Course Profile - Department of Physics

Course Number : PHYS 453	**Course Title :** Nuclear Physics
Required / Elective : elective	**Pre / Co-requisites :**
Catalog Description: Introduction to subatomic particles; properties of nuclei and nucleons; spin and magnetic moments; nuclear reactions; radioactivity; alpha and beta decays; nucleon interactions and nucleon scattering at low energies; nuclear models; elementary particles.	**Textbook / Required Material :** Kenneth S. Krane, *Introductory Nuclear Physics*, Pub. Wiley, Second edition, ISBN: 978-0-471-82872-3.
Course Structure / Schedule : (3+0+0) 3 / 6 ECTS	
Extended Description : The role of nuclear models. Quantum systems of identical particles. Shell model approach to the nuclear many body problem: mean field and residual interaction. Some applications to the ground state description of doubly magic nuclei (charge radii, neutron and proton density distributions, binding energy). Infinite nuclear matter. Nucleon effective mass. An effective theory approach in terms of mesons exchange. The spin-orbit interaction as a relativistic effect. Applications: ground state properties; spin and magnetic moments; nuclear reactions; radioactivity; alpha and beta decays; nucleon interactions and nucleon scattering at low energies; nuclear models; elementary particles. Nuclear radiation, detection methods, Types of detectors: scintillators, solid state. Resolution for the different types of detectors. Calibration of a detector. Nuclear fission and fusion.	
Design content : None	**Computer usage**: Lessons are integrated with practical training on the PC in the radiation laboratory.

Course Learning Outcomes [relevant program outcomes in brackets]**:**

On successful completion of this course students will be able to

1. gain the central concepts of nuclear physics (1).
2. solve nuclear problems with computational techniques (1, 3).
3. learn some of the most recent developments of Nuclear Physics and its perspectives (5).
4. develop an understanding of nuclear techniques and their applications (1, 5).
5. improve radiation measurement skills and familiarity with lab equipment (7).
6. improve ability to organize, analyze and present quantitative data (11).

Recommended reading

1. Cook, N., *Models of the Atomic Nucleus*, Springer Verlag (2006), ISBN 3540285695
2. Basdevant J-L., Rich J., Spiro M., *Fundamentals in Nuclear Physics: From Nuclear Structure to Cosmology*, Springer 2005. ISBN 978-0387016726

Teaching methods

1. Lecture and discussion
2. Demonstrations and videos
3. Experiments and laboratory activities
4. Group discussion and interpretation of observations
5. Reading and problem assignments

Assessment methods (Related to course outcomes)**:**

1. Two mid-term examinations
2. Written tests and quizzes
3. Questions/ assignments
4. Final exam
5. Classroom observation (attendance)

Student workload:

Preparatory reading	30 hrs
Lectures, discussions	45 hrs
Assignment/presentations	45 hrs
Independent work	27 hrs
Final Exam	3 hrs
**TOTAL …… **	**150 hrs … to match 25 x 6 ECTS**

Prepared by : Nafiye Güneç KIYAK , 01.02.2010	**Revision Date :**