Academic Program Description Form

University Name: Al Nahrain University Faculty/Institute: College of Science Scientific Department: Physics Academic or Professional Program Name: higher education Final Certificate Name: MSc.Ph.D Academic System: Semester **Description Preparation Date: 2024-2025** File Completion Date: 2025/3/25

Signature Saad N- Alo Head of Department Name:

Prof Dr Saad Naji Abood Date: 2025/4/10

Signature Scientific Associate Name Manaf Aduan Saleh Date 18/4/2025

Approval of the Dean



The file is checked by: Orooba Nadh: A Horbi Department of Quality Assurance and University Performance

Director of the Quality Assurance and University Performance Department: Date:

Ministry of High

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Signature: 10 .

1. Program Vision

The student's ability to understand and apply a variety of physical, and acquire the ability to explain and understand many of the physical processes.

2. Program Mission

Qualifying students practically and scientifically through an intensive scientific curriculum of teaching and learning methods and preparing the student in an academic way that is compatible with the necessities of scientific development. Preparing distinguished students in the field of scientific research who hold graduate studies.

3. Program Objectives

Increasing the efficiency of students and raising their level of knowledge so that they are qualified to work in various state departments so that they can be effective and distinguished elements in their fields of work and scientific research.

4. Program Accreditation

Does the program have program accreditation? And from which agency?

From the Association of Arab Universities

5. Other external influences

Is there a sponsor for the program?

Ministry of Higher Education and Scientific Research

6. Program Struct	ure			
Program Structure	Number of Courses	Credit hours	Percentage	Reviews*
Institution Requirements	2		100	

College	2	100	
Requirements			
Department	2	100	
Requirements			
Summer Training	_	_	
Other			

* ممكن ان تتضمن الملاحظات فيما اذا كان المقرر أساسي او اختياري .

7. Program Description							
Credit Hours	5	Course Name	Course Code	Year/Level			
Practical	theoretical			ماجستير			
				ماجستير			
				ماجستير			
				ماجستير			
				ماجستير			
				ماجستير			
	2	English Language II	MSc.	ماجستير			
	2	Advanced Nuclear physics	MSc.	ماجستير			
	2	Advanced Quantum mechanics	MSc.	ماجستير			
	2	Electromagnetic theory	MSc.	ماجستير			
	2	Charged particles Optics	MSc.	ماجستير			
	2	Advanced Plasma physics	Ph.D	دکتوراه			
	2	Statistical mechanics	Ph.D	دكتوراه			
	2	Advance Solid state physics II	Ph.D	دكتوراه			
	2	English Language	Ph.D	دکتوراه			
	2	Nuclear models	Ph.D	دکتوراه			
	2	Radiological physics	Ph.D	دکتوراه			

8.Expected learning outcomes of the program						
Knowledge						
Learning Outcomes 1	The student acquires the ability to explain and understand many of					
	the biological processes in primary and graduate studies that serve					
	the labor market and scientific research.					
Skills						
Learning Outcomes 2	Preparing students who are scientifically empowered in the field of					
	specialization and the labor market.					
Learning Outcomes 3	Identifying the most important advanced scientific and research					
	materials that serve the fields of communications and modern					
	technology.					
Ethics						
Learning Outcomes 4	Ability to apply principles of physics.					
Learning Outcomes 5	The ability to solve scientific problems and find possible alternatives					
	to those solutions.					

9. Teaching and Learning Strategies

- 1. Solve various problems in different physics applications.
- 2. Giving homework to increase students' ability in problem–solving techniques.
- 3. Promote quick student response by asking conceptual questions during class.
- 4. Encouraging students in strategies to solve examples in class.
- 5. Encouraging students to publish research in graduate studies.
- 6. Encouraging students to use modern, advanced applications in the field of specialization.

10. Evaluation methods

- 1. Seminar.
- 2. Oral exams.
- 3. Quizzes.
- 4. Direct questions.
- 5. Homework.
- 6. Reports

11.Faculty

Faculty Members

	•					
Number	of the	Special	Spe	ecialization	Academic	
teaching	staff	Requirements/S			Rank	
		kills (if				
		applicable)				
		,		Γ		
lecture	staff		Special	General		
	1		فيزياء طبية	علوم الفيزياء	استاذ دكتور	أ _. د.اسماء هادي محمد
	1		بصريات	علوم الفيزياء	استاذ دكتور	ا د سهی موسی خور شید
	1		بصريات الكترون	علوم الفيزياء	استاذ دکتور	ا _{.د.} عدي علي حسين
	1		صلبة	علوم الفيزياء	استاذ دكتور	أ.د.احمد عبد الرحمن
	1		فيزياء نظرية	علوم الفيزياء	استاذ دکتور	أ د سعد ناجي عبود
	1		صلبة	علوم الفيزياء	استاذ دكتور	أدعماد خضير عباس
	1		معالجة صور رقمية	علوم الفيزياء	استاذ دكتور	أ _. د.اليث عبد العزيز عباس
	1		بلازما	علوم الفيزياء	استاذ دكتور	أ _. د.خالد عباس يحيى
	1		فلك	علوم الفيزياء	استاذ مساعد دكتور	أ.م.د.جزيل حسين
	1		بلازما	علوم الفيزياء	استاذ مساعد دكتور	أ.م.د.حسن ناصر
	1		صلبة	علوم الفيزياء	استاذ مساعد دكتور	أ.م.د <u>و</u> سن علي موسى
	1		اشعاعية	علوم الفيزياء	استاذ مساعد دكتور	أ.م.د.مروة عبد المحسن
	1		احصائية	علوم الفيزياء	استاذ مساعد دکتور	أ.م.د ابراهيم عبدالمهدي
	1		بلازما	علوم الفيزياء	استاذ مساعد دکتور	ا <u>م د نی</u> سان سعود
	1		صلبة	علوم الفيزياء	استاذ مساعد دکتور	ا.م.د سديم عباس

1		نظرية	علوم الفيزياء	مدرس دکتور	م.د.احمد شاکر
1		بصريات	علوم الفيزياء	استاذ مساعد	ا _م نور محمد حسن
1		نظرية	علوم الفيزياء	مدرس دکتور	م د عمر ایاد
1		فأك	علوم الفيزياء	مدرس دکتور	م د سلام اسماعیل
1		الكترونيك	علوم الفيزياء	استاذ مساعد دكتور	ا _{.م.} د.زینب منذر
1		كيمياء	علوم كيمياء	استاذ مساعد دکتور	أ.م.د.احمد صبيح
1		رياضات	علوم رياضيات	مدرس دکتور	م د فاطمة عبد الصاحب
1		شريعة	شريعة	مدرس	م عمر عدنان
1		رياضيات	علوم رياضيات	مدرس دکتور	م د منی صالح
1		اللغة العربية	اللغة عربية	مدرس دکتور	م د احمد نعمة
1		رياضيات	علوم الرياضيات	استاذ مساعد	ا.م.ابتسانم کامل
1		رياضيات	علوم رياضيات	مدرس دکتور	م.د.ايمان عبد الو هاب
1		رياضيات	علوم رياضيات	مدرس دکتور	م د احمد ايوب

Professional Development

Mentoring new faculty members

Assess teaching techniques and give the students surveys about those techniques.

Professional development of faculty members

Involve the new staff in teaching process and encourage them to develop the lecture with the supervision of the main lecturer.

12.Acceptance Criterion

(Setting regulations related to enrollment in the college or institute, whether central admission or others)

13. The most important sources of information about the program

دليل اتحاد الجامعات العربية "ضمان الجودة والاعتماد للبرامج الاكاديمية في كليات الجامعات العربية

الامانه العام /عمان/الاردن/2022

14. Program Development Plan

	Program Skills Outline														
Required program Learning outcomes															
			Ethics	Skills			Knowledge			dge	Basic	Course Name	Cours	Year/Level	
C4	C3	C2	C1	B4	B 3	B2	B1	A4	A3	A2	A1	or		e Code	
												optio			
												nal			
								~	~	~	~	اساسى	English Language I	MSc	اجستير
								>	•	~	•	اساسى	Advanced Nuclear physics		
								~	~	~	~	اساسى	Advanced Quantum mechanics		
								~	~	~	~	اساسى	Electromagnetic theory		
								~	~	~	~	اختياري	Charged particles optics		
			1				•			•	•		÷		

										Ph.D	دکتوراه
		1									
				>	>	~	~	اساسي	English Language		
				<	>	~	~	اساسى	Advanced Plasma		
									physics		
				<	~	~	~	اساسى	Advance Solid state		
									physics II		
				<	~	~	~	اختياري	Radiological physics		
				~	~	~	~	اختياري	Nuclear models		
				~	~	~	~	اساسى	Statistical mechanics		

يرجى وضع اشارة في المربعات المقابلة لمخرجات التعلم الفردية من البرنامج الخاضعة للتقييم

1. Cour	1. Course Name:							
Statistical Physics/ M.Sc. students								
2. Cour	2. Course Code:							
3. Seme	ester / Year:							
	First Course / 2024 - 2025							
4. Desc	ription Preparation Date:							
	20/10/2024							
5. Avail	able Attendance Forms:							
	In presence							
6. Num	ber of Credit Hours (Total) / Number of Units (Total)							
	2 hours							
7. Cour	se administrator's name (mention all, if more than one name)							
Nam	e: Prof.Dr.Khalid Abbas Yahya							
Emai	l: khalid.abbass@nahrainuniv.edu.iq							
8. Cours	se Objectives							
Course Objec	• The course aims to teach graduate students the subject of statistical physics by studying general theories in this subject.							
	Among the models of statistics such as Maxwell-Boltzmann							
	statistics, Bose-Einstein statistics, and Fermi-Dirac statistics, and the comparison between these models							
	 Benefiting from this course in assigning the rest of the other courses 							
	postgraduate students.							
	Keeping up with scientific curricula and courses in							
	international universities.							
9. Teac	hing and Learning Strategies							
Strategy	•Activating students and activating educational attitudes by accustoming students to							
	respecting different opinions, appreciating others, and benefiting from others' ideas							
	• Exchanging ideas (dialogical method) and encouraging acceptance of others' ideas.							
	•Asking questions to a specific student, with the aim of developing several skills, the							
	•The student is asked to write a report/research on a specific topic, and this method							
	develops the student's research, analysis, expression, and presentation skills.							
	Questions related to the lecture are asked as homework to activate and deepen the							
	assignment							

10. C	10. Course Structure								
Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method				
1	2	Giving an introduction to the course topic	Introduction to statistical physics	In presence	Exams and assignments				
2	2	Study of the Maxwell- Boltzmann model	Maxwell Boltzmann statistical equation	In presence	Exams and assignments				
3	2	Application of Maxwell Boltzmann statistics	Study of statistical systems	In presence	Exams and assignments				
4	2	Study of velocity distribution	Study of velocity distribution with three component	In presence	Exams and assignments				
5	2	Spectra study	Doppler Broadening of spectral lines	In presence	Exams and assignments				
6	2	Study of the Bose- Einstein model	Bose-Einstein distribution equation	In presence	Exams and assignments				
7	2	Bose Einstein Model Application	Black –body radiation-photon gas	In presence	Exams and assignments				
8	2	Application of heat capacity	Heat capacity in a solid body phonon gas	In presence	Exams and assignments				
9	2	Study of the Fermi-Dirac statistics model	Fermi-Dirac distribution equation	In presence	Exams and assignments				

