Academic Program Description Form

University Name: Al Nahrain University

Faculty/Institute: College of Science

Scientific Department: Physics

Academic or Professional Program Name: B.Sc in Physics

Final Certificate Name: B.Sc

Academic System: Semester

Description Preparation Date: 2024-2025

File Completion Date: 2025/3/25

Signature: Saad N. Abood

Head of Department Name:

Prof Dr Saad Naji Abood

Date: 2025/4/10

Signature:

Scientific Associate Name

Manaf Adnan Saleh

Date: 10/4/2025

The file is checked by: Dr. Orooba Nadhim Harbi

Department of Quality Assurance and University Performance

Director of the Quality Assurance and University Performance Department:

Date: 10.04.2025

Signature:

Approval of the Dean

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 Structure

Program Structure	Number of Courses	Credit hours	Percentage	Reviews*
Institution Requirements	2		100	

College Requirements	**2**		**100**	
Department Requirements	**2**		**100**	
Summer Training	–		–	
Other				

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

7. Program Description

Credit Hours		Course Name	Course Code	Year/Level
practical	**theoretical**			**B.Sc**
	2	Geometrical Optics	PHY	الثالثة
	2	Quantum mechanics I	PHY	الثالثة
	2	Methodology	PHY	الثالثة
	2	Laser physics I	PHY	الثالثة
	2	Optional Semiconductors	PHY	الثالثة
	2	Optional Sustainable Energy	PHY	الثالثة
2	**2**	Numerical methods of physics	PHY	الثالثة
2	**2**	Material physics I	PHY	الثالثة
2	**2**	Material physics II	PHY	الثالثة
	2	Optional 2 reflectivity Theory	PHY	الثالثة
	2	Quantum mechanics II	PHY	الثالثة
		Complex analysis	PHY	الثالثة
	2	Laser physics I	PHY	الثالثة
	2	Physical Optics	PHY	الثالثة
	2	Optional physical Spectra	PHY	الثالثة
	2	Mathematical physics	PHY	الثالثة
	2	Molecular physics	PHY	الثالثة
2	**2**	Laser physics I	PHY	الرابعة
2	**2**	Solid state physics I	PHY	الرابعة
	2	Advanced Medical physics	PHY	الرابعة
	2	Nanotechnology	PHY	الرابعة
2	**2**	Nuclear physics I	PHY	الرابعة
2	**2**	Solar physics	PHY	الرابعة
2	**2**	Laser physics II	PHY	الرابعة
2	**2**	Solid state physics II	PHY	الرابعة
2	**2**	Nuclear physics II	PHY	الرابعة
	2	Health physics	PHY	الرابعة

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 teaching staff		Special Requirements/Skills (if applicable)		Specialization		Academic Rank	
lecture	staff			Special	General		
	1			فيزياء طبية	علوم الفيزياء	استاذ دكتور	أ.د.اسماء هادي محمد
	1			بصريات	علوم الفيزياء	استاذ دكتور	أ.د.سهى موسى خورشيد
	1			بصريات الكترون	علوم الفيزياء	استاذ دكتور	أ.د.عدي علي حسين
	1			صلبة	علوم الفيزياء	استاذ دكتور	أ.د.احمد عبد الرحمن
	1			فيزياء نظرية	علوم الفيزياء	استاذ دكتور	أ.د.سعد ناجي عبود
	1			صلبة	علوم الفيزياء	استاذ دكتور	أ.د.عماد خضير عباس
	1			معالجة صور رقمية	علوم الفيزياء	استاذ دكتور	أ.د.ليث 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.وسن علي موسى
	1			اشعاعية	علوم الفيزياء	استاذ مساعد دكتور	أ.م.د.مروة عبد المحسن
	1			احصائية	علوم الفيزياء	استاذ مساعد دكتور	أ.م.د ابراهيم عبدالمهدي
	1			بلازما	علوم الفيزياء	استاذ مساعد دكتور	ا.م.د.نيسان سعود
	1			صلبة	علوم الفيزياء	استاذ مساعد دكتور	ا.م.د سديم عباس
	1			نظرية	علوم الفيزياء	مدرس دكتور	م.د.احمد شاكر
	1			بصريات	علوم الفيزياء	استاذ مساعد	أ.م.نور محمد حسن
	1			نظرية	علوم الفيزياء	مدرس دكتور	م.د.عمر اياد

