Medicinal Chemistry

Pharmaceutical Science

#### *Specialization*

A1N, Second cycle, has only first-cycle course/s as entry requirements

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#### **Entry requirements**

For admission to course is required passed courses KEM011 Basic chemistry 1 (15 credits), KEM021 Basic chemistry 2 (15 credits) and KEM031 Organic Chemistry for Pharmacist students (15 credits) or the equivalent knowledge. In total are required passed courses in pharmacy programme of at least 90 credits or passed courses in chemistry of at least 75 credits.

## Learning outcomes

On successful completion of the course the student will be able to:

### *Knowledge and understanding*

- account one-dimensional (1D) and advanced two-dimensional (2D) NMR spectroscopic methods such as COSY, NOESY, ROESY, HSQC, HMBC and interpret the respective spectra
- predict NMR-spectroscopic data for medicinal organic compounds
- identify the adequate NMR-spectroscopic methods that can use to decide structure of medicinal molecules their purity and interaction with proteins.

### *Competence and skills*

- prepare NMR-samples
- decide structure of medicinal small molecules by means of NMR-spectroscopic technology,
- decide purity of substances by means of NMR-spectroscopic methods,
- identify protein binding of small molecules by means of NMR Spectroscopy,
- interpret 1D and 2D NMR-spectra.

### *Judgement and approach*

- assess purity of NMR-samples
- assess usability of different NMR-methods to solve a structure decide purity or analyse protein interactions

## Course content

The aim of course is to give advanced and expanded knowledge of NMR-spectroscopic methods that are used in pharmaceutical research for identification of medicinal substances for estimate of their purity and for study of their interactions with proteins.

Course treat following subjects:

- Vector model in NMR Spectroscopy,
- Relaxation mechanisms in NMR Spectroscopy,
- Practical aspects on NMR Spectroscopy (sample preparation, data collection, data analysis),
- One-dimensional NMR-techniques,
- Homonuclear NMR-techniques (COSY, TOCSY),

- Heteronuclear NMR-techniques (HSQC, HMBC),
- Correlations in 3D (NOESY),
- Diffusion-NMR-spectroscopy,
- Use of RDC-coupling and PCS for structure determination,
- Structural analysis of bioactive natural products,
- Purity determination of test.

### **Form of teaching**

Teaching include group seminars and independent project. Group seminars is compulsory.

*Language of instruction:* Swedish and English

Course is given as principal rule in Swedish but can completely or partly give in English if circumstances requires it.

### **Assessment**

Examination takes place through diagnostic tests as well as through reports and oral presentations. Written diagnostic tests are organised continuously during the course as per schedule. To pass whole course is required passed results on tests as well as on reports and presentations.

For a student who has not become passed at regular test, an additional examination sessions are offered. Possibilities to supplement failed compulsory compulsory components are limited and are determined in consultation with course coordinator.

If a student who has failed the same part of the examination twice wishes to change examiner before the next examination a written application shall be sent to the department responsible for the course and shall be granted unless there are special reasons against (Chapter 6, Section 22 of Higher Education Regulation).

In case a course has ceased or gone through larger changes the student should normally be guaranteed access to at least 3 examination sessions (including regular examination session) during a time of at least a year based on the earlier planning of course.

### **Grades**

The grading scale comprises: Pass with Distinction (VG), Pass (G) and Fail (U). For grade Pass is required at least 50% of the maximum score in the diagnostic tests as well as on submitted reports and presentations.

For grade Pass with distinction is required at least 75% of the maximum score in the diagnostic tests as well as on submitted reports and presentations.

Regarding application of the ECTS scale for grade please see Vice-Chancellor decision 28/05/2007, diary nr G 8 1976/07.

### **Course evaluation**

The course evaluation takes place in the form of an anonymous questionnaire on the teaching platform of University of Gothenburg (GUL). A compilation of the questionnaire is done by the course coordinator and the results are to be discussed between course administration and student representatives at a Course Board, where proposals for development of the course are discussed. Notes from the course board meeting should be taken and submitted to the course administration for archiving and to the management as well as council of the pharmacy programme (AUR) for information. Compilation of course questionnaire and any changes in the set-up of the course are made available for both earlier and future students.