		,				
10	2	Application of the Fermi-Dirac statistics model	Fermi-Dirac gas	In presence	Exams and assignments	
11	2	Applying entropy to the model	Entropy and temperature	In presence	Exams and assignments	
12	2	Fermi-Dirac application using free energy	Free energy	In presence	Exams and assignments	
13	2	Statistical application	Gibbs paradox	In presence	Exams and assignments	
14	2	Types of systems	Open system	In presence	Exams and assignments	
15	2	Types of systems	Closed system	In presence	Exams and assignments	
11. Course Evaluation						
Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports etc						

- Evaluation is done through
 1- Daily and monthly exams 25%
 2- 2- Homework assignments 5%
 3- Final exam 70%

12. Learning and Teaching Resources									
Required textbooks (curricular books, if any)	Introduction to Statistical Physics								
	Kerson Huang								
Main references (sources)	All sources on the subject of Statistical physics								
Recommended books and references	All books specialized in advanced statistical								
(scientific journals, reports)	physics								
Electronic References, Websites	Official websites of scientific libraries								

1. Course Name: Advanced Solid State Physics I/ Master

2. Course Code:

3. Semester / Year: first 2024/2025

4. Description Preparation Date: 26/11/2023

5. Available Attendance Forms: present

6. Number of Credit Hours (Total) / Number of Units (Total) 3 hrs. per week/ 3 units per week

7. Course administrator's name (mention all, if more than one name) Name: Prof. Dr. Emad Khudhair Abbas Email: emad.abbas@nahrainuniv.edu.iq

8. Course Objectives					
Course Objectives	 Understand the advanced concepts in solid-state physics Linking a theoretical concept with a practical concept Allow the student to show a problem in the field of solid-state physics and how to solve it. allowing the student to choose the research project that qualifies him to obtai master's degree. 				
9. Teaching and Learning Strategies					

Strategy	 Seminar presentation by students to enhance their skills help students with the scientific discussion during lectures help the student in the solving the problems 	
	5 help the student in the solving the problems	

10. Course Structure

Week	Hours	Required	Unit or subject name	Learning	Evaluation
		Learning		method	method
		Outcomes			
1-3	9	Academic	Lattice Vibration in 1	lectures	discussion
			2D, and 3D		
4-7	12	Academic	Mechanical	lectures	Exam
			Properties of Solid		
8-11	12	Academic	Magnetic	Lectures	discussion

			D			
10.11	0		Proper	ties of solid	. .	
12-14	9	Academic	Dielect	ric	Lectures	Exam
			proper	ties of solid	-	
15	3	Academic	Review	I	Lectures	discussion
11. Course Evaluation						
Distributing the score out of 100 according to the tasks assigned to the student, such as daily preparation, daily oral, monthly, or written exams, reports etc 30% mid exam+ discussion+ solving homework 70% final exam						
12. L	_earning	and Teaching Re	sources			
Require	d textboo	ks (curricular books, i	if any)	1] Introduction to solid state physics		
			·	by C. Kittel		
				2] Elementary to solid state Physics		
				by M. Omar		
				3] Solid state physics by Ashcroft		
				and Mermin		
Primary	reference	es (sources)		1] Solid state physics by Ashcroft		
				and Mermin		
Recomn	Recommended books and references			All related international lectures		
(scientific journals, reports)				and research were dependent		
Electron	ic Refere	nces, Websites		All books and global sites on the internet		

1. Course Name:

English Language 1

2. Course Code:

3. Semester / Year:

M.Sc./1st Sem. 2024-2025

4. Description Preparation Date:

1/10/2024

- 5. Available Attendance Forms:
 - Physical Attendance
- 6. Number of Credit Hours (Total) / Number of Units (Total)

1 Hour/ 1 Unit

7. Course administrator's name (mention all, if more than one name)

Name: Assis. Prof. Dr. Jazeel Hussein Azeez

Email: Jazeel.azeez@nahrainuniv.edu.iq

8. Course Objectives

Course

Objectives • Students can conduct a conversation in English and use the appropriate dialogue style.

- Enhancing students' abilities to communicate with other people around the world.
 - Students can understand articles and dialogues in English and translate them into their mother language, Arabic.
 - · Enhancing students' abilities in how to use English grammar in conversation

9. Teaching and Learning Strategies

Strategy

- The strategies followed in this curriculum are:
- Providing detailed lectures to students, including external paragraphs and writing skills.
- Providing audio lectures
- Adopting the conversation method and active participation to consolidate concepts and deepen understanding.
- Giving students homework that includes practicing writing skills to avoid paraphrasing.

Week	Hours	Required Learning	Unit or subject	Learning	Evaluation
		Outcomes	name	method	method
1	1	-Introducing the	-Following	Whiteboard	Oral and written
		students to the	instructions: filling in	and LCD	exams
		importance of	forms		
		following instructions	-Reading methods:		
		(on forms, essay	skim; scan; intensive		
		questions, etc.)	reading; extensive		
			reading		
2	1	-Introducing the	-Checking your	Whiteboard	Oral and written
		students to different	writing: error	and LCD	exams
		reading strategies.	correction –		
			punctuation and		
			spelling		
			-Writing an informal		
			email		
3	1	-Encouraging the	Skimming	Whiteboard	Oral and written
		students to reflect	-Skinining and	and LCD	exams
		on how the skills	the general idea, and		
		presented and	for particular		
		practiced here can	information		
		be applied to their			
		other studies.			
4	1	-Encouraging the	-Brainstorming	Whiteboard	Oral and written
		students to be	ideas: topic areas	and LCD	exams
		critical of their own	and examples;		
		written work and to	completing a		
		develop the habit of	paragraph		
		checking their own	-Linking ideas (1):		
		work systematically,	but, however,		
		in this case for	although		
		errors of punctuation	Writing a description		
		and spelling.	of my country		
		Students will also			

		produce their first	Synonyms and		
		piece of written work	antonyms:		
		for this course: an	recognizing		
		informal email	synonyms and		
			antonyms		
5	1	-giving the students	-Predicting content:	Whiteboard	Oral and written
		further practice in	using the title and the	and LCD	exams
		skimming and	pictures.		
		scanning, and	Meaning from		
		getting them to look	context: guessing the		
		at words that go	meaning of new		
		together	words.		
		(collocations).	- Antonyms from		
			prefixes: making an		
			opposite word using		
			un–, in–, il–, im–, ir–		
6	1	giving the students	-Sentences/	Whiteboard	Oral and written
		practice in	Paragraphs; helping	and LCD	exams
		brainstorming for	your writing flow		
		ideas, and looking at	-Varying the		
		ways of linking	structure: making		
		these ideas logically	writing interesting		
		and clearly. The	-Writing an article		
		student will write a			
		description of their			
		own country.			
7	1	Evaluate the		Whiteboard	Written exam
		students	First Mid Exam	and LCD	
8	1	-Helping the	- Identifying the	Whiteboard	Oral and written
		students get a better	main message: using	and LCD	exams
		understanding of a	topic sentences to		
		text when skimming,	identify paragraph		
		by drawing their	content.		
		attention to the			

		position and role of			
		topic sentences.			
9	1	-helping the student	 Organizing ideas 	Whiteboard	Oral and written
		to select the parts of	(1): planning the	and LCD	exams
		a text that they need	arguments for and		
		in their academic	against		
		studies more quickly	-Linking ideas (2):		
		and efficiently.	first, for instance, in		
			conclusion.		
			-Writing a discursive		
			essay		
			-Avoiding repetition		
			(1): using synonyms		
			to vary your writing		
10	1	-Encouraging the	-Purpose and	Whiteboard	Oral and written
		student to organize	audience (1 and 2):	and LCD	exams
		their ideas for an	using visual and		
		essay in a logical	written clues		
		way, and to link	- Suffixes: identifying		
		those ideas with the	parts of speech		
		appropriate type of	Prefixes: changing		
		linking device.	the meaning of		
			words		
11	1	-Improving the		Whiteboard	Oral and written
		students' ability to	- Using formal	and LCD	exams
		assess a text for its	expressions: writing		
		usefulness by	academic emails and		
		identifying its	letters		
		purpose and for	-Writing a formal		
		whom it has been	email		
		written			
12	1	Evaluate the	Second Mid Exam	Whiteboard	Written exam
		students		and LCD	
13	1	The students are	Writing essays on	Whiteboard	Oral and written
		requested to write	selected subject	and LCD	exams

		essays on certain				
		subjects				
14	1	The students will be			Whiteboard	Oral and written
		exposed to different			and LCD	exams
		audio assays and	Lictori	na Practico 1		
		then they are	LISIEIII	ING FLACIICE I		
		requested to answer				
		the questions				
15	1	The students will be	Listeni	ng Practice 2	Whiteboard	Oral and written
		exposed to different			and LCD	exams
		audio assays and				
		then they are				
		requested to answer				
		the questions				
11. Cou	rse Eval	uation			• •	
30 Marks (N 70 Marks Fi	Aid exam nal Exan	+ Homework+ Quizze	es)			
12. Lea	rning an	d Teaching Resourc	es			
Required textbooks (curricular books, if any)			Headway Academic Skills Reading, Writing, and Study Skills Level 2 Student Book			
Main referer	Main references (sources)					
Recommend	led book	s and references (so	cientific			
journals, rep	journals, reports)					
Electronic References, Websites			https://elt.o	up.com/student/h d?cc=us&selLan	neadway/advanc guage=en	

1. Course Name: Relativis	stic Quantum Mechanics
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2. Course Code:

3. Semester / Year: First / 2024-2025

4. Description Preparation Date: September 2024

5. Available Attendance Forms: Attendance in class

6. Number of Credit Hours (Total) / Number of Units (Total): 45 hours /3 units

7. Course administrator's name (mention all, if more than one name) Name: Prof. Dr. Oday Ali Hussein Email: oday.hussein@nahrainuniv.edu.ig

8. Course Objectives

Course Objectives This course aims to obtain basic knowledge of the subject of relativistic quantum mechanics and p s skills in dealing with applications that fall within the relative range of high energies when dealing with physics topics in microscopic systems

9. Teaching and Learning Strategies

Strategy

A- Cognitive goals.

- A1- Understanding the basics of relativistic quantum mechanics.
- A2- Understand the difference between relativistic and non-relativistic quantum mechanics.
- A3- Understanding Klien-Gordon's treatments of the subject of relativistic quantum mechanics and distinguishing areas of success and failure.
- A4- Understanding Dirac's treatments of the subject of relative quantum mechanics and knowing the areas of success and knowledge addition to physics.
- A5- Comparability between Schrodinger, Klien-Gorden and Dirac treatments.