م.د.سلام اسماعيل	مدرس دكتور	علوم الفيزياء	فلك			1	
أ.م.د.زينب منذر	استاذ مساعد دكتور	علوم الفيزياء	الكترونيك			1	
أ.م.د.احمد صبيح	استاذ مساعد دكتور	علوم كيمياء	كيمياء			1	
م.د.فاطمة عبد الصاحب	مدرس دكتور	علوم رياضيات	رياضات			1	
م.عمر عدنان	مدرس	شريعة	شريعة			1	
م.د.منى صالح	مدرس دكتور	علوم رياضيات	رياضيات			1	
م.د.احمد نعمة	مدرس دكتور	اللغة عربية	اللغة العربية			1	
ا.م.ابتسام كامل	استاذ مساعد	علوم الرياضيات	رياضيات			1	
م.د.ايمان عبد الوهاب	مدرس دكتور	علوم رياضيات	رياضيات			1	
م.د.احمد ايوب	مدرس دكتور	علوم رياضيات	رياضيات			1	

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

Involve more high level books and upgrade the lectures each year.

Program Skills Outline																
Required program Learning outcomes																
Ethics				Skills				Knowledge				Basic or optional	Course Name	Course Code	Year/Level	
C4	C3	C2	C1	B4	B3	B2	B1	A4	A3	A2	A1					
								✔	✔	✔	✔	اساسى	Geometrical Optics	PHY	مرحلة ثالثة	
								✔	✔	✔	✔	اساسى	Quantum mechanics I	PHY	مرحلة ثالثة	بكالوريوس
								✔	✔	✔	✔	اساسى	Laser physics I	PHY	مرحلة ثالثة	
								✔	✔	✔	✔	اختياري	Methodology	PHY	مرحلة ثالثة	
								✔	✔	✔	✔	اساسى	Optional Semiconductors	PHY	مرحلة ثالثة	
								✔	✔	✔	✔	اساسى	Optional Sustainable Energy	PHY	مرحلة ثالثة	
								✔	✔	✔	✔	اساسى	Numerical methods of physics	PHY	مرحلة ثالثة	
								✔	✔	✔	✔	اساسى	Material physics I	PHY	مرحلة ثالثة	

								✔	✔	✔	✔	اساسى	Material physics II	PHY	مرحلة ثالثة	
								✔	✔	✔	✔	اختياري	Optional 2 reflectivity Theory	PHY	مرحلة ثالثة	
								✔	✔	✔	✔	اساسى	Quantum mechanics II	PHY	مرحلة ثالثة	
								✔	✔	✔	✔	اساسى	Complex analysis	PHY	مرحلة ثالثة	
								✔	✔	✔	✔	اساسى	Laser physics I	PHY	مرحلة ثالثة	
								✔	✔	✔	✔	اساسى	Physical Optics	PHY	مرحلة ثالثة	
								✔	✔	✔	✔	اساسي	Optional physical Spectra	PHY	مرحلة ثالثة	
								✔	✔	✔	✔	اساسي	Mathematical physics	PHY	مرحلة ثالثة	
								✔	✔	✔	✔	اساسي	Molecular physics	PHY	مرحلة ثالثة	
								✔	✔	✔	✔	اساسي	**Physical Optics**	PHY	مرحلة ثالثة	
								✔	✔	✔	✔	اساسى	Laser physics I	PHY	مرحلة رابعة	
								✔	✔	✔	✔	اساسى	Solid state physics I	PHY	مرحلة رابعة	
								✔	✔	✔	✔	اساسى	Advanced Medical physics	PHY	مرحلة رابعة	

								✔	✔	✔	✔	اساسی	Nanotechnology	PHY	مرحلة رابعة	
								✔	✔	✔	✔	اساسی	Nuclear physics I	PHY	مرحلة رابعة	
								✔	✔	✔	✔	اساسی	Solar physics	PHY	مرحلة رابعة	
								✔	✔	✔	✔	اساسی	Laser physics II	PHY	مرحلة رابعة	
								✔	✔	✔	✔	اساسی	Solid state physics II	PHY	مرحلة رابعة	
								✔	✔	✔	✔	اساسی	Nuclear physics II	PHY	مرحلة رابعة	
								✔	✔	✔	✔	اساسی	Advanced Medical physics	PHY	مرحلة رابعة	
								✔	✔	✔	✔	اساسی	Solar physics	PHY	مرحلة رابعة	

Course Description Form

1. Course Name:
Numerical Analysis
2. Course Code:
PHYS3205
3. Semester / Year:
First Semester / 2024-2025
4. Description Preparation Date:
20 / 10 / 2024
5. Available Attendance Forms:
By presence
6. Number of Credit Hours (Total) / Number of Units (Total)
3
7. Course administrator's name (mention all, if more than one name)
Names: Dr. Omar Ayad Jalal Email: omar.jalal@nahrainuniv.edu.iq Bilal Abdulsattar Yousif Email: belal.alshekhly@nahrainuniv.edu.iq Saif Muhammed Jasim Email: saif.muhammed@nahrainuniv.edu.iq
8. Course Objectives

Course Objectives	• **Teaching students the basics of numerical analysis.** • **Teaching the student to write advanced programs in the MATLAB language, specifically for numerical methods.** • **Teaching the student to solve some physical and engineering problems using numerical analysis.**
9. Teaching and Learning Strategies	
Strategy	• Discussing the topics of the methodological book and auxiliary references • Theoretical lectures including problem solving and discussion of homework • Asking students for a set of thinking questions during lectures on specific topics.

