Course Unit Descriptor

Study Programme: Physics	
Course Unit Title: Strongly correlated systems	
Course Unit Code: F18JKS	
Name of Lecturer(s): Full Professor Milica Pavkov Hrvojević	
Type and Level of Studies: PhD Academic Degree	
Course Status (compulsory/elective): Compulsory	
Semester (winter/summer): Summer	
Language of instruction: English	
Mode of course unit delivery (face-to-face/distance learning): Face-to-face	
Number of ECTS Allocated: 30	
Prerequisites:	
Course Aims: Students will affirm and broaden the previous knowledge in Strongly correlated systems in magnetism.	
Learning Outcomes: On completion of this module, student should be able to understand basic ideas and reasoning behind the using of different models of magnetism such as Hubbard, Heisenberg, Ising model.	

Syllabus:

Theory

Quasiparticles of femionic and bosonic type. Bosonic and fermionic representations of spin operators. Swinger boson representation. Holstein - Primakoff representation. Magnetic ions in crystals. Exchange interaction. Magnetism of spin systems. Molecular field approximation. Heisenberg model. Ising model. XY and XXZ models. Tyablikov approximation RPA (random phase approximation). Ground state of feromagnets and antiferromagnets. 1D and 2D Heisenberg model. Exact solution. Exact solution of 1D Hubbard model. Hubbard t-J model. Superconductors of I and II kind. Vortex. Josephson effect. High temperature superconductors.

Practice

Seminars

Required Reading:
1. K. Yosida: Theory of Magnetism, Springer, 1996
2. L.P. Levy: Magnetism and Superconductivity, Springer, 2000.
3. S.V. Tyablikov, The Methods in the Quantum Theory of Magnetism, Plenum Press, New York, 1967
4. D.C. Mattis, Theory of Magnetism I i II, Springer, 1988
5. P.G. de Gennes: Superconductivity of Metals and Alloys, Addison-Wesley, 1989
6. M. Tinkham: Introduction to Suprconductivity, Kreiger, New York, 1980
7. P.W. Anderson: The Theory of Superconductivity in the High-Tc Cuprates, Princeton, 1997

Weekly Contact Hours:	**Lectures:** 5		**Practical work:** 15

Teaching Methods: Lectures

Knowledge Assessment (maximum of 100 points):

Pre-exam obligations	points	Final exam	points
Active class participation		written exam	
Practical work		oral exam	70
Preliminary exam(s)		…….	

Seminar(s)	30		
The methods of knowledge assessment may differ; the table presents only some of the options: written exam, oral exam, project presentation, seminars, etc.			