B . '	The skills	goals	special	to	the	course.
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- B1. Theoretical and mathematical skills.B2. Applied skills.B3. Developmental skills

10. Course Structure

Week	Hours	Required Learning	Unit or subject name	Learning method	Evaluation method
		Outcomes			
1	3	Gain the required background	Introduction and Review	Theoretical	Written exams and homework
2	3	Enable the student to derive basic equations	Derivation of the Klien-Gordon Eq.	Theoretical	Written exams and homework
3	3	Teach the student the concept of invariance	Relativistic Invariance of the Klien-Gordon Eq.	Theoretical	Written exams and homework
4	3	Expanding the student's awareness of the occurrence of electromagnetic fields	The Klien- Gordon Eq. in an EM-Field	Theoretical	Written exams and homework
5	3	Teach the student some applications which has previously learned	Solution of the Klien-Gordon Eq. for a Free Particle	Theoretical	Written exams and homework
6	3	Learning another application	Solution of the Klien-Gordon Eq. for a Charged Particle in an EM-Field	Theoretical	Written exams and homework
7	3	Enabling the student to derive another basic aspect of the topic	Derivation of Dirac's Eq.	Theoretical	Written exams and homework

8	3	Teaching the student some applications	Solution of the Dirac Eq. for a Free Particle	Theoretical	Written exams and homework
9	3	Learning another application	Solution of the Dirac Eq. for a Charged Particle in an EM-Field	Theoretical	Written exams and homework
10	3	Learning another application	The Dirac Eq. for a central Field	Theoretical	Written exams and homework
11	3	Learning another application	The Relativistic Hydrogen Atom	Theoretical	Written exams and homework
12	3	Learning another application	Classification of Energy Levels	Theoretical	Written exams and homework
13	3	Learning another application	Fine Structure Energy Levels	Theoretical	Written exams and homework
14	3	Expanding the student's awareness of new theoretical concepts	Negative Energy State	Theoretical	Written exams and homework
15	3	Teach the student how to use new concepts to explain phenomena	Dirac's Interpretation of Negative Energy State	Theoretical	Written exams and homework
11	Course	Evaluation			

Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports etc

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Relativistic Quantum Mechanics, Walter Greiner, Third edition, Spr
Main references (sources)	Quantum Mechanics, L. I. Schiff, 3 rd Edition (Mc Graw-Hill Inc., NY)
Recommended books and references	
(scientific journals, reports)	
Electronic References, Websites	

1. Course Name:

English Language II

2. Course Code:

3. Semester / Year:

M.Sc./2nd Sem. 2024-2025

4. Description Preparation Date:

1/2/2025

5. Available Attendance Forms:

Physical Attendance

6. Number of Credit Hours (Total) / Number of Units (Total)

1 Hour/ 1 Unit

7. Course administrator's name (mention all, if more than one name)

Name: Assis. Prof. Dr. Jazeel Hussein Azeez

Email: Jazeel.azeez@nahrainuniv.edu.iq

8. Course Objectives

Course Objective Students can understand articles and dialogues in English and translate them into their mother languages, Arabic. Students can write scientific articles of their own, taking into account the rules of the language and the words used. Students can quote from written articles and rephrase them to avoid plagiarism in their research and articles. Teaching and Learning Strategies Strategy The strategies followed in this curriculum are: Providing detailed lectures to students, including external paragraphs and writing skills. Providing listening lectures

- Giving students homework that includes practicing writing skills to avoid paraphrasing.
- Students participate in discussion and conversation using "English vocabulary" words in the classroom.

Week	Hours	Required Learning	Unit or subject name	Learning	Evaluation
		Outcomes		method	method
1	1	-Introduce students to	-Making notes:	Whiteboard	Oral and
		different techniques for	organizing, recording, and	and LCD	written
		making notes, and help	remembering important		exams
		them determine what is	information		
		key information in a text	-Interpreting meaning:		
		by distinguishing between	recording fact and		
		speculation and fact.	Speculation		
2	1	-Show students how to	-Paraphrasing and	Whiteboard	Oral and
		use their own words by	summarizing: using other	and LCD	written
		paraphrasing and	sources		exams
		summarizing, and to show	-Writing a summary		
		the use of synonyms	-Noun/Verb +		
		when writing up notes.	preposition: associated		
			words		
			-Using numbers:		
			numbers in writing		
3	1	-Draw students' attention	 Dealing with difficult 	Whiteboard	Oral and
		to the help dictionaries	language and unknown	and LCD	written
		give in showing the use,	vocabulary		exams
		as well as the meaning, of	-Using the Internet;		
		vocabulary, and to help	search engines; online		
		them express quantity	encyclopedias; subject		
		and numbers.	directories		
		-Improve students to use	Developing a search		
		the original sources on	plan: making a search		
		the Internet.	efficient and reliable		
		-Draw students' attention			
		to the importance of			
		checking the reliability of			
		information obtained on			
		the Internet, and to help			

		them find information more efficiently.			
4	1	-Develop students'	-Adding extra	Whiteboard	Oral and
		writing style by using	information: non-defining	and LCD	written
		relative clauses to add	relative clauses		exams
		extra information, and to	Organizing ideas (2):		
		draw their attention to	structuring your ideas		
		how to organize a	logically, e.g.		
		paragraph, in this case	chronologically		
		chronologically.	Writing from research		
5	1	-Help students to identify	-Rephrasing and	Whiteboard	Oral and
		ways of explaining words	explaining; dealing with	and LCD	written
		or rephrasing language in	difficult scientific and		exams
		a text. and to show how	technological words		
		understanding how	Avoiding repetition (2):		
		pronouns work can help	pronouns and what they		
		with understanding the	refer to.		
		text and avoiding			
		repetition.			
6	1	-Help students to write	-Linking ideas (3): cause	Whiteboard	Oral and
		with more clarity by using	and result	and LCD	written
		features that produce	-Coherent writing; writing		exams
		coherence, e.g. pronouns	up notes		
		to avoid repetition, and	-Abbreviations (1 and 2):		
		linking words and phrases	how to write and say		
		that show results.	common abbreviations		
		-Help students to	-Acknowledgements:		
		understand the function	acknowledging book and		
		abbreviations have in	website sources		
		academic texts. This will			
		neip students to			
7	1			\A/bitchccrd	Oral and
/		Evaluate the Student	First Mid Errore		
			FIRST MIIO EXAM		written
					exams

		[]			
8	1	-Introduce students to	-Intensive reading:	Whiteboard	Oral and
		techniques that improve	strategies for focusing	and LCD	written
		their intensive reading,	your reading		exams
		including the use of	-Linking ideas (4);		
		discourse markers to	sequencing words to		
		indicate steps in a	describe a process		
		process.			
9	1	-Make students aware of	-The passive voice;	Whiteboard	Oral and
		the need to write in a	writing in a neutral style	and LCD	written
		neutral and objective style	 Clarifying a sequence: 		exams
		when describing scientific	-Using indexes:		
		or technological	identifying keywords and		
		processes, and to draw	categories for a search,		
		their attention to how the	and finding them in a		
		passive voice is used to	reference book		
		this end.	-Compound nouns		
			Compound adjectives		
10	1	-Develop students'	-Interpreting data:	Whiteboard	Oral and
		vocabulary by increasing	statistical information in	and LCD	written
		their awareness and	graphs, charts, and texts		exams
		understanding of	-Avoiding repetition (3):		
		compound vocabulary	describing graphs using		
		(nouns and adjectives).	synonyms, adjectives +		
		-Encourage students to	nouns, verbs + adverbs		
		think about the			
		vocabulary they use in			
		their writing and how to			
		vary it.			
11	1	-Make students aware of	-Illustrating data: using a	Whiteboard	Oral and
		the different functions	graph or bar chart	and LCD	written
		graphs and charts may	-Describing a graph or		exams
		have, and to practice the	chart: transforming data		
		appropriate language	into text		
		needed to describe them.	 Writing about data 		

12	1	Evaluate the student	Second	d Mid Exam	Whiteboard	Oral and
					and LCD	written
						exams
13	1	The students are	Writin	g essays on	Whiteboard	Oral and
		requested to write essays	selecting subject		and LCD	written
		on certain subjects				exams
14	1	The students will be			Whiteboard	Oral and
		exposed to different audio			and LCD	written
		assays and then they are	Listeni	ing Practice 1		exams
		requested to answer the				
		questions				
15	1	The students will be	Listeni	ing Practice 2	Whiteboard	Oral and
		exposed to different audio			and LCD	written
		assays and then they are				exams
		requested to answer the				
		questions				
11. C	Course E	valuation				·
30 Mark	s (Mid ex	am + Homework+ Quizzes))			
70 Mark	s Final Ex	kam				
12. L	earning.	and Teaching Resource	S			
Required textbooks (curricular books, if any)				Headway Academic Skills Reading, Writing, and Study Skills		
				Level 2 Stuc	lent Book	
Main refe	erences (s	sources)				
Recomm	iended b	ooks and references (so	entific			
journals,	reports)				
Electroni	c Referen	ces, Websites		https://elt.oup.co eddownload?cc=	om/student/head =us&selLanguag	way/advanc ge=en

Course description Second Course- Nuclear physics

This course explores elements of advanced nuclear physics for M. Sc. students. It covers basic properties of the nucleus, a nuclear force, binding energy and nuclear stability, nuclear models "the types of models are emphasized. The liquid drop model and the shell model" and collective models. It also covers radioactive decays and nuclear radioactivity, elementary particles and cosmic rays . The lecture course will be integrated with problem solving classes.

Nuclear physics	Course Name .1
-	Course Code .2
Ph. D	Type of Study .3
Semester 2/2025	Year/Semester .4
1/2/2025	Description Preparation Date .5
Presence	Available Attendance .6 Forms
3	Number of Credit Hours .7
Prof. Dr. Saad N. Abood Saadnaji_95@yahoo.com	Course administer name .8

Objective .9

The main objectives of this course is hopefully to be achieved in the following steps:

- An overview of the history of the physics of the nucleus.
- A review of elements of quantum mechanics necessary to understand nuclear physics.
- Introduction of the liquid drop model and shell model
- Applications to the study of natural radioactivity and nuclear reactions.
- Elementary particles and Cosmic rays and applications.

10. مخرجات التعلم وطرائق التعليم والتعلم والتقييم

أ- المعرفة والفهم

To provide students with an opportunity to develop knowledge and understanding of the key principles and applications of Nuclear Physics, and their relevance to current developments in physics.

ب - المهارات الخاصة بالموضوع Here are some advanced skills related to the topic of nuclear physics:

1- Understanding Atomic Nucleus Theory: You should have a grasp of the concept of atomic nuclei, their composition, nuclear reactions, and the forces that govern them.

