هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

اعتماد NCAAA T4 2020

Course Specifications

Course Title:	**Nuclear Technology**
Course Code:	**PHY4604**
Program:	**B.Sc**
Department:	**Physics**
College:	**Applied Sciences**
Institution:	**Umm Al-Qura University**

Table of Contents

A. Course Identification

1. Credit hours: 3
2. Course type **a.** University ☐ College ☐ Department ☒ Others ☐ **b.** Required ☐ Elective ☒
3. Level/year at which this course is offered: 10
4. Pre-requisites for this course (if any): Nuclear 2
5. Co-requisites for this course (if any):

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	30	100%
2	Blended		
3	E-learning		
4	Distance learning		
5	Other		

7. Contact Hours (based on academic semester)

No	Activity	Contact Hours
1	Lecture	30
2	Laboratory/Studio	
3	Tutorial	
4	Others (specify)	
	Total	30

B. Course Objectives and Learning Outcomes

1. Course Description

The course will cover the principles and basics of fission chain reactions and its application in nuclear power reactors and the unique aspects of nuclear energy as clean and sustainable source of energy, as well as theory and function of commercial nuclear power reactors. Topics related to nuclear power generation like nuclear waste, nuclear safety, nuclear proliferation, and nuclear security are covered in this course. Acceleration of charged particles and its application in nuclear field are also presented in this course.

2. Course Main Objective

To provide the scientific and technical background needed to proper understanding of applications of nuclear fission and related aspects in the field of nuclear power production.

3. Course Learning Outcomes

	CLOs	Aligned PLOs
1	**Knowledge and Understanding**	
1.1	Demonstrate the fundamentals and basic concepts of fission chain reaction and its application in nuclear reactors and nuclear power generation, and the related issues like nuclear waste, nuclear safety, nuclear security, and nuclear proliferation.	K1(M) K2(M)
2	**Skills :**	
2.1	To know how to assess, evaluate, or calculate the following: power generated in nuclear reactor, environmental impact of nuclear reactor, and nuclear waste.	S1(M)
2.2	Effectively communicates physics concepts, processes, and results, both orally and in writing related nuclear technology	S2(M)
3	**Values:**	
3.1	Works responsibly and effectively within the work team to practice and interact with the environmental consequences, and safety and security cultures related to nuclear power production.	V1(M) V2(M)

C. Course Content

No	List of Topics	Contact Hours
1	**Chain Reactions and Nuclear Reactors** Criticality and the Multiplication Factor Thermalization of Neutrons Reactor Kinetics Conversion Ratio and Production of Plutonium in Thermal Reactors Control Materials and Poisons	4
2	**Nuclear Reactor** Structure of Nuclear Reactors Reactor Types The Natural Reactor at Oklo	6
3	**Nuclear Fuel Cycle** Characteristics of the Nuclear Fuel Cycle Front End of the Fuel Cycle Fuel Utilization Back End of Fuel Cycle Uranium Resources	6
4	**Nuclear Waste management** Categories of Nuclear Waste Treatment and Conditioning Storage and Disposal Responsibilities to Future Generations	4
5	Safety, Security and Safeguard in Nuclear Energy General Considerations in Reactor Safety Reactor Safety Standards Nuclear Reactor Accidents	6

	Terrorist Threats Nuclear Security: Physical protection and Security Measures Nuclear Safeguard and Nuclear Proliferation Environmental Impact of Nuclear Energy	
6	**Accelerators** Ion Sources Electrostatic Machines Linear Accelerators Cyclotrons, Synchrotrons, and Rings Charged Particle Beam Transport and Analysis Radioactive Ion Beams	4
Total		30

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	Demonstrate the fundamentals and basic concepts of fission chain reaction and its application in nuclear reactors and nuclear power generation, and the related issues like nuclear waste, nuclear safety, nuclear security, and nuclear proliferation. .	1.Lecture method: Board and PowerPoint. 2.Begin the lecture with a brief idea of the topic. 3.Demonstrate the basic principles. 4.Discussing phenomena with illustrating pictures and diagrams. 5.Solve problem 6.Brain storming	• Midterm exams. • Final exam. • Homework • Oral Questions.
2.0	**Skills**		
2.1	To know how to assess, evaluate, or calculate the following: power generated in nuclear reactor, environmental impact of nuclear reactor, and nuclear waste.	1. Lecture method: Board and PowerPoint. 2. Interactive group work 3. Demonstrate the basic principles. 4. Discussing phenomena with illustrating pictures and diagrams. 5. Solve problem 6. Brain storming	• Midterm exams. • Final exam. • Homework • Oral Questions. •Group output
2.2	Effectively communicates physics concepts, processes, and results, both orally and in writing related nuclear technology		
3.0	**Values**		

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
3.1	Works responsibly and effectively within the work team to practice and interact with the environmental consequences, and safety and security cultures related to nuclear power production.	1. Give students tasks of duties as a teamwork. 2. Asking the teamwork to write scientific reports or project. 3. Asking the teamwork to demonstrate the results of the scientific reports or project. 4. Interactive Drills	Evaluate: • the scientific reports, • the teamwork, • the efforts of each student in preparing the report. • Drill Assessment

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
2	Term Works	All weeks	20%
3	Mid-term exam	5th week	30%
4	Final exam	End of the term	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 : 3 hours per week

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	1. Nuclear energy: principles, practices, and prospects / David Bodansky. —2nd ed. 2004 Springer-Verlag New York, LLC. 2. Walter D. Loveland, David J. Morrissey Glenn T. Seaborg. Modern Nuclear Chemistry. 2nd Ed. 2006 by John Wiley & Sons, Inc.
Essential References Materials	1. Handbook of Nuclear Engineering: Vol. 1: Nuclear Engineering Fundamentals; Vol. 2: Reactor 2.Eisenbud,M. and Gesell,M., "Enviromental Radioactivity",4th edition, Academic Press, London, 1997.
Electronic Materials	https://world-nuclear.org/ http://www.lnhb.fr/nuclear-data/nuclear-data-table/ https://www.nrc.gov/reading-rm/basic-ref/students/for-educators.html https://www.wins.org/

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• Classroom • Laboratory • Library
Technology Resources (AV, data show, Smart Board, software, etc.)	• Data show • Black Bord
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	(NO)

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment	Students	Questionnaire
Effectiveness of Student evaluation	Instructor	Exams
Extent of achieving course learning outcomes	Instructor	Course report
Quality of learning resources	Instructor	Course report

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	
Reference No.	
Date	