	• Giving students homework that requires finding solutions on their own.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	Graphical method	Graphical method	Theoretical and Experimental	Oral and written exam
2	2	Bisection method	Bisection method	Theoretical and Experimental	Oral and written exam
3	2	Fixed Point method	Fixed Point method	Theoretical and Experimental	Oral and written exam
4	2	Newton-Raphsen method	Newton-Raphsen method	Theoretical and Experimental	Oral and written exam
5	2	Gauss Elimination method	Gauss Elimination method	Theoretical and Experimental	Oral and written exam
6	2	Gauss-Seidal method	Gauss-Seidal method	Theoretical and Experimental	Oral and written exam
7	2	Least Square Fitting	Least Square Fitting	Theoretical and Experimental	Oral and written exam
8	2	Trapezoidal Rule	Trapezoidal Rule	Theoretical and Experimental	Oral and written exam
9	2	Simpson's method I	Simpson's method I	Theoretical and Experimental	Oral and written exam
10	2	Simpson's method II	Simpson's method II	Theoretical and Experimental	Oral and written exam
11	2	Euler's method	Euler's method	Theoretical and Experimental	Oral and written exam
12	2	Runge- Kutta method I	Runge- Kutta method I	Theoretical and Experimental	Oral and written exam
13	2	Runge- Kutta method II	Runge- Kutta method II	Theoretical and Experimental	Oral and written exam
14	2	Solution of non-linear system (Newton's method)	Solution of non-linear system (Newton's method)	Theoretical and Experimental	Oral and written exam

15	2	Solution of non-linear system (iteration method)	Solution of non-linear system (iteration method)	Theoretical and Experimental	Oral and written exam

11. Course Evaluation

- Daily tests 10%
- Monthly exams 80%
- Homework assignments and student interaction in discussion sessions 10%

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	ESSENTIAL MATLAB (For Engineers and Scientists), 3rd edition (2007), Brain D. Hahan *and* Danial T. Valentine.
Main references (sources)	• Getting Started with MATLAB 7, The MathWorks (2007). MATLAB Primer (Seventh Edition 2005),Timothy A. Davies *and* Kermit Sigmon.
Recommended books and references (scientific journals, reports…)	----------
Electronic References, Websites	www.mathwork.com

Course Description Form

1. Course Name:

Quantum Mechanics 1

2. Course Code:

3. Semester / Year:

First Semester/ Third Year Students

4. Description Preparation Date:

01/09/2024

5. Available Attendance Forms:

1. Classroom Lectures
2. Electronic Classroom

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

4 Hrs. a week (60 Hrs. Total) / 4 untis

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

Name: Ibrahim Abdelmahdi Sadiq
Email: ibrahim.sadiq@nahrainuniv.edu.iq

8. Course Objectives

Course Objectives	• To know the origins of the Quantum Mechanics **(QM)** • To realize the basic concepts and principles of q**(QM)**. • To have the ability to understand the applications of **(QM)**. • To have skills necessary to solve problems concerning QM and its applications. • The student is able to study advanced programs in QM. • The student is also able to understand other physics programs that requires the knowle and skills quantum mechanics program provides.

9. Teaching and Learning Strategies

Strategy	• Classroom Attendance • Exercises and solved problems. • Home Assessments (Solving problems and Reports) • Seminars

10. Course Structure

Week	Hrs.	Required Learning Outcomes	Unit title / Subjective	Learning method	Evaluation method
1	4		**The Origins of QM**	Classroom lecture	
2	4		**Historic Developments of QM**	Classroom lecture	
3	4		**Basic Concepts and Principles of QM**	Classroom lecture	
4	4		**The Basic Postulates of QM**	Classroom lecture	
5	4		**The Basic Postulates of QM**	Classroom lecture	
6	4		**Some Applications of TDSE**	Classroom lecture	
7	4		**Applications of TISE:THE FREE PARTICLE**	Classroom lecture	
8	4		**The Step Potential**	Classroom lecture	
9	4		**The Potential Barrier**	Classroom lecture	