2- Nuclear Energy Concepts: You should understand how energy is generated through atomic nuclei, whether through nuclear reactions or nuclear transformations.

3- Nuclear Fission: You should be able to comprehend the mechanism of nuclear fission and how it is used to generate energy, as well as the concept of chain reactions and nuclear chain reactions.

4- Nuclear Analysis: You should be capable of analyzing and understanding nuclear data, using tools and techniques employed in the collection and analysis of nuclear data.

5- Nuclear Decay: You should be familiar with the concept of nuclear decay, its types, and how to calculate decay rates and nuclear half-life.

6- Renewable Nuclear Energy: You should be knowledgeable about the concept of renewable nuclear energy and current developments in nuclear technology, as well as potential uses of nuclear energy in the future.

7- Particle Physics: You should be acquainted with the concepts and mechanisms of particle physics, including particle interactions and their applications in nuclear and medical research.

Nuclear Radiation and Radiotherapy: You should have an understanding of the effects of nuclear radiation on matter and living organisms, as well as the applications of radiotherapy in the fields of medicine and life sciences.

These are just some examples of advanced skills in the field of nuclear physics. Specializing in this area may require in-depth study and practical experimentation to develop the necessary skills.

طرائق التعليم والتعلم

- Theoretical lectures

- Requesting students to come up with a set of thought-provoking questions during the lectures on specific topics.

- Assigning students homework that requires finding self-solutions.
- -

طرائق التقييم

- Daily quizzes -
- Monthly exams -
- .Homework assignments and student participation in discussion sessions -

ج- مهارات التفكير:

Here are some thinking skills that students can develop in this subject:

1-Analytical skills: The ability to analyze complex nuclear phenomena and understand the interactions and relationships between different elements in the atomic nucleus.

2-Critical thinking skills: The ability to evaluate evidence and data related to nuclear physics and analyze them critically to arrive at well-considered conclusions.

3-Creative skills: The ability to think creatively and propose new solutions or unique approaches to solving complex nuclear problems.

4-Scientific skills: The ability to design and conduct scientific experiments related to nuclear physics and analyze the data derived from them.

5-Mathematical skills: The ability to use mathematics and equations to solve complex nuclear problems and apply mathematical models.

6- Communication skills: The ability to clearly explain complex nuclear concepts and articles

د - المهارات العامة والمنقولة (المهارات الأخرى المتعلقة بقابلية التوظيف والتطور الشخصي). - متابعة التطور العلمي للمناهج للجامعات العالمية عن طريق الانترنيت

11. بنية المقرر

البنية التحتية

	<u> </u>	· · · · · · · · · · · · · · · · · · ·			
امتحان شفهي وتحريري	(نظري)	Background and basic nuclear properties	Historical review and general introduction The atomic mass unit Energy unit Basic nuclear properties	3	1
امتحان شفهي وتحريري	(نظري)	Basic nuclear properties	The size of the nucleus, Nuclear energy level, Intrinsic angular momentum of the nucleus, Nuclear electromagnetic moment, Electric Quadra pole moment, Parity	3	2
امتحان شفهي وتحريري	(نظري)	Yukawa's mesons field theory, Nuclear binding energy, average binding energy	Yukawa's mesons field theory, Nuclear binding energy	3	3
امتحان شفهي وتحريري	(نظري)	Nuclear forces, Separation energy of nuclear particle	Nuclear forces, Separation energy of nuclear particle (alpha neutron, proton), Abundance systematic of the stable nuclides	3	4
امتحان شفهي وتحريري	(نظري)	Nuclear models	Nuclear models, Electron proton hypothesis, Prout hypothesis	3	5
امتحان شفهي وتحريري	(نظري)	Liquid drop model, mass parabola	Liquid drop model, Mass parabola	3	6
		Mid Exam-1	Mid Exam	3	7
امتحان شفهي وتحريري	(نظري)	Shell model	Shell model, potential, Finite and infinite square potential, harmonic potential	3	8
امتحان شفهي وتحريري	(نظري)	Shell model and optical model	Spin orbit potential, Predictions of shell model, Optical model	3	9
امتحان شفهي وتحريري	(نظري)	Interaction of radiation with matter	Interaction of radiation with the matter, Statistical nature of radiation	3	10
امتحان شفهي وتحريري	(نظري)	Interaction of radiation with matter	Heavy charge particles, Light charge particles,	3	11
امتحان شفهي وتحريري	(نظري)	Interaction of radiation with matter	Neutrons, Electromagnetic radiation,	3	12
امتحان شفهي وتحريري	(نظري)	Exposure and dose	Exposure and dose principles,	3	13
امتحان شفهي وتحريري	(نظري)	Shielding	Shielding principles	3	14
		Mid Exam-2	Mid Exam-2	3	15

 Text Book: Walter E. Meyerhof: elements of nuclear physics Kenneth S. Krane: Introductory nuclear physics Henry Semat and John R. Albright: Introduction to atomic and nuclear physics Beiser: Concept of modern physics Irving Kaplan: Nuclear physics Cohen: Concepts of Nuclear Physics Kupta: Concepts of Modern Physics 		القراءات المطلوبة : النصوص الأساسية كتب المقرر أخرى 				
/	ئال	متطلبات خاصة (وتشمل على سبيل الم ورش العمل والدوريات والبرمجيات والمواقع الالكترونية)				
Nothing		الخدمات الاجتماعية (وتشمل على سبيل المثال محاضر ات الضيوف والتدريب المهني والدر اسات الميدانية)				
12. القبول						
Nothing	المتطلبات السابقة					
3		أقل عدد من الطلبة				
10		أكبر عدد من الطلبة				

On successful completion of the course students will be able to:

1. Have acquire knowledge and understanding about the electronic and nuclear structure of atoms .

2. Have solved problems related to the structure of atoms and the effect of ionizing radiation on the body and the environment.

3. Have an appreciation of the influence of atomic and nuclear physics on modern scientific development.

4. Have the foundations for examining in more detail various aspects of experimental and theoretical physics which relate to both atomic and nuclear physics.

5. Be able to explain the key areas in which Atomic and Nuclear Physics affects everyday living.

1. Course Name: Advanced Quantum Mechanics	5
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2. Course Code:

3. Semester / Year: Second / 2024-2025

4. Description Preparation Date: January 2025

5. Available Attendance Forms: Attendance in class

6. Number of Credit Hours (Total) / Number of Units (Total): 45 hours /3 units

7. Course administrator's name (mention all, if more than one name) Name: Prof. Dr. Oday Ali Hussein Email: oday.hussein@nahrainuniv.edu.iq

8. Course Objectives

Course Objectives The student acquires basic knowledge of the subject of advanced quantum mechanics and possesses skills in dealing with applications that are dealt with according to the basics and principles of quantum mechanics, especially those that involve a greater degree of complexity in relation to what the subject of advanced quantum mechanics in the initial study stage.

9. Teaching and Learning Strategies

Strategy

A- Cognitive

goals.

A!- Understand the basics of advanced quantum mechanics

A2- The ability to deal with advanced issues that include a greater degree of complexity compared to what he learned previously.

A3- The ability to understand and deal with complex quantum systems on their own or subject to external influences that make dealing with them in traditional ways impossible.

- A4- The ability to use advanced solution methods in dealing with quantitative problems..
 - B. The skills goals special to the course.
 - B1. Theoretical and mathematical skills.
 - B2. Applied skills.
 - B3. Developmental skills

10. Co	ourse Si	tructure	[
Week	Hours	Required	Unit or subject	Learning method	Evaluation method
		Learning	name		
		Outcomes			
1	3		Introduction and Review	Theoretical	Written exams and homework
2	3		Matrix representation of Kets, Bras, and Operators	Theoretical	Written exams and homework
3	3		Angular Momentum	Theoretical	Written exams and homework
4	3		Angular Momentum in Cartesian coordinates	Theoretical	Written exams and homework
5	3		Angular Momentum in Spherical coordinates	Theoretical	Written exams and homework
6	3		Spin Angular Momentum	Theoretical	Written exams and homework
7	3		Matrix representation of angular momentum operators	Theoretical	Written exams and homework
8	3		Matrix Formalism for Spin operators	Theoretical	Written exams and homework
9	3		Systems with spin one-half	Theoretical	Written exams and homework
10	3		A vector Model for Spin One-half Particle	Theoretical	Written exams and homework

11	3		Electron-Spin	Theoretical	Written exams and		
			precession		homework		
12	3		Systems with	Theoretical	Written exams and		
			spin zero		homework		
13	3		Coherent States	Theoretical	Written exams and		
			of Simple		homework		
			Harmonic				
			Oscillator				
14	3		The Number	Theoretical	Written exams and		
			Operator and		homework		
			Number				
			Eigenstate	I			
15	3		The Coherent	Ineoretical	Written exams and		
			States		homework		
11.	Course	Evaluation					
Distrib prepar	uting the ation. da	e score out of 100 ilv oral. monthly. or	according to the written exams, rer	tasks assigned to ports etc	the student such as dail		
12.	Learning	g and Teaching R	esources				
Require	ed textboo	oks (curricular books.	if any Ouantum	Mechanics, L. I.	Schiff, 3 rd Edition		
		(,	(Mc Graw	(Mc Graw-Hill Inc. NY)			
Main re	forences	(sources)	Advance	Advanced Quantum Mechanics I I Sakurai			
Inall'I te		(sources)	(Addison	Advanced Quantum Mechanics, J. J. Sakurai,			
			(Addison	-wesley)			
Recommended books and references			ences				
(scientific journals, reports)							
Electro	Electronic References, Websites						

2. Course Code:

3. Semester / Year: First / 2024-2025

4. Description Preparation Date: January 2025

5. Available Attendance Forms: Attendance in class

6. Number of Credit Hours (Total) / Number of Units (Total): 30 hours /2 units

7. Course administrator's name (mention all, if more than one name) Name: Prof. Dr. Oday Ali Hussein Email: oday.hussein@nahrainuniv.edu.iq

8. Course Objectives

Course Objectives The student acquires basic knowledge of the optics of charged particles and learns the importance of the subject and that it is an essential part in the design and operation of many important applications, especially in the field of high energies such as accelerators, electric and magnetic storage rings, electron microscopes, and other applications.

