# Relaxation Methods in Chemistry

**Schedule:**

**Week 1:** Reversible chemical reactions. Rapid perturbation of chemical equilibrium. Detection of relaxation, timescales of emission spectroscopies. The key role of nuclear magnetic resonance (NMR) based on relaxation time constants. The frequency of chemical equilibrium.

**Week 2:** Principles of NMR. The phenomenon of magnetism in macroscopic systems. Quantum-chemical foundations of magnetism. The NMR phenomenon.

**Week 3:** Applications of NMR. Practical aspects of NMR, FT-NMR. The chemical shift spectrum and its information content. Multinuclear NMR and examples.

**Week 4:** Relaxation. Origin and types of relaxation in NMR spectroscopy. Determination of relaxation time constants. Pulse sequences.

**Week 5:** Practice I. Learning and determining basic NMR parameters in practice, fundamentals of instrument operation.

**Week 6:** Concept and fundamental laws of equilibrium reactions. Relationship between exchange processes and transverse relaxation. Lineshape analysis, spectrum simulation.

**Week 7:** Longitudinal relaxation. Selective excitation techniques. Dynamic NMR on the longitudinal NMR timescale.

**Week 8:** Practice II. Determination of relaxation time constants.

**Week 9:** Basics of two-dimensional NMR. Concept of 2D NMR and its fundamental types. Exchange spectroscopy, EXSY, NOESY.

**Week 10:** Examples of dynamic NMR. Literature examples.

**Week 11:** Measurements in gradient fields. Theory of reversible diffusion. DOSY.

**Week 12:** Less common techniques. Low-field NMR relaxometry, NMR cryoporometry. Investigation of porous materials.

**Week 13:** Other relaxation techniques. Independent literature review.