Course Title	Course Code	Number of Study Hours				Year	Level	Prerequisites
		Theo.	Lab.	Credit	ECTS			
Nuclear Structure and Spectroscopy	PHYS650	3	-	3	9	1st/ 2nd	2nd/ 3rd	-

Student's workload			
In-class activities	Contact Hours	Self-learning/study	Hours
Lectures	45	Preparation for classes	90
Laboratory	-	Case studies	-
Exams and quizzes	5	Working on lab experiment	-
Lab demo	-	HW/Assignments	32
		Study for exam	70
Total	50	Total	192
Total Learning Hours = 242		Equivalent ECTS points = Total LH/28 = 9	

BRIEF COURSE DESCRIPTION

- This course is designed to provide knowledge and understanding of the properties of nuclei and current experimental techniques at a level appropriate to postgraduate research.

COURSE OBJECTIVES

The main objectives of this course are focused on the following:

1. Outline the single-particle aspects of the properties of nuclei.
2. Describe the experimental techniques used to measure the properties of nuclei.
3. Discuss the collective properties of nuclei
4. Explain the nuclear structure under the different nuclear models and especially the shell model.
5. Evaluate the importance of laser spectroscopy, γ-ray spectroscopy and the experimental techniques.

COURSE CONTENTS

- Review of the properties of nuclei: Describe some introductory terminology, Use a nuclear symbol to express the composition of an atomic nucleus, Review nuclear properties.
- Nuclear models: Liquid drop model, Fermi gas, deviance of the nuclear structure, Shell model (in more details). Single-particle aspects. The nuclear potential and single-particle levels.
- The filling of shells: ground state spins and parities; pairing.
- Nuclear magnetic moments and nuclear quadrupole moments : single-particle model and experiment, Nuclear quadrupole moments of single-particle states and experimentally observed deviations, Multi-particle configurations and residual interactions.
- Collective states.
- Spectroscopy and analysis techniques :Vibrations of spherical nuclei. Residual interactions correlations- deformation. Rotations and vibrations of deformed even-even nuclei. Nilsson model. Rapidly rotating nuclei: moments of inertia, pairing, alignment, super deformation. Laser spectroscopy, γ-ray spectroscopy. Gedetectors; γ-ray arrays; coincidence techniques. The measurement of excited state life times. Internal conversion.

ASSESSMENT CRITERIA

- Mid-Term exam and Quizzes: 30 %
- Assignments and classroom activities: 20 %
- Final Exam: 50%

COURSE TEACHING STRATEGIES

- Lectures, Discussion and group activity.

TEXT BOOK

- K. S. Krane, Introductory Nuclear Physics, 3rd Edition, ISBN: 978-0-471-80553-3, November1987, ©1987
- R. F. Casten, Nuclear Structure From A Simple Perspective, ISBN 0-19-504599-8Published by Oxford University Press, Inc., 1990
- G. F. Knoll, Radiation detection and measurement, 4th Edition, ISBN: 978-0-470-13148-0, Publisher: John Wiley & Sons, Inc., 2010

REFERENCE BOOKS

- J. Lilley, Nuclear Physics: Principles and Applications, 3rd Edition, ISBN: 978-0-471-97935-7, April 2001
- D.J. Bennet, J. R. Thomson, The elements of Nuclear Power, ISBN 13:9780582022249, Publisher: Longman, 1989.