هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

Course Specifications

Course Title:	**Nuclear Physics 1**
Course Code:	**461Phys**
Program:	**Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Jazan University**

Table of Contents

A. Course Identification

1. Credit hours:
2. Course type **a.** University ☐ College ☐ Department ☒ Others ☐ **b.** Required ☒ Elective ☐
3. Level/year at which this course is offered: Level 7/ Year 4
4. Pre-requisites for this course (if any)**: 352 PHYS**
5. Co-requisites for this course (if any)**: NIL**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	**36**	**80%**
2	**Blended**	**9**	**20%**
3	**E-learning**		
4	**Distance learning**		
5	**Other**		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	**Lecture**	**42**
2	**Laboratory/Studio**	**--**
3	**Tutorial**	**3**
4	**Others** (specify)	
	Total	**45**

B. Course Objectives and Learning Outcomes

1. Course Description

This course is to provide knowledge and understanding of the basics of nuclear physics like nuclear properties, nuclear force, nuclear structure, radioactivity, reactions and power production to enable progression to a postgraduate course or to provide a platform for entering industry.

2. Course Main Objective

This course is designed to provide students with:

- The fundamental of the nuclear physics and its scale.
- The basic properties of the nuclear force.
- The structure of the nucleus under different nuclear models.
- The stability of nuclei and their decay.
- The fission process and the basics of nuclear reactor.
- The fusion process and how intermediate and heavy elements are created in the stars.

3. Course Learning Outcomes

CLOs	Aligned

		PLOs
1	**Knowledge and Understanding**	
1.1	**Define:** The atomic number Z – the mass number – Isotopes – isobars – isotones - atomic mass unit- The binding energy - the Q-value – half life time-decay constant – cross section – reaction rate – flux	**PLO1.1**
1.2	**Describe:** Nuclear structure, nuclear volume and nuclear density, nuclear angular momentum, nuclear electric quadrupole moment – nuclear force – shell model – liquid drop model – fermi gas model- alpha decay – beta decay – gamma decay – carbon dating – compound nucleus – nuclear reactor	**PLO1.1**
1.3	**Discuss** excited states and stability, nuclear reaction, nuclear fission, nuclear fusion.	**PLO1.2**
2	**Skills :**	
2.1	**Calculate** binding energy and mass defect, atomic weight, nuclear force, nuclear density, angular momentum, Q-value, nuclear energy	**PLO2.2**
2.2	**Solve** the problems related with radioactive decay	**PLO2.1**
2.3	**Evaluate** liquid drop model, shell model, nuclear force and exchange force	**PLO2.1**
2.4	**Develop** communication and critical thinking competencies during interactive discussion, group assignments, essays or web-based activities	**PLO2.4**
3	**Values:**	
3.1	**Show** effective collaboration and bear individual responsibility during group work and/or assignments	**PLO3.1**

C. Course Content

No	List of Topics	Contact Hours
1	**Nuclear Properties:** Nuclear scale, units, size and density, quadrupole moment, Notation, isotopes, The nuclear chart (Nuclear landscape), how to write a nuclear reaction, Binding Energy BE, Q-value.	**12**
2	**Nuclear forces:** exchange force, proton potential well and neutron potential wells, nuclear force.	**6**
3	**Nuclear models:** Fermi gas model, Liquid drop model, Shell model, deformation.	**9**
4	**Radioactivity:** Types of radiation,- Alpha , - Beta+ , Beta-, - Gamma, Electron capture, decay chains, Uses of Radioactivity, Radioactivity decay law, Half-life, life time, nuclear dating, Carbon, Rock dating	**6**
5	**Nuclear reactions:** The conservation laws, types of reaction, Elastic, Inelastic, Transfer, Compound, Fission, why fission happens, spontaneous, induced (controlled), nuclear reactor., Fusion, p-p cycle, CNO cycle, nucleosynthesis.	**9**
6	**Review**	**3**
Total		45

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge and Understanding**		
1.1	**Define:** The atomic number Z – the mass number – Isotopes – isobars – isotones - atomic mass unit- The binding energy - the Q-value – half life time-decay constant – cross section – reaction rate –	Lectures, discussion	Quizzes, mid-term exams

	flux		
1.2	**Describe:** Nuclear structure, nuclear volume and nuclear density, nuclear angular momentum, nuclear electric quadrupole moment – nuclear force – shell model – liquid drop model – fermi gas model- alpha decay – beta decay – gamma decay – carbon dating – compound nucleus – nuclear reactor	Lectures, discussion	Quizzes, mid-term exams
1.3	**Discuss** excited states and stability, nuclear reaction, nuclear fission, nuclear fusion.	Lectures, discussion	Quizzes, mid-term exams
2.0	**Skills**		
2.1	**Calculate** binding energy and mass defect, atomic weight, nuclear force, nuclear density, angular momentum, Q-value, nuclear energy	Lectures, discussion	Quizzes, mid-term exams and final exam
2.2	**Solve** the problems related with radioactive decay	Lectures, discussion	Quizzes, mid-term
2.3	**Evaluate** liquid drop model, shell model, nuclear force and exchange force	Lectures, discussion	exams and final exam
2.4	**Develop** communication and critical thinking competencies during interactive discussion, group assignments, essays or web-based activities	Lectures, discussion	exams and final exam
3.0	**Values**		
3.1	**Show** effective collaboration and bear individual responsibility during group work and/or assignments	Individual and group practices-Brain storming – free related small web-based topics	Case study- reports-project work-presentation

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	**Homework assignment 1**	**2**	**6**
2	**Homework assignment 2**	**4**	**2**
3	**1st Mid-term Exam**	**6**	**20**
4	**Homework assignment 3**	**10**	**2**
5	**2nd Mid-term Exam**	**12**	**20**
6	**Final Exam**	**16**	**50**

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

Each group of students is assigned to a staff member who will be available for help and academic guidance office hours at specific 2h on daily basis.

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	Introductory Nuclear Physics, Krane K.S. Wiley, New York, (1987).
Essential References Materials	Nuclear and Particle Physics, Williams W.S.C Clarendon Press, Oxford, (1991).
Electronic Materials	http://hyperphysics.phy-astr.gsu.edu **http://www.wikipedia.org/**
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	**1 Lecture room(s) for groups of 50 students.**
Technology Resources (AV, data show, Smart Board, software, etc.)	**1 Computer laboratories each for groups of 25 students.**
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching	Students, Peer and program leader	Indirect (CES)- Indirect peer evaluation
Assessment	Students, Program assessment committee	Direct/ Indirect
Extent of achievement of course learning outcomes	Instructor	Direct/Indirect
Quality of learning resources	Students, Faculty members	Indirect
Strategies for Obtaining	Student Feedback	Student assessment of Teaching Quality (NCAAA form).
Processes for Improvement of Teaching	Faculty members	Revision of course contents, course specifications, and teaching strategies every 5 years.
Processes for Verifying Standards of Student Achievement	independent member teaching staff of a sample of student work, periodic exchange and remarking of tests or a sample of	Check marking by an independent staff member of a sample of student work. Periodic exchange and check marking of a sample of

	assignments with staff at another institution)	assignments with a staff member in another institution.

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	**Council of Physics Department**
Reference No.	8
Date	16/4/1442