Module	***NMR Spectroscopy and Imaging Methods***
Code	72557
Instruction language	English
ECTS credits	6
Attendance time	5 hours per week
Duration	1 semester
Cycle	Winter semester
Coordinator	Dean of Physics Studies
Lecturers	Prof. Dr. Volker Rasche
Allocation to study programmes	Physics M.Sc., elective module, 1st or 2nd semester Wirtschaftsphysik M.Sc., elective module, 1st - 3nd semester
Formal prerequisites	None
Recommended prerequisites	None
Learning objectives	Students who successfully passed this module: • know the basic concepts of imaging techniques in medicine and various system architectures • understand the application of various imaging methods • understand the fundamentals of magnetic resonance spectroscopy
Content	The lectures is focussing on magnetic resonance imaging and spectroscopy. It will especially introduce the physical principles of magnetic resonance, including: • QM description of spins, spin operators, density matrix • Semi-classical description, Bloch equations • Lineshape of NMR signal • Spin echoes • Theory of relaxation: coherence times (T2 and T1), intensity of NMR signal • Electronic shielding, chemical shift • Spin-Spin coupling, J coupling After the physical basics, the general principle of MR imaging and reconstruction techniques, including spatial encoding, contrast manipulation, and special imaging techniques for retrieving functional and quantitative data will addressed. Other imaging modalities based on x-rays, radioisotopes, or ultrasound will be briefly addressed and compared to MRI. • During the term, the students will get the opportunity to perform experiments on clinical and preclinical MR systems.
Literature	• Olaf Dössel, *Bildgebende Verfahren in der Medizin. Von der Technik zur medizinischen Anwendung.* (2000), ISBN: 3540660143 • Arnulf Oppelt (Ed), *Imaging Systems for Medical Diagnostics*, (2005), ISBN: 3895782262 • C.P. Slichter, Principles of magnetic resonance imaging, (1996) ISBN: 3-540-50157-6 • M. H. Levitt, Spin dynamics: basics of nuclear magnetic resonance.

	(2008) ISBN: 978-0470511176
Teaching and learning methods	Lecture with exercises (5 hours per week)
Workload	45 hours lecture (attendance time) 15 hours exercise (attendance time) 45 hours practical course 30 hours project work 45 hours self-study Total: 180 hours
Assessment	A prerequisite for the participation in the examination is an ungraded course achievement, which is determined and notified by the lecturer at the beginning of the course. The examination is a graded project work.
Basis for	Research in the fields of biophysics and medical techniques