As well as acquiring skills in dealing with applications in which the subject of charger particle optics is a basis in terms of design and operation

9. Teaching and Learning Strategies

Strategy A- Cognitive goals.
A1- Understanding the basics of charged particle optics
A2- Knowing the methods of dealing with charged particles in electric and magnetic fields
A3- Identify applications in which charged particle optics are an active part in their design and operation
A4- Knowing the defects and how to avoid them in these systems and applications.
- B. The skills goals special to the course.
- B1. Theoretical and mathematical skills. B2. Applied skills.
- B3. Developmental skills

10. Course Structure Week Hours Required Unit or subject Learning method Learning name Outcomes

1	2	Gain the required background	Introduction to charged particles optics	Theoretical	Written exams and homework
2	2	Enable the student to derive equations and know the relative effect	The relativistic corrected of accelerating voltage	Theoretical	Written exams and homework
3	2	The student knows the importance of electronic microscopes digitally	Advantage of high voltage electron microscopy	Theoretical	Written exams and homework
4	2	Enable the student to derive equations	Trajectory of an electron beam in magnetic field	Theoretical	Written exams and homework
5	2	Enable the student to derive equations	Trajectory of an electron beam in electric field	Theoretical	Written exams and homework
6	2	The student learns about magnetic lenses, their types, and their importance	Magnetic lenses	Theoretical	Written exams and homework
7	2	The student learns about these lenses, their specifications	Weak lens approximation	Theoretical	Written exams and homework
8	2	The student learns about these lenses, their specifications	Strong lens (objective lens)	Theoretical	Written exams and homework
9	2	The student learns the distribution of fields in magnetic lenses	Axial field distribution in magnetic lens	Theoretical	Written exams and homework
10	2	The student learns about magnetic lenses, their types, and their importance	Electrostatic lenses	Theoretical	Written exams and homework
11	2	The student learns these concepts	Brightness and electron-probe current	Theoretical	Written exams and homework
12	2	The student learns these concepts	Magnification (operation)	Theoretical	Written exams and homework

Evaluation method

			conditions of		
			electron lenses		
13	2	Learning another application	Electron gun	Theoretical	Written exams and homework
14	2	The student learns these concepts	Resolution (Resolving power)	Theoretical	Written exams and homework
15	2	The student learns these concepts	Resolution of the electron microscopy	Theoretical	Written exams and homework

11. Course Evaluation

Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports etc

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Principles of electron optics, P.W. Hawkes an
, , , , , , , , , , , , , , , , , , ,	Kasper, Academic press.
Main references (sources)	Optics of charged particles, H. Wollnik, Elsevier
Recommended books and references	
(scientific journals, reports)	
Electronic References, Websites	

1.	Course	Name:	Electromagnatic	Theory	/Master
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2. Course Code:

- 3. Semester / Year: second 2024/2025
- 4. Description Preparation Date: 15/2/2024
- 5. Available Attendance Forms: present
- 6. Number of Credit Hours (Total) / Number of Units (Total) 2 hrs. per week/ 2 units per week

7. Course administrator's name (mention all, if more than one name) Name: Prof. Dr. Suha Mousa Khorsheed Email: suha.korsheed@nahrainuniv.edu.iq

8. Cours	se Objectives
Course Object	 Understand the advanced concepts in electromagnatic theory Linking a theoretical concept with the application Giving the student the opportunity to choose the research project that qualifies hin obtain higher students .
9. Teach	ning and Learning Strategies
Strategy	 Seminar presentation by students to enhance their skills help students on the scientific discussion during lectures help the student in the solving the problems

10. Co	10. Course Structure				
Week	Hour	s Unit or subject name			
1	3	VECTOR OPERATORS			
2	3	PHASORS			
3	3	ELECTRIC FIELDS I			
		Coulomb's Law and Gauss's La			
4	3	ELECTRIC FIELDS II			
		The Equations of Poisson			
-	2				
5	3	Charge Conservation, conduct			
6	3	ELECTRIC FIELDS III			
_		Electric Multipoles			
7	3	ELECTRIC FIELDS IV			
0	2	Energy,			
8	3	Exam			
9	3	, Capacitance, and Forces			
10	3	ELECTRIC FIELDS V			
11	2	Electric Circuits A			
11	3	RC Circuits			
12	3	ELECTRIC FIELDS VI			
13	3	Electric Circuits B			
14	3	Circuit Theorems			
15	3	Exam			

Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports etc 30% mid exam+ discussion+ solving homework 70% final exam

11. Learning and Teaching Resources

Required textbooks (curricular books, if any)	1] Electromagnetic Fields and Waves, Paul Lorrain, Uniuersite de Montreal and McGill University, 1987		
Main references (sources)	Electromagnetic Fields and Waves, Paul Lorr Uniuersite de Montreal and McGill University, 1987		
Recommended books and references (scientific journals, reports)	All related international lectures and research were dependent		
Electronic References, Websites	All books and global sites in the internet		

Course description Second Course- Nuclear physics

This course explores elements of advanced nuclear physics for M. Sc. students. It covers basic properties of the nucleus, a nuclear force, binding energy and nuclear stability, nuclear models "the types of models are emphasized. The liquid drop model and the shell model" and collective models. It also covers radioactive decays and nuclear radioactivity, elementary particles and cosmic rays . The lecture course will be integrated with problem solving classes.

Advanced Classical Mechanics	Course Name .1
-	Course Code .2
Ph. D	Type of Study .3
Semester 2/2025	Year/Semester .4
1/2/2025	Description Preparation Date .5
Presence	Available Attendance .6 Forms
3	Number of Credit Hours .7
Prof. Dr. Saad N. Abood Saadnaji_95@yahoo.com	Course administer name .8

Objective .9

The main objectives of this course is hopefully to be achieved in the following steps:

- An overview of the history of the physics of the nucleus.
- A review of elements of quantum mechanics necessary to understand nuclear physics.
- Introduction of the liquid drop model and shell model
- Applications to the study of natural radioactivity and nuclear reactions.
- Elementary particles and Cosmic rays and applications.

10. مخرجات التعلم وطرائق التعليم والتعلم والتقييم

أ_ المعرفة والفهم

To provide students with an opportunity to develop knowledge and understanding of the key principles and applications of Nuclear Physics, and their relevance to current developments in physics.

ب - المهارات الخاصة بالموضوع Here are some advanced skills related to the topic of nuclear physics:

1- Understanding Atomic Nucleus Theory: You should have a grasp of the concept of atomic nuclei, their composition, nuclear reactions, and the forces that govern them.

2- Nuclear Energy Concepts: You should understand how energy is generated through atomic nuclei, whether through nuclear reactions or nuclear transformations.

3- Nuclear Fission: You should be able to comprehend the mechanism of nuclear fission and how it is used to generate energy, as well as the concept of chain reactions and nuclear chain reactions.

4- Nuclear Analysis: You should be capable of analyzing and understanding nuclear data, using tools and techniques employed in the collection and analysis of nuclear data.

5- Nuclear Decay: You should be familiar with the concept of nuclear decay, its types, and how to calculate decay rates and nuclear half-life.

6- Renewable Nuclear Energy: You should be knowledgeable about the concept of renewable nuclear energy and current developments in nuclear technology, as well as potential uses of nuclear energy in the future.

7- Particle Physics: You should be acquainted with the concepts and mechanisms of particle physics, including particle interactions and their applications in nuclear and medical research.

Nuclear Radiation and Radiotherapy: You should have an understanding of the effects of nuclear radiation on matter and living organisms, as well as the applications of radiotherapy in the fields of medicine and life sciences.

الصفحة 2

These are just some examples of advanced skills in the field of nuclear physics. Specializing in this area may require in-depth study and practical experimentation to develop the necessary skills.

طرائق التعليم والتعلم

- Theoretical lectures
- Requesting students to come up with a set of thought-provoking questions during the lectures on specific topics.
- Assigning students homework that requires finding self-solutions.

طرائق التقييم

Daily quizzes -

Monthly exams

.Homework assignments and student participation in discussion sessions -

ج- مهارات التفكير:

Here are some thinking skills that students can develop in this subject:

1-Analytical skills: The ability to analyze complex nuclear phenomena and understand the interactions and relationships between different elements in the atomic nucleus.

2-Critical thinking skills: The ability to evaluate evidence and data related to nuclear physics and analyze them critically to arrive at well-considered conclusions.

3-Creative skills: The ability to think creatively and propose new solutions or unique approaches to solving complex nuclear problems.

4-Scientific skills: The ability to design and conduct scientific experiments related to nuclear physics and analyze the data derived from them.

5-Mathematical skills: The ability to use mathematics and equations to solve complex nuclear problems and apply mathematical models.

6- Communication skills: The ability to clearly explain complex nuclear concepts and articles

	11. بنية المقرر								
<u> </u>							نية	البنية التحذ	
 Text Book: Walter E. Meyerhof: elements of nuclear physics Kenneth S. Krane: Introductory nuclear physics Henry Semat and John R. Albright: Introduction to atomic and nuclear physics Beiser: Concept of modern physics Irving Kaplan: Nuclear physics Cohen: Concepts of Nuclear Physics Kupta: Concepts of Modern Physics 									
	متطلبات خاصة (وتشمل على سبيل المثال ورش العمل والدوريات والبرمجيات والمواقع الالكترونية)								
	الخدمات الاجتماعية (وتشمل على سبيل المثال محاضرات الضيوف والتدريب المهنى و الدر اسات الميدانية)								
ىفھي _ي	امتحان ش وتحرير	(نظري)	Nuclear models	stable nuclidesNuclear models, Electronproton hypothesis, Prouthypothesis		3	5		
ىفھي _ي	امتحان ش وتحرير	(نظري)	Liquid drop model, mass parabola	Liquid drop model, Mass parabola		3	6		
			Mid Exam-1	Mid Exam 3 7					
ىفھي ري	امتحان ش وتحرير	(نظري)	Shell model	Shell model , potential, Finite and infinite square potential, harmonic potential		8			
ىفھي _ي	امتحان ش وتحرير	(نظري)	Shell model and optical model	Spi Pre	n orbit dictions of sh Optical m	potential, ell model, odel	3	9	
ىفھي _ي	امتحان ش وتحرير	(نظري)	Interaction of radiation with matter	on with Interaction of radiation with the matter, Statistical nature 3 10		10			
ىفھي _ي	امتحان ش وتحرير	(نظري)	Interaction of radiation with matter	Hea cha	avy charge part rge particles,	icles, Light	3	11	
ىفھي _ي	امتحان ش وتحرير	(نظري)	Interaction of radiation with matter	Neutrons, Electromagnetic radiation,		romagnetic	3	12	
ىفھي _ي	امتحان ش وتحرير	(نظري)	Exposure and dose	Exp	posure and dose	principles,	3	13	
ىفھي ري	امتحان ش وتحرير	(نظري)	Shielding		Shielding pri	nciples	3	14	
			Mid Exam-2		Mid Exam	n-2	3	15	
								قبول	1. ال
المتطلبات السابقة									

الصفحة 4

3	أقل عدد من الطلبة
10	أكبر عدد من الطلبة

On successful completion of the course students will be able to:

1. Have acquire knowledge and understanding about the electronic and nuclear structure of atoms .

2. Have solved problems related to the structure of atoms and the effect of ionizing radiation on the body and the environment.

3. Have an appreciation of the influence of atomic and nuclear physics on modern scientific development.

4. Have the foundations for examining in more detail various aspects of experimental and theoretical physics which relate to both atomic and nuclear physics.