10	4		**The 1D Box Potential**	Classroom lecture	
11	4		**The 3D Box Potential**	Classroom lecture	
12	4		**The 1D Harmonic Oscillator**	Classroom lecture	
13	4		**The 3D Harmonic Oscillator**	Classroom lecture	
14	4		**The Ladder Operators**	Classroom lecture	
15	4		**Review**	Classroom lecture	
				Classroom lecture	

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:

Daily Oral (5 Marks)
Quizzes (10 Marks)
Home Assignment (Solving problems and Reports) (5 Marks)
Midterm Exam (20 Marks)

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	
Main references (sources)	1. Fundamentals of Quantum Mechanics, Ajit Kumar, Cambridge University Press. First published 2018. 2. Introduction to Quantum Mechanics, A. C. Phillips Department, John Wiley & Sons Ltd, 2003. 3. Quantum Mechanics Concepts and Applications Second Edition, Nouredine Zettili, John Wiley & Sons, Ltd. 2009. 4. Introduction to Quantum Mechanics Second Edit David J. Griffiths, Pearson Education. Inc. 2005
Recommended books and references (scientific journals, reports…)	• Introduction to Quantum Mechanics by Dicke and Wittke • An Introdution to Theory of Quantum Mechanics and Applications by Amnon Yariv • Solved Problems in Quantum Mechanics (Schaum's Outlines Series)
Electronic References, Websites	

Course Description Form

1. Course Name:

Materials Physics

2. Course Code:

3. Semester / Year:

First/ 2024

4. Description Preparation Date:

21/10/2024

5. Available Attendance Forms:

Physical attendance

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

2 hours weekly (30 total)/ 2 units

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

Name: Assist. Prof. Dr. Sadeem Abbas Fadhil
Email: sadeemfadhil@yahoo.com

8. Course Objectives

Course Objectives	• **Understanding Physical Properties**: Enabling students to understand the physical properties of different materials, such as density, hardness, and elasticity. • **Applying Theoretical Concepts**: Connecting theoretical concepts in physics to practical applications in everyday life and industry. • **Developing Analytical Skills**: Enhancing analytical and critical thinking skills through the study of material behavior under various conditions. • **Encouraging Innovation**: Inspiring students to innovate in the design and application of materials, supporting research and development in fields like engineering and materials science. • **Understanding Chemical and Physical Changes**: Studying how changes in environmental conditions affect the properties of materials.

	• **Interacting with Technology**: Enhancing students' understanding of how modern technology is used in the study and application of materials science.

9. Teaching and Learning Strategies

Strategy	• **Lectures and Interactive Discussions**: Use lectures to introduce key concepts, followed by discussions to encourage student engagement and clarify doubts. • **Case Studies**: Analyze real-world applications and case studies to show how materials physics is applied in industry, engineering, and technology. • **Group Projects**: Encourage collaborative learning through group projects that focus on designing or testing new materials, fostering teamwork and problem-solving skills. • **Simulations and Modeling**: Use computer simulations to visualize complex concepts and predict material behavior under different conditions. • **Flipped Classroom**: Assign readings or video lectures for students to review at home, freeing up class time for discussions, problem-solving, and hands-on activities. • **Guest Lectures and Industry Visits**: Invite professionals from the materials science field or organize visits to relevant industries to provide real-world insights. • **Problem-Based Learning**: Present students with real-life problems related to materials and encourage them to propose solutions based on their understanding of physics principles. • **Peer Teaching**: Allow students to teach certain topics to their peers, reinforcing their own understanding and enhancing communication skills. • **Assessment and Feedback**: Use varied assessment methods, including quizzes, lab reports, and presentations, to gauge understanding and provide timely feedback.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	Give the students a general idea about the subject.	Introduction	Whiteboard	Oral and written exams
2	2	Make the student able to understand	Atomic Bonding of Materials	Whiteboard	Oral and written exams

		the Atomic Bonding of Materials			
3		Make the student able to understand forces and energy between atoms	Forces and energy between atoms		Oral and written exams
4	2	Make the student able to understand the structure of solids.	Structure of Solids	Whiteboard	Oral and written exams
5	2	Make the student understand the crystal defects and their effects on the properties of the materials.	Crystal Defects	Whiteboard	Oral and written exams
6	2	exam	Mid exam 1	Whiteboard	Oral and written exams
7		Learning about crystal lattice systems	Crystal lattice systems		
8	2	Learning about the Mechanical Properties of Materials	Mechanical Properties of Materials	Whiteboard	Oral and written exams
9	2	Learning about the Electrical Properties of Materials	Electrical Properties of Materials	Whiteboard	Oral and written exams
10	2	Learning about the thermal Properties of Materials	Thermal Properties of Materials	Whiteboard	Oral and written exams
11	2	Learning about the Magnetic Properties of Materials	Magnetic and Properties of Materials	Whiteboard	Oral and written exams
12	2	Learning about the Optical Properties of Materials	Optical Properties of Materials	Whiteboard	Oral and written exams
13	2	Discussing reports	Reports discussion	Whiteboard	Oral and written exams
14	2	Make the students learn about different materials applications	Materials applications	Whiteboard	Oral and written exams
15	2	Preparation for final exam	Preparation for final exam	Whiteboard	Oral and written exams

