



# Course Specification

## (Bachelor)

Course Title: **Nuclear Physics I**

Course Code: **PHYS 0351**

Program: **Bachelor of Science in Physics (BS)**

Department: **Physics**

College: **College of Science**

Institution: **Majmaah University**

Version: **2024**

Last Revision Date: **29/ 12/ 2024**



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## A. General information about the course:

### 1. Course Identification

<b>1. Credit Hours: 3(3+0+0)</b>					
<b>3</b>					
<b>2. Course type</b>					
<b>A.</b>	<input type="checkbox"/> University	<input checked="" type="checkbox"/> College	<input checked="" type="checkbox"/> Department	<input type="checkbox"/> Track	<input type="checkbox"/> Others
<b>B.</b>	<input checked="" type="checkbox"/> Required		<input type="checkbox"/> Elective		
<b>3. Level/year at which this course is offered: 6<sup>th</sup> level/ 3<sup>rd</sup> Year</b>					
<b>4. Course General Description:</b>					
The course describes the properties of nuclei and various models useful for the description of nuclear properties. It covers nuclear binding energy, nuclear stability, and radioactive decay. It also covers the different types of nuclear reactions and radiation detectors.					
<b>5. Pre-requirements for this course (if any):</b>					
PHYS 0241					
<b>6. Co-requisites for this course (if any):</b>					
None					
<b>7. Course Main Objective(s):</b>					
<ol style="list-style-type: none"> <li>1. To develop a clear understanding of the basic concepts in nuclear physics.</li> <li>2. Explain the physical principles underlying the liquid drop model of the nucleus and use it to explain nuclear masses and binding energies.</li> <li>3. Acquire knowledge of natural radioactivity and various decay modes.</li> <li>4. Be familiar with the different types of nuclear reactions and nuclear detectors.</li> </ol>					

### 2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100%
2	E-learning		
3	Hybrid <ul style="list-style-type: none"> <li>• Traditional classroom</li> <li>• E-learning</li> </ul>		
4	Distance learning		



### 3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	45
2.	Laboratory/Studio	
3.	Field	
4.	Tutorial	
5.	Others (specify)	
<b>Total</b>		<b>45</b>

### B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
<b>1.0</b>	<b>Knowledge and understanding</b>			
1.1	Recognize the constituents of the nucleus.	K1	Lecture Exercises Quizzes Problem-solving	Homework Exams Quiz
1.2	Identify basic nuclear properties such as nuclear charge, radius, mass, magnetic moments, and spin and parity.	K2	Lecture Exercises Quizzes Problem-solving	Homework Exams Quiz
1.3	Identify the nuclear binding energy and semi-empirical mass formula.	K1, K2	Lecture Exercises Quizzes Problem-solving	Homework Exams Quiz
1.4	Describe natural radioactivity and the differences between various decay modes.	K1, K2	Lecture Exercises Quizzes Problem-solving	Homework Exams Quiz



Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.5	Recognize the different types of nuclear reactions.	K1, K2	Lecture Exercises Quizzes Problem solving	Homework Exams Quiz
<b>2.0</b>	<b>Skills</b>			
2.1	Solve basic problems involving the application of the concepts of nuclear properties covered in the course.	S2	Lecture -Exercises	Homework Exams Quiz
2.2	Calculate the Q-values of various decay modes and the application of the selection rules for the allowed transitions.	S2	Lecture -Exercises	Homework Exams Quiz
2.3	Apply the basic laws of radioactivity in solving related problems.	S2	Lecture -Exercises	Homework Exams Quiz
<b>3.0</b>	<b>Values, autonomy, and responsibility</b>			
3.1	Work effectively in groups as well as individuals.	v1	Lectures	Homework, Classwork
3.2	Present a short report in written form and orally using appropriate scientific language.	v1	Lectures	Homework, Classwork
3.3	Use information technology and modern computer tools to locate and retrieve scientific information relevant to nuclear physics.	v1	Lectures	Homework, Classwork



## C. Course Content

No	List of Topics	Contact Hours
1.	Nuclear properties: constituents of the nucleus, radius, and mass	6
2.	Binding energy and semi-empirical mass formula	6
3.	Natural Radioactivity: Decay law-nuclear stability – Alpha, Beta, and Gamma decays	9
4.	Artificial Radioactivity: Discovery of artificial radionuclides – Interaction of radiation with matter	6
5.	Nuclear Reactions	6
6.	Nuclear Fission and Nuclear Fusion	6
7.	Nuclear Detectors	6
<b>Total</b>		<b>45</b>

## D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm 1*	6	15
2.	H. W	Every week	10
3.	Mid-term 2*	11	15
4.	Presentation	12	10
5.	Electronic exam	13	10
6.	Final exam *	16	40
	total		100

\*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

## E. Learning Resources and Facilities

### 1. References and Learning Resources

#### Essential References

- Introductory Nuclear Physics, K.S. Krane, 2<sup>nd</sup> edition, John Wiley and Sons, 1988.





	<ul style="list-style-type: none"> <li>• Concepts of Modern Physics, Beiser, McGraw Hill, 6<sup>th</sup> edition, 2003.</li> </ul>
<b>Supportive References</b>	<ul style="list-style-type: none"> <li>• Modern Physics, K.S. Krane, John Wiley and Sons Inc. 2012</li> <li>• Radiation Detection and Measurement, Glenn F. Knoll, John Wiley &amp; Sons, Inc. 2010</li> </ul>
<b>Electronic Materials</b>	<ul style="list-style-type: none"> <li>• Saudi Digital Library (SDL)</li> <li>• <a href="https://www.wikipedia.org/">https://www.wikipedia.org/</a></li> <li>• Web of Knowledge</li> <li>• Physics Today (web version)</li> <li>• MIT Courseware</li> <li>• <a href="http://faculty.mu.edu.sa/mskhan">http://faculty.mu.edu.sa/mskhan</a></li> <li>• <a href="http://vlib.org/physics.html">http://vlib.org/physics.html</a></li> <li>• <a href="http://dir.yahoo.com/science/physics">http://dir.yahoo.com/science/physics</a></li> <li>• <a href="http://demonstrations.wolfram.com">http://demonstrations.wolfram.com</a></li> <li>• <a href="http://askthephysicist.com">http://askthephysicist.com</a></li> <li>• <a href="http://cyberphysics.co.uk">http://cyberphysics.co.uk</a></li> </ul>
<b>Other Learning Materials</b>	

## 2. Required Facilities and equipment

Items	Resources
<b>facilities</b> (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Lecture room with at least 25 seats.  Auditorium of a capacity of not less than 100 seats for large lecture format classes.
<b>Technology equipment</b> (projector, smart board, software)	A smart board to write on a computer.
<b>Other equipment</b> (depending on the nature of the specialty)	Library, Seminar Room, and Wi-Fi internet connections.

## F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Internal Reviewer committee	Direct
Effectiveness of Students' assessment	Students	indirect
Quality of learning resources	Qiyas center, stockholder, and others	Direct
The extent to which CLOs have been achieved	Peer Reviewer	Direct
Other		

**Assessors** (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify))





Assessment Methods (Direct, Indirect)

### G. Specification Approval

COUNCIL /COMMITTEE	DEPARTMENT COUNCIL
REFERENCE NO.	
DATE	9 /22/ 2023