5. Be able to explain the key areas in which Atomic and Nuclear Physics affects everyday living.

1. Course Name:

English

2. Course Code:

3. Semester / Year:

2024-2025

4. Description Preparation Date:

2024

- 5. Available Attendance Forms:
 - Attendance
- 6. Number of Credit Hours (Total) / Number of Units (Total) 30 Hours

7. Course administrator's name (mention all, if more than one name) Name: Dr. Asmaa Hadi Mohammed

Email: asmaa.hadi@nahrainuniv.edu.iq

8. Course Objectives

Course Objectives	1- Introducing students to English and emphasizing its role	S
-	the most used language in the world to describe and	
	understand different types of science, especially modern	
	physics.	
	2- Encouraging students to use the English language in the	-
	daily lives by visiting websites that help them deal with dai \prime	,
	developments in the fields of education, family, and societ	
	3- Increasing students' self-confidence in their ability to	le
	English, improving their skills in reading, writing and semant	cs,
	eliciting the idea of the main topic of research and s	en
	publications.	

9. Teaching and Learning Strategies

Strategy	1- Curriculum for innovation Knowledge of the rules and principles of the English language.
	2- Adoption of blended learning through the use of multimedia technology, curricula and extra-curricular assignments.
	3- Transferred general and qualification skills (other skills related to employability and personal.
	development).

10. Cou Week	4- Training students to use modern teaching methods and methods, including blended learning using technology. 4- Training students to conduct research related to all areas of the English language. 5- Assigning students to conduct research related to all areas of the English language. 6- Enabling students to use their personal skills. 10. Course Structure Veek Hours Required Unit or subject Learning method Evaluation method Quicomes Outcomes Image: Course Structure Image: Course Structure						
Week 1 Week 2 Week 3 Week 4 Week 5 Week 5 Week 6 Week 7 Week 8 Week 9 Week 10 Week 11 Week 11 Week 12 Week 13 Week 14 Week 15	30	Students can learn how to understand and translate articles written in English into their native language. Students will understand how to avoid citing papers that have been cited. Allow students to conduct research and write research reports in English. Learn about the English language and its role in transferring and understanding different types of science and technology.	-Introducti -Feats of engineerin -Water, wa everywher -The Terrac army. -The Olymp games. -Exam -Work. -Communit technology -Writing: Keeping he -Writing: sof energy. -Writing: examples of trade -Writing: population trends. -Research: Crediting so -Language writing for speaking: interpretin translating -Final exam	on g. ater e cotta pic cation 7. ealthy. ource of fair ources for g and n	Giving students a detailed lecture on the origins and grammar of the English language. Listen to, understand, and translate the articles and conversations in the course correctly. Using dialogue and active participation to consolidate concepts and deepen understanding. Giving students homework that includes an exercise in avoiding textual hijacking. Students compose scient articles in English by f writing them in Arabic a then translating them i English	Exams Quizzes Assignments Homework	
11. C	ourse E	valuation					
daily pre	paration	: 10, daily oral:10), monthly:	30, or v	vritten exams:40, report	s:10	
12. Learning and Teaching Resources							
Required	Required textbooks (curricular books, if any) Headway- Academic Skills Reading, Writing, and Study Skills level 3						
L	2						

Main references (sources)	Headway- Academic Skills Reading, Writing, and Study Skills level 3	
Recommended books and references (scientific journals, reports)		
Electronic References, Websites		

1. Course Name:

English

2. Course Code:

3. Semester / Year:

2024-2025

4. Description Preparation Date:

2024

- 5. Available Attendance Forms:
 - Attendance
- 6. Number of Credit Hours (Total) / Number of Units (Total) 30 Hours

7. Course administrator's name (mention all, if more than one name) Name: Dr. Asmaa Hadi Mohammed

Email: asmaa.hadi@nahrainuniv.edu.iq

8. Course Objectives

Course Objectives	1- Introducing students to English and emphasizing its role	S
-	the most used language in the world to describe and	
	understand different types of science, especially modern	
	physics.	
	2- Encouraging students to use the English language in the	-
	daily lives by visiting websites that help them deal with dai \prime	,
	developments in the fields of education, family, and societ	
	3- Increasing students' self-confidence in their ability to	le
	English, improving their skills in reading, writing and semant	cs,
	eliciting the idea of the main topic of research and s	en
	publications.	

9. Teaching and Learning Strategies

Strategy	1- Curriculum for innovation Knowledge of the rules and principles of the English language.
	2- Adoption of blended learning through the use of multimedia technology, curricula and extra-curricular assignments.
	3- Transferred general and qualification skills (other skills related to employability and personal.
	development).

10. Cou Week	4- Training students to use modern teaching methods and methods, including blended learning using technology. 4- Training students to conduct research related to all areas of the English language. 5- Assigning students to conduct research related to all areas of the English language. 6- Enabling students to use their personal skills. 10. Course Structure Veek Hours Required Unit or subject Learning method Evaluation method Quicomes Outcomes Image: Course Structure Image: Course Structure						
Week 1 Week 2 Week 3 Week 4 Week 5 Week 5 Week 6 Week 7 Week 8 Week 9 Week 10 Week 11 Week 11 Week 12 Week 13 Week 14 Week 15	30	Students can learn how to understand and translate articles written in English into their native language. Students will understand how to avoid citing papers that have been cited. Allow students to conduct research and write research reports in English. Learn about the English language and its role in transferring and understanding different types of science and technology.	-Introducti -Feats of engineerin -Water, wa everywher -The Terrac army. -The Olymp games. -Exam -Work. -Communit technology -Writing: Keeping he -Writing: sof energy. -Writing: examples of trade -Writing: population trends. -Research: Crediting so -Language writing for speaking: interpretin translating -Final exam	on g. ater e cotta pic cation 7. ealthy. ource of fair ources for g and n	Giving students a detailed lecture on the origins and grammar of the English language. Listen to, understand, and translate the articles and conversations in the course correctly. Using dialogue and active participation to consolidate concepts and deepen understanding. Giving students homework that includes an exercise in avoiding textual hijacking. Students compose scient articles in English by f writing them in Arabic a then translating them i English	Exams Quizzes Assignments Homework	
11. C	ourse E	valuation					
daily pre	paration	: 10, daily oral:10), monthly:	30, or v	vritten exams:40, report	s:10	
12. Learning and Teaching Resources							
Required	Required textbooks (curricular books, if any) Headway- Academic Skills Reading, Writing, and Study Skills level 3						
L	2						

Main references (sources)	Headway- Academic Skills Reading, Writing, and Study Skills level 3	
Recommended books and references (scientific journals, reports)		
Electronic References, Websites		

Modu	Module Aims, Learning Outcomes and Indicative Contents					
	الإرشادية والمحتويات التعلم ونتائج الدراسية المادة أهداف					
Module Aims المادة أهداف الدراسية	 Introducing students to the general basic concept of Radiology Physics. Identify the types and the most important Sources of Ionizing Radiation. Focusing on the theoretical aspects of the discussed subject material, with some examples added for clarification. Introducing the student to the importance of the application of ionizing radiation to diagnosis and treatment of human disease. 					
Module Learning Outcomes التعلم مخرجات الدراسية للمادة	 Students can understand the general concept of Radiology Physics. Students will understand Modern Physics. Allow students to know about Radiation Quantities and Units. Learn about the Dose in Water for Various Radiation Beams. The ability to Basic Definitions for Atomic and nuclear Structure. The ability to know about the Nuclear Models. 					
Indicative Contents المحتويات الإرشادية	 Indicative content includes the following. 1- Gravimetric analysis 2- The Fundamental Physical Constants. 3- Milestones in Modern Physics and Medical Physics. 4- Rutherford–Bohr Atomic Model 5- Introduction to Wave Mechanics 6- Basic Definitions for Atomic and nuclear Structure. 					

Learning and Teaching Strategies استراتيجيات التعلم والتعليم				
Strategies	 Discussing the topics of the curriculum book and supporting references Theoretical lectures including problem solving and discussion of homework Asking students, a set of thinking questions during the lectures for specific topics. Giving students homework that requires finding self- solutions. 			

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري				
	Material Covered			
Week 1	Fundamentals of Dosimetry			
Week 2	QUANTITIES AND UNITS			
Week 3	CHARGED PARTICLE EQUILIBRIUM IN DOSIMETRY			
Week 4	The Fano Theorem: CAVITY THEORY			
Week 5	Basic Definitions for Atomic Structure			
Week 6	Mid exam			
Week 7	Physics of Small Dimensions and Large Velocities			
Week 8	Einstein's Special Theory of Relativity			
Week 9	Particle-Wave Duality: Davisson–Germer Experiment			
Week 10	Uncertainty Principle			
Week 11	Maxwell's Equations			
Week 12	Production of X Rays			
Week 13	Emission of Radiation by Accelerated Charged Particle (Bremsstrahlung Production)			
Week 14	Synchrotron Radiation			
Week 1 5	Final exam			

Learning and Teaching Resources				
مصادر التعلم والتدريس				
	Text	Available in the Library?		
Required Texts	Radiation physics for medical physicists by Ervin B. Podgor sak ,2005			

1. Cour	se Name:				
Advanced Plasma Physics / Ph.D. students					
2. Cour	se Code:				
3. Seme	ester / Year:				
	Second Course / 2024 - 2025				
4. Desc	ription Preparation Date:				
	9/2/2025				
5. Avail	able Attendance Forms:				
	In presence				
6. Num	ber of Credit Hours (Total) / Number of Units (Total)				
	2 hours				
7. Cour	se administrator's name (mention all, if more than one name)				
Nam	e: Prof.Dr.Khalid Abbas Yahya				
Emai	l: khalid.abbass@nahrainuniv.edu.iq				
8. Cours	se Objectives				
Course Objec	 Course Objectives The course aims to teach graduate students the subject of plasma physics by studying general theories in this subject. Among the models of plasma physics such as Single particle motions , Plasma as fluid and Kinetic theory of plasma, and the comparison between these models Benefiting from this course in assigning the rest of the other courses postgraduate students. Keeping up with scientific curricula and courses in international universities. 				
9. Teac	ning and Learning Strategies				
Strategy	 Activating students and activating educational attitudes by accustoming students to respecting different opinions, appreciating others, and benefiting from others' ideas and information. Exchanging ideas (dialogical method) and encouraging acceptance of others' ideas. Asking questions to a specific student, with the aim of developing several skills, the most important of which are constructing questions, exchanging ideas, and reading. The student is asked to write a report/research on a specific topic, and this method develops the student's research, analysis, expression, and presentation skills. Questions related to the lecture are asked as homework to activate and deepen the learning objectives and follow up with the student in correcting errors in the assignment 				