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

-Daily exams and attendance 10 Marks -Mid term exams 25 Marks -Home works and reports 5 Marks - Final exam 60 Marks

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Fundamentals of Materials Science and Engineering: An Integrated Approach By: WILLIAM D. CALLISTER, JR. & DAVID G. RETHWISCH, 2015 John Wiley & Sons, Inc.
Main references (sources)	Introduction to Solid State Physics, by Kittel 2005
Recommended books and references (scientific journals, reports…)	MIT lectures about materials
Electronic References, Websites	Internet websites, Like edx and others.

Course Description Form

1. Course Name :semiconductors

2. Course Code:

3. Semester / Year:2024_2025

4. Description Preparation Date:

5. Available Attendance Forms:

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

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

Name: alaajaarghazai
Email: dr.alaa.ghazai2nahraianuniv.edu.iq

8. Course Objectives

Course Objectives	• ..... • ..... • .....

9. Teaching and Learning Strategies

Strategy	

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
2 3 4 5 6 7			Energy Band and Carrier Concentratic in Thermal Equilibrium		

8 9 1 1 1 1 1 1			Semiconduct Materials Basic Crysta Structures Valence Bon Energy Banc Intrinsic Carrier Concentratic Donors and Acceptors Carrier Transport Phenomena Carrier Drift Carrier Diffusion Generation and Recombinati Processes Continuity Equation Thermionic Emission Process Tunneling Process Space-Charg Effect High-Field Effects p-n Junction 82 Thermal Equilibrium Condition Depletion Region Depletion Capacitance Current-		

			Voltage Characteristi Charge Stora and Transier Behavior Junction Breakdown Heterojuncti		

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)	
Main references (sources)	3RD EDITION Semiconductor Devices Physics and Technolog M. SZE and M. K. LEE JOHN WILEY & SO INC.2010
Recommended books and references (scientific journals, reports…)	Semiconductor Physics and Devices B Principles Third Edition Donald A. Nea Univer.\ip of New Mexico
Electronic References, Websites	

Course Description Form

1. Course Name:
Sustainable Energy
2. Course Code:
PHYS
3. Semester / Year:
First Semester / 2024−2025
4. Description Preparation Date:
20 / 09 / 2024
5. Available Attendance Forms:
By presence
6. Number of Credit Hours (Total) / Number of Units (Total)
2
7. Course administrator's name (mention all, if more than one name)
Names: Assist. Proff. Ahmed Kadhim Al-Lami Email: Ahmed.kadhim@nahrainuniv.edu.iq
8. Course Objectives

Course Objectives	• **Teaching students the basics of sustainable Energy.** • **Teaching the student to deal with new scientific understanding of the renewable energy** • **Teaching the student to find out why to deal with new sources of energy and its problems**
9. Teaching and Learning Strategies	
Strategy	• Discussing the topics of the methodological book and auxiliary references • Theoretical lectures including problem solving and discussion of homework • Asking students for a set of thinking questions during lectures on specific topics. • Giving students homework that requires finding solutions on their own.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	Find out the total energy	Total Energy Usage	Theoretical and Experimental	Oral and written exam
2	2	Understanding	what is Energy?	Theoretical	Oral and written exam
3	2	Know about resources of energy	Energy Resources	Theoretical	Oral and written exam
4	2	Wind energy	Calculation of Wind Energy and Power	Theoretical	Oral and written exam
5	2	Renewable energies	Applications of Renewable Energies	Theoretical	Oral and written exam
6	2		Mid-term exam	Theoretical	
7	2	photovoltaic	Photovoltaic	Theoretical	Oral and written exam
8	2	Solar radiation	Solar Radiation	Theoretical	Oral and written exam
9	2	Solar power understanding	Solar Power	Theoretical	Oral and written exam
10	2	atmosphere	Atmosphere Influence on Solar Radiation	Theoretical	Oral and written exam
11	2	What is geothermal	Geothermal Resources	Theoretical	Oral and written exam
12	2		Resource Identification	Theoretical	Oral and written exam
13	2	How to calculate the geothermal power	Geothermal Power Technology	Theoretical	Oral and written exam
14	2	What is binary scale	Binary-Scale	Theoretical	Oral and written exam

15	2		Mid-Term Exam		

11. Course Evaluation

- Daily tests 10%
- Monthly exams 80%
- Homework assignments and student interaction in discussion sessions 10%

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Sustainable energy textbook
Main references (sources)	Renewable ewnergy
Recommended books and references (scientific journals, reports…)	----------
Electronic References, Websites	

TEMPLATE FOR COURSE SPECIFICATION

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

COURSE SPECIFICATION

This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the programme specification.

1. Teaching Institution	Dr. Suha Mousa Alawsi Working in lab 1-Ruaa Tahseen 2-Ghufran Mohammed 3-Zena mowafaq
	Alnahrain university /college of Science /physics
3. Course title/code	Geomatrical optics
4. Modes of Attendance offered	
5. Semester/Year	FIRST /2024-2025
6. Number of hours tuition (total)	9 h
7. Date of production/revision of this specification	10/10/2024
8. Aims of the Course	
1. Teaching the student the basics of optics. 2- Teaching the student how to use the practical experiences of optics and linking them to the theoretical side	

9· Learning Outcomes, Teaching ,Learning and Assessment Methode

A- Cognitive goals .

A1- Enable students to know the most important Arab and foreign scientists in Optics

A2- Enable students to understand how to use some visual effects such as interference and polarization.

A 3- Enable students to analyze the resulting images.

A4- Enable the student to simulate some physical systems such as the eye, telescopes, cameras and communications

.

B. The skills goals special to the course.

B1 - Practical skills

B2 - Reminding and Analyzing Skills

B3 - Use and development skills.

Teaching and Learning Methods

-Discussing the topics of the curriculum book and the auxiliary 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

Assessment methods

-daily tests
-Monthly exams
-Homework and student interaction in discussion sessions
- Making scientific reports for the lesson topics

C. Affective and value goals

C1 - Enable students to write scientific reports in various scientific fields.

C2 - Enable students to simulate physical systems by finding appropriate solutions to the problems that appear in these systems.

C3- Enabling students to understand and analyze the results with a view to benefiting from it in any field of scientific research

D. General and rehabilitative transferred skills(other skills relevant to employability and personal development)

- Follow up on scientific development by communicating with international universities via the Internet
-Participation in scientific conferences inside and outside the country
- Participation in workshops and scientific symposia inside and outside the country

.

10. Course Structure					
Week	Hours	ILOs	Unit/Module or Topic Title	Teaching Method	Assessment Method
1	9h		Introduction	Pract+theor	Daily and monthly Exam
2	9h		Refraction	Pract+theor	Daily and monthly Exam
3	9h		Low of refraction	Pract+theor	Daily and monthly Exam
4	9h		Reflection	Pract+theor	Daily and monthly Exam
5	9h		Low of reflection	Pract+theor	Daily and monthly Exam
6	9h		Lenses	Pract+theor	
7	9h		Thin lenses	Pract+theor	
8	9h		Thick lenses	Pract+theor	Daily and monthly Exam
9	9h		Mirror	Pract+theor	Daily and monthly Exam
10	9h		Prism	Pract+theor	Daily and monthly Exam
11	9h		Ray tracing of paraxial ray	Pract+theor	Daily and monthly Exam
12	9h		Ray tracing meridinal ray	Pract+theor	Daily and monthly Exam
13	9h		Aberration	Pract+theor	Daily and monthly Exam
14	9h		Types of aberrations	Pract+theor	Daily and monthly Exam
15	9h		Selected Examples III	Pract+theor	Daily and monthly Exam

11. Infrastructure	
1. Books Required reading:	Fundamental of optics , janckes 1986 ➢ Supplementary Books: ✓ Optical engineering , smith. First edition, 1998 ✓ Optical engineering , smith. second edition, 2007
2. Main references (sources)	www.opticka.com

A- Recommended books and references (scientific journals, reports…).	
B-Electronic references, Internet sites…	

12. The development of the curriculum plan

Course Description Form

1. Course Name:
Laser physics (1)
2. Course Code:
3. Semester / Year:
2025_2024
4. Description Preparation Date:
2024
5. Available Attendance Forms:
Attending
6. Number of Credit Hours (Total) / Number of Units (Total)
10 hours per week (4 theoretical + 6 practical)
7. Course administrator's name (mention all, if more than one name)
Name: Dr. Wildan Wohammed Awad Email: wildan.awad@nahrainuniv.edu.iq 1-zainab hazem shakir 2-zena kumel abduldin 30zahraa salman abdulamer
8. Course Objectives