10. C	10. Course Structure						
Week	Hours	Required	Unit or subject name	Learning	Evaluation		
		Learning		method	method		
		Outcomes					
1	2	Introduction to defining plasma and its properties	Introduction to plasma physics	In presence	Exams and assignments		
2	2	Equation of boundary conditions for plasma	Study of plasma parameters	In presence	Exams and assignments		
4	2	Derivation of the equations of motion in the presence of electric and magnetic fields	Single charged particle model	In presence	Exams and assignments		
5	2	Study of plasma particle capture	Ponderomotive force	In presence	Exams and assignments		
6	2	Study of special equations for fluid plasma	Plasma as fluid	In presence	Exams and assignments		
7	2	Derivation of equations for the plasma model as a fluid	Continuity equation	In presence	Exams and assignments		
8	2	Derivation of equations for the plasma model as a fluid	Study momentum equation	In presence	Exams and assignments		
9	2	Vlasov equation	Kinetic theory of plasma physics	In presence	Exams and assignments		
8	2	Boltazmann equation	Study momentum equation	In presence	Exams		

9	2	Application in plasma	Plasma conferment	In presence	Exams and assignments
10	2	Applications in plasma	Derivation of plasma pinch equations	In presence	Exams and assignments
12	2	Applications in plasma	Wave in plasma	In presence	Exams and assignments
13	2	Applications in plasma	Ion and electron plasma wave	In presence	Exams and assignments
14	2	Applications in plasma	MHD equations	In presence	Exams and assignments
15	2	Applications in plasma	Diffusion of plasma	In presence	Exams and assignments
11.	Course E	Evaluation	·		·
Distrib	uting the	score out of 10	0 according to the tasks assign	ed to the stud	ent such as daily

preparation, daily oral, monthly, or written exams, reports etc

Evaluation is done through

- 1- Daily and monthly exams 25%
- 2- 2- Homework assignments 5%
- 3- 3- Final exam 70%

$12. \ \ \text{Learning and Teaching Resources}$

Required textbooks (curricular books, if any)	FUNDAMENTALS OF PLASMA PHYSICS		
	J. A. Bittencourt, Ph.D		
Main references (sources)	All sources on the subject of Advance Plasma		
	Physics		
Recommended books and references	All books specialized in advanced Advance		
	Plasma Physics.		
(scientific journals, reports)			
Electronic References, Websites	Official websites of scientific libraries		

Course description

Advanced Statistical Mechanics

The Statistical Mechanics course provides a fundamental understanding of the behavior of large systems composed of many particles, such as gases, liquids, and solids. This course explores the statistical description of thermodynamic properties and phenomena, bridging the gap between microscopic interactions and macroscopic observables. Topics covered include the principles of classical and quantum statistics, partition functions, Boltzmann distribution, statistical ensembles, entropy, and the connection between statistical mechanics and thermodynamics. Students will learn to apply statistical methods to analyze and predict the behavior of physical systems, gaining insights into topics such as phase transitions, equilibrium properties, and transport phenomena. The course emphasizes the development of mathematical and analytical skills necessary for solving problems and deriving statistical mechanics equations. Through lectures, problem-solving abilities, as well as the ability to interpret and communicate statistical results. This course is designed for advanced undergraduate or graduate students in physics, chemistry, or related disciplines, providing a solid foundation for further studies in statistical mechanics and related fields.

Statistical Mechanics	Course Name .1
-	Course Code .2
Ph. D	Type of Study .3
Semester 2/2024-2025	Year/Semester .4
1/2/2025	Description Preparation Date .5
Presence	Available Attendance .6 Forms
3	Number of Credit Hours .7
Prof. Dr. Saad N. Abood Saadnaji_95@yahoo.com	Course administer name .8
	Objective .9

- 1- Develop a fundamental understanding of statistical mechanics principles and concepts.
- 2- Gain knowledge of classical and quantum statistical mechanics and their applications.
- 3- Understand the connection between statistical mechanics and thermodynamics.
- 4- Learn to analyze and interpret the behavior of physical systems using statistical methods.

5- Acquire proficiency in using mathematical tools and techniques relevant to statistical mechanics.

10. مخرجات التعلم وطرائق التعليم والتعلم والتقييم

أ- المعرفة والفهم:

1- Statistical Mechanics Principles: Students will acquire knowledge of the fundamental principles and concepts of statistical mechanics, including the connection between microscopic .interactions and macroscopic observables

2- Classical and Quantum Statistics: Students will develop an understanding of classical and quantum statistical mechanics, including the different statistical ensembles and their applications in analyzing physical systems.

3- Thermodynamic Connections: Students will gain an understanding of the relationship between statistical mechanics and thermodynamics, including the interpretation of .thermodynamic quantities in terms of statistical averages

4- Mathematical Tools: Students will learn and apply mathematical tools -

ب - لمهارات الخاصة

1- Mathematical Proficiency: Students will develop strong mathematical skills, including calculus, differential equations, probability theory, and statistical methods, to solve .problems and derive equations in statistical mechanics

2- Analytical Thinking: Students will cultivate the ability to analyze complex systems, identify relevant variables, and apply statistical mechanics principles to derive insights into .the behavior of physical systems

طرائق التعليم والتعلم

1- Lectures: Traditional lectures involve the instructor presenting information to students, covering key concepts, theories, and examples related to the subject matter in English. Students listen, take notes, and engage in discussions or ask questions as appropriate.

2- Discussions: Facilitated discussions encourage active participation and critical thinking among students. They can be conducted in English, allowing students to share their perspectives, analyze case studies, debate topics, and collaborate in problem-solving activities.

طرائق التقييم

Written Examinations: Traditional written exams assess students' knowledge and understanding of the subject matter. They can include multiple-choice questions, short-answer questions, essay questions, or problem-solving exercises conducted in English.

Assignments and Essays: Assignments and essays allow students to demonstrate their comprehension and critical thinking skills. They can be written in English, requiring students to analyze concepts, apply theories, and present coherent arguments or explanations.

ج- مهارات التفكير :

1- Analysis: The ability to break down complex information or ideas into smaller components, .identify patterns, relationships, and underlying assumptions, and evaluate their significance

2- Evaluation: The skill to assess the credibility, reliability, and validity of information, .arguments, or claims, considering evidence, sources, and logical reasoning

3- Problem-Solving: The capacity to identify problems, analyze their root causes, generate .creative solutions, and evaluate the effectiveness of different approaches or strategies

د - المهارات العامة والمنقولة (المهارات الأخرى المتعلقة بقابلية التوظيف والتطور الشخصي).

1- Communication Skills: The ability to effectively convey ideas, thoughts, and information in written and oral forms, including active listening, clear articulation, and persuasive .presentation

2- Critical Thinking: The skill to analyze, evaluate, and interpret information and arguments, .considering multiple perspectives, and making well-reasoned judgments or decisions

3- Problem-Solving: The capacity to identify problems, analyze their root causes, develop .creative solutions, and implement effective strategies to achieve desired outcomes

13-خطة تطوير المقرر الدراسي

1- Learning objectives: Identify specific learning objectives for the course, such as understanding .the fundamental concepts of statistical mechanics and applying them to problem-solving

11. بنية المقرر اسم الوحدة / المساق أو الموضوع الأسب مخرجات التعلم المطلوبة طريقة التعليم طريقة التقييم الساعات و ع How to connect thermodynamics to the statistical approach. **Basic Concepts:** Understand the Phase space, density fundamental concepts function, Liouville of statistical equation, and mechanics, including امتحانات شفهية microcanonical the microstate and 3 نظرى 2-1حضوري وتحريرية ensemble. macrostate, probability distributions, and the Maximum concept of configuration, partition .equilibrium function, probabilities, fluctuations. **Applications:** 3 نظرى حضوري equipartition, oscillators, Ensembles: paramagnetism. Familiarize with different **Inverse Laplace** ensembles, such as transform of $Q(\beta)$ used the microcanonical to find density of states ensemble. **g**(**E**). canonical امتحانات شفهبة **Negative temperatures** 4 - 3ensemble, and وتحريرية in magnetic systems. grand canonical ensemble, and Overview of canonical, understand their iso-thermal/isobaric significance in and grand canonical describing physical ensembles. .systems حضوري Most likely **Statistical** 3 نظري configuration, partition **Ensembles:** Gain function, probabilities. knowledge of fluctuations, phases & statistical ensembles امتحانات شفهية equilibrium. 6-5 and their relation to وتحريرية thermodynamic The basic QM theory quantities, including for ensembles and the partition density matrix. function, Helmholtz

		A spin-1/2 particle, a particle in a box, harmonic oscillator; systems of many particles. About QM states of free particles, infinite systems.	free energy, and .entropy		
امتحانات شفهية وتحريرية	حضوري	Statistics for ideal gases & occupation numbers. Kinetic pressure and effusion of gases through a hole.	Boltzmann Statistics: Understand the Boltzmann statistics and its application in calculating the probability of different energy .states in a system	3 نظري	7
امتحانات شفهية وتحريرية	حضوري	Gases with internal degrees of freedom; chemical equilibrium. Statistics for ideal Bose gas; Bose-Einstein condensation Statistics for blackbody radiation and for vibrations in solids.	Quantum Statistics: Comprehend quantum statistics, including Fermi- Dirac statistics for systems of fermions and Bose-Einstein statistics for systems of bosons, and their implications in describing the .behavior of particles	3 نظر ي	8
امتحانات شفهية وتحريرية	حضوري	Statistics for ideal fermi gas at weak and strong degeneracy. Pauli paramagnetism and Landau diamagnetism in ideal fermi gases.	Quantum Statistics: Comprehend quantum statistics, including Fermi- Dirac statistics for systems of fermions and Bose-Einstein statistics for systems of bosons, and their implications in describing the .behavior of particles	3 نظر ي	9
امتحانات شفهية وتحريرية	حضوري	Stellar thermodynamics in white dwarf stars and Chadrasekhar's limit.	Quantum Statistics: Comprehend quantum statistics, including Fermi-	3 نظري	10

			Dirac statistics for systems of fermions and Bose-Einstein statistics for systems of bosons, and their implications in		
			behavior of particles		
امتحانات شفهية	حضوري		Phase Transitions:	3 نظر ی	
وتحريرية		Stellar thermodynamics in white dwarf stars and Chadrasekhar's limit.	Study phase transitions in statistical mechanics, including critical phenomena, phase diagrams, and the concept of order .parameters	, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	11
امتحانات شفهية وتحريرية	حضوري	Stellar thermodynamics in white dwarf stars and Chadrasekhar's limit.	Phase Transitions: Study phase transitions in statistical mechanics, including critical phenomena, phase diagrams, and the concept of order .parameters	3 نظ <i>ر</i> ي	12
امتحانات شفهية وتحريرية	حضوري	Electron gas in metals; Thomas-Fermi model for heavy atoms.	Transport Phenomena: Understand the statistical mechanics of transport phenomena, including the Boltzmann transport equation, conductivity, diffusion, and .viscosity	3 نظر ي	13
امتحانات شفهية وتحريرية	حضوري	Statistics of cluster expansions for nonideal gases.	Quantum Statistics: Comprehend quantum statistics, including Fermi- Dirac statistics for systems of fermions and Bose-Einstein	3 نظري	14

			statistics for systems of bosons, and their implications in describing the .behavior of particles		
امتحانات شفهية وتحريرية	حضوري	Van der Waals gas, Ising model and mean-field theory (zeroth approximation).	Thermodynamic Properties: Analyze the connection between statistical mechanics and thermodynamics, including the calculation of thermodynamic properties such as energy, temperature, entropy, and .pressure	3 نظ <i>ر ي</i>	15

2- Content analysis: Analyze and evaluate the current content of the course, identify key concepts and essential skills to be covered, and determine any new content that can be added or expanded .upon

3- Development of instructional materials: Develop diverse learning materials, including required textbooks, lectures, additional scientific resources, and interactive activities such as experiments .and computer simulations

4- Structuring the course schedule: Organize the distribution of content over specific time periods, including the number of hours dedicated

	12. البنية التحتية
 1- Statistical Mechanics: Algorithms and " Computations" by Werner Krauth: This book provides a comprehensive introduction to statistical mechanics, with a focus on numerical and computational methods. It covers both classical and quantum statistical mechanics and includes numerous exercises and computer simulations 2- Statistical Mechanics: Theory and Molecular " Simulation" by Mark Tuckerman: This textbook offers a detailed introduction to statistical mechanics, emphasizing molecular simulation techniques. It covers a wide range of topics, including ensembles, Monte .Carlo methods, and molecular dynamics simulations 3- Statistical Mechanics: A Set of Lectures" by Richard " P. Feynman: Based on Feynman's lectures at the University of Auckland, this book provides a clear and concise introduction to statistical mechanics. It covers topics such as the laws of thermodynamics, ensembles, .and the statistical interpretation of entropy 	1-الكتب المقررة المطلوبة
	2-المراجع الرئيسية(المصادر)
لايوجد	ا- الكتب والمراجع التي يوصي بها (المجلات العلمية, التقارير,)
المواقع الالكترونية بالفيزياء الأحصائية	ب -المراجع الالكترونية مواقع الانترنيت

1. Cour	se Name:	Advanced Solid	Course Description Form d State Physics II/ Ph.D.				
2. Cour	se Coue.						
3. Seme	ester / Yea	ar: Second / 20	024-2025				
4. Desc	ription Pr	eparation Date:	24/1/2025				
5. Avai	lable Atte	ndance Forms:	present				
6. Num	ber of Cre	edit Hours (Tota	al) / Number of Units (Total) 3 hrs. per week	k/ 3 units per	week		
7. Cour	se admini	strator's name (mention all, if more than one name)				
l l	Name: Pro Email: dr a	of. Dr. Alaa Jabl	par Ghazai hrainuniy edu iq				
E E	Name: Ah Email: <u>tab</u>	med Abdulrahn bakh2013@gma	han Ahmed Al-Tabbakh <u>ail.com</u>				
8. Cour	se Object	ives					
9. Teac	 and superconductors to correlated electron systems, atomically thin crystals, and topological materials. Also considered are applications of modern near-field optics to probing optical constants and imaging surface collective modes. Nonlinear, ultrafast optics, and other topics may be covered if time permits. Understand the advanced concepts in solid-state physics Linking a theoretical concept with a practical concept Allow the student to know a problem in the field of solid-state and try to solve Allowing the student to well select of the research project which qualifies him/her to obtain a doctorate. 						
10. Co	urse Struc	ture		T	E h th		
week	Hours	Learning	Unit of subject name	method	method		
1-2	6	Academic	General properties: Macroscopic electrodynamics. Linear response functions: permittivity, permeability, conductivity. Frequency and momentum dispersion. Fundamental constraints: reciprocity, K-K relations, sum rules. Electromagnetic excitations in anisotropic media	lectures	discussion		
3-4	6	Academic	Insulators: Drude-Lorentz model. Phonon-polaritons. Surface phonons • Metals Kubo formula and RPA. Interband response. Bulk and surface plasmons, Landau damping. Plasmon-phonon coupling • Semiconductors Direct and indirect gap semiconductors. Electron-hole interaction and exciton	lectures	discussion		

		1	66			
			effects.	Nanostructures: energy bands,		
5	3		unect a	id maneet excitons.		Evam
5	5	Acadomia	Strong	alastron phonon interactions	lasturas	discussion
6-7	6	Academic	Optical density-	response of polarons. Charge wave materials	lectures	discussion
8	3	Academic	BCS su superflu dirty and	perconductors Energy gap and id stiffness. Optical response of d clean SC •	lectures	discussion
9	3	Academic	Correlat Phenom Drude, superco	ted electron systems enological models (extended memory function). High-Tc nductors. Correlated oxides	lectures	discussion
10-11	6	Academic	2D, layered, and Dirac materials Graphene: optical response and plasmons. hBN: hyperbolic polaritons. TMD: excitons. vdW heterostructures: hybrid collective modes, superlattice effects.		lectures	discussion
12						Exam
13-14		Academic	Topolog semime Diffract by a dip type an Polarito	tals • Near-field optics ion by small apertures. Scattering pole near an interface. Aperture- nd scattering-type microscopy. ns as a spectroscopic tool •	lectures	discussion
15		Academic	Inhomo Effectiv	geneous media Impurity spectra. e medium theory. Metamaterials tonic crystals	lectures	discussion
11. Co	ourse Eva	luation	una prio			
Distribu daily ora 30% mid 70% fin 12. Le	ting the s al, monthl d exam+ o al exam carning an	core out of 100 y, or written exa discussion+ solv d Teaching Res	according ams, repor ring home	to the tasks assigned to the studer ts etc work	nt, such as d	aily preparation,
Require	d textbool	ks		• M. Dressel and G. Grüner, Electro	dynamics of	solids (2002)
(curricular books, if any)				 D. B. Tanner, Optical effects in solids (2019) M. Fox, Optical properties of solids (2011) D. van der Marel and T. Giamarchi, Introduction to Correlated Matter (2019) L. Novotny and B. Hecht, Principles of nano-optics (2006) E.L. Ivchenko and G.E. Pikus, Superlattices and other heterostructures. Symmetry and optical phenomena (Springer, 2012) 		
Primary references (sources)				 Electrodynamics of correlated elec 83, 471-541 (2011) D. N. Basov et al., Colloquium: Mod. Phys. 86, 959-994 (2014) D. N. Basov, M. M. Fogler, F. J. van der Waals materials, Science, 33 G. Wang et al., Colloquium: Excite metal dichalcogenides, Rev. Mod. I Armitage et al., Weyl and Dirac set solids, Rev. Mod. Phys. 90, 015001 	tron materials Graphene sp García de Al 54, aag1992- ons in atomic Phys. 90, 021 emimetals in (2018)	s, Rev. Mod. Phys. pectroscopy, Rev. bajo, Polaritons in 1 (2016) ally thin transition 001 (2018) • N.P. three-dimensional

Recommended books and references	Advanced Solid State Physics
(scientific journals, reports)	Ву
	Neil Ashcroft and N. David Mermin
	Advanced Solid State Drusies (2nd edition)
	By
	P. Phillips
Electronic References, Websites	All books and global sites on the internet

1. Course Name:						
				Nuclear Models		
2. 0	Course	e Code:				
3. 5	Semes	ter / Year:				
			Secor	nd semester / PhD stag	e	
4. I	Descri	ption Preparat	ion Date	2:		
		± •		2-2-2025		
5. A	Availa	ble Attendanc	e Forms	•		
				Weekly		
6. ľ	Numbe	er of Credit He	ours (To	tal) / Number of Units	(Total)	
	30 hours					
7. 0	Course	e administrator	r's name	(mention all, if more	than one nam	ne)
Name:	Dr. pro	of. Ghaith Naima	ı Flaiyh			
Email	-	ohaith flaiv	h@sc.uol	haohdad edu iq		
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8. 0	Course	e Objectives				
Course (Objecti	ves				
			• Teach	ing PhD students theories of	nuclear models	
9.]	Гeachi	ing and Learni	ng Strat	egies		
Strategy		0				
		• To enal	ble the stu	dent to understand and gras	p the fundamen	tals of nuclear
		physics.				
		• To enab	ole the stud	lent to understand physical p	phenomena from	a mathematical
		perspectiv	ve.	1 1 . 1 1		
		• To enab	ole the stuc	lent to understand and grasp	the fundamental	s of nuclear physi
		• To enab	le use of fi	lent to acquire knowledge ar	d understanding	of the scientific l
		of physics	and pract	ical applications.	la understanding	, of the scientifie it
		• To deve	elop logica	l and scientific analysis and	interpretation of	physical phenome
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Radiology Physics.

Module Aims, Learning Outcomes and Indicative Contents		
الإرشادية والمحتويات التعلم ونتائج الدراسية المادة أهداف		
Module Aims المادة أهداف الدراسية	 Introducing students to the general basic concept of Radiology Physics. Identify the types and the most important Sources of Ionizing Radiation. Focusing on the theoretical aspects of the discussed subject material, with some examples added for clarification. Introducing the student to the importance of the application of ionizing radiation to diagnosis and treatment of human disease. 	
Module Learning Outcomes التعلم مخرجات الدراسية للمادة	 Students can understand the general concept of Radiology Physics. Students will understand Modern Physics. Allow students to know about Radiation Quantities and Units. Learn about the Dose in Water for Various Radiation Beams. The ability to Basic Definitions for Atomic and nuclear Structure. The ability to know about the Nuclear Models. 	
Indicative Contents المحتويات الإرشادية	 Indicative content includes the following. 1- Gravimetric analysis 2- The Fundamental Physical Constants. 3- Milestones in Modern Physics and Medical Physics. 4- Rutherford–Bohr Atomic Model 5- Introduction to Wave Mechanics 6- Basic Definitions for Atomic and nuclear Structure. 	

Learning and Teaching Strategies استراتيجيات التعلم والتعليم			
Strategies	 Discussing the topics of the curriculum book and supporting references Theoretical lectures including problem solving and discussion of homework Asking students, a set of thinking questions during the lectures for specific topics. Giving students homework that requires finding self- solutions. 		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري		
	Material Covered	
Week 1	Fundamentals of Dosimetry	
Week 2	QUANTITIES AND UNITS	
Week 3	CHARGED PARTICLE EQUILIBRIUM IN DOSIMETRY	
Week 4	The Fano Theorem: CAVITY THEORY	
Week 5	Basic Definitions for Atomic Structure	
Week 6	Mid exam	
Week 7	Physics of Small Dimensions and Large Velocities	
Week 8	Einstein's Special Theory of Relativity	
Week 9	Particle-Wave Duality: Davisson–Germer Experiment	
Week 10	Uncertainty Principle	
Week 11	Maxwell's Equations	
Week 12	Production of X Rays	
Week 13	Emission of Radiation by Accelerated Charged Particle (Bremsstrahlung Production)	
Week 14	Synchrotron Radiation	
Week 1 5	Final exam	
Radiology Physics.

Learning and Teaching Resources		
مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Radiation physics for medical physicists by Ervin B. Podgor sak ,2005	