Course Objectives	• **Teaching the student the basics of laser physics** • **Teaching the student to write special reports for the laboratory.** • **Teaching the student the properties of the laser beam and the possibility of entering the applied fields**

9. Teaching and Learning Strategies

Strategy	)iscuss the topics of the methodological book and auxiliary eferences Theoretical lectures including problem solutions and discussion of homework Ask students a set of thinking questions during lectures for specific topics. Giving students homework that requires .finding self-solutions

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1.	10	Study the Black Body Radiation	Black Body Radiation		
2.	10	Photon interaction with matter	Absorption , Spontaneous Emission, Stimulated Emission		
3.	10	The low Transitions	Forbidden and Allowed Transitions		
4.	10	Understand the Rate of Stimulated Emission and Absorption	Rate of Stimulated Emission and Absorption		
5.	10	Gain Coefficient, Absorption Cross Section	Gain Coefficient, Absorption Cross Section		
6.	10	Understand Einstein's Calculations	Einstein's Calculations		
7.	10	The different between Maser and Laser	Idea of Maser and Laser		
8.	10	Understand Laser Principles	Principles of Laser		
9.	10	How to find Gain Coefficient and Threshold Condition	Gain Coefficient and Threshol Condition		
10.	10	Pumping Plan and Methods	Pumping Plan and Methods		
11.	10	Types of Optical Resonators	Types of Optical Resonators		
12.	10	Resonator Optical of Stability	Resonator Optical of Stability		
13.	10	Understand Resonator Mods	Resonator Mods		
14.	10	Calculate Quality Factor	Quality Factor		
15.	10	Continuous wave and pulse operation	Pulsed and continuous laser output types		

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)	
Main references (sources)	Fundemantial of laser physics (200
Recommended books and references (scientific journals, reports…)	Principles of laser (o.svelto 1989)

Electronic References, Websites	

Course Description Form

1. Course Name: Complex Analysis

2. Course Code:

3. Semester / Year: First/2024-2025

4. Description Preparation Date:2024-2025

5. Available Attendance Forms: Attendance

6. Number of Credit Hours (Total) / Number of Units (Total)60 hours

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

Name: Dr. Iman A. Hussain
Email: iman a. hussain@nahrainuniv.edu.iq

8. Course Objectives

Course Objectives	**1-To study the techniques of complex variable and functions together with their derivatives, contour integration and transformations.** **2-To study complex power series, classification of singularities.** **3-To study calculus of residues and its applications the evaluation of integ and other concepts and properties**

9. Teaching and Learning Strategies

Strategy	Lectures, Homework, some activities in the class, Electronic referenc

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1-3	12	Field of complex numbers	Chapter 1	lectures	
4-8	20	Analytic Functions	Chapter 2	lectures	
9-11	12	Log function, Elemen Functions	Chapter 3	lectures	
12-1	16	Integral, series, series	Chapter 4,5	lectures	

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)	1-Complex variables and applications Ruel v. Churchill 2-Complex analysis Theodore
Main references (sources)	1. Ablowitz, M. J., Fokas, A. S. (2003). *Complex variables: introduction and applications* (2nd ed). Cambridge University Press. 2. Brown, J. W., Churchill, R. V. (2009). *Complex Variables and Applications.* 8th Edition. New York: McGraw-Hill Higher Education. 3. Lundmark, H. (2004). *Visualizing complex analytic functions using domain coloring.* 4. Needham, T. (1997). *Visual Complex Analysis.* Oxford University Press, Oxford.
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	z-library, connected papers

Course Description Form

1. Course Name:
Quantum Mechanics 2
2. Course Code:
3. Semester / Year:
2nd Semester– 3rd Year Students
4. Description Preparation Date:
January 2025
5. Available Attendance Forms:
• Classroom Lecture, Online Meeting, Video Lectures
6. Number of Credit Hours (Total) / Number of Units (Total)
60 hrs. / 4 units
7. Course administrator's name (mention all, if more than one name)
Name: Ibrahim A. Sadiq Email: ibrahim.sadiq@nahrainuniv.edu.iq Tutor:Ghufran Mohammed Jassam Email:ghufran.muhammed@nahrainuniv.edu.iq

8. Course Objectives	
Course Objectives	• The student will have additional knowledge of the first semester's quantum mechanics curriculum. • Develop the student's understanding of the basic concepts of quantum mechanics and some of its applications, acquired in the first semester. • The student will have the ability to understand the applications of quantum mechanics and the skills to solve problems related to those applications for the second semester's topics. • Enabling the student to begin studying advanced chapters in quantum Mechanics and other academic subjects that require the student to possess concepts and skills required by the study of quantum mechanics.

9. Teaching and Learning Strategies	
Strategy	• Solved examples to enhance understanding. • Discussion during lectures and during solved examples to consolidate concepts and enhance understanding. • Students are assigned homework. • Daily tests using oral questions and discussion to focus on students' acquisition of key concepts. • Weekly assessment of acquired problem-solving skills (daily homework) • Termly exams as a comprehensive assessment of students' understanding of concepts and their ability to find solutions.

10. Course Structure

Week	Hrs.	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method

1	4	the required skills and knowledge	**The Harmonic Oscillator**	Classroom or video lecture	Oral questions and written tests
2	4	the required skills and knowledge	**Ladder Operators of the Harmonic Oscillator**	Classroom video lecture	Oral questions and written tests
3	4	the required skills and knowledge	**Commutation Relation**	Classroom video lecture	Oral questions and written tests
4	4	the required skills and knowledge	**The Angular Momentum**	Classroom video lecture	Oral questions and written tests
5	4	the required skills and knowledge	**The Hydrogen Atom**	Classroom video lecture	Oral questions and written tests
6	4	the required skills and knowledge	**The Hydrogen Atom**	Classroom video lecture	Oral questions and written tests
7	4	the required skills and knowledge	**QM Matrix Representation and Dirac Notation**	Classroom video lecture	Oral questions and written tests
8	4	the required skills and knowledge	**QM Matrix Representation and Dirac Notation**	Classroom video lecture	Oral questions and written tests
9	4	the required skills and knowledge	**QM Matrix Representation and Dirac Notation**	Classroom video lecture	Oral questions and written tests
10	4	the required skills and knowledge	**The Spin And Pauli Matrices**	Classroom video lecture	Oral questions and written tests
11	4	the required skills and knowledge	**The Spin And Pauli Matrices**	Classroom video lecture	Oral questions and written tests
12	4	the required skills and knowledge	**Time –independent Perturbatio**	Classroom video lecture	Oral questions and written tests
13	4	the required skills and knowledge	**Time-dependent Perturbation**	Classroom video lecture	Oral questions and written tests
14	4	the required skills and knowledge	**Variation Method Perturbation**	Classroom video lecture	Oral questions and written tests
15	4	the required skills and knowledge	**Review**	Classroom video lecture	Oral questions and written tests

11. Course Evaluation

Distributing the score out of 100 according to the tasks assigned to the student
40 % (semester work) + 60 % (final examination)

12. Learning and Teaching Resources

Required Textbooks	1. **Introduction to QM by A.C Philips Griffiths (2nd Ed.).** 2. **Fundamentals of QM by Ajit Kumar.** 3. **QM Concepts and Applications by Nouredine Zettili (2nd Ed.)**.
Main References	1. **Introduction to QM by A.C Philips Griffiths (2nd Ed.)..** **2. An Introdution to Theory of QM and Applications by Amnon Yariv.** **3. Solved Problems in QM (Schaum's Outlines Series)**
Recommended books and references (scientific journals, reports...)	**1 Introduction to Quantum Mechanics by Dicke and Wittke** **2. Quantum Mechanics by Leonard Schiff**
Electronic References, Websites	

Course Description Form

1. Course Name:

Materials Physics II

2. Course Code:

3. Semester / Year:

Second/ 2025

4. Description Preparation Date:

27/1/2025

5. Available Attendance Forms:

Physical attendance

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

2 hours weekly (30 total)/ 2 units

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

Name: Assist. Prof. Dr. Sadeem Abbas Fadhil
Email: sadeemfadhil@yahoo.com

8. Course Objectives

Course Objectives	• **Understanding Physical Properties**: Enabling students to understand the physical properties of different materials, such as density, hardness, and elasticity of metals, polymers, ceramics, and composite materials. • **Applying Theoretical Concepts**: Connecting theoretical concepts in physics to practical applications in everyday life and industry. • **Developing Analytical Skills**: Enhancing analytical and critical thinking skills through the study of material behavior under various conditions. • **Encouraging Innovation**: Inspiring students to innovate in the design and application of materials, supporting research and development in fields like engineering and materials science. • **Understanding Chemical and Physical Changes**: Studying how changes in environmental conditions affect the properties of materials.

	• **Interacting with Technology**: Enhancing students' understanding of how modern technology is used in the study and application of materials science.

9. Teaching and Learning Strategies

Strategy	• **Lectures and Interactive Discussions**: Use lectures to introduce key concepts, followed by discussions to encourage student engagement and clarify doubts. • **Case Studies**: Analyze real-world applications and case studies to show how materials physics is applied in industry, engineering, and technology. • **Group Projects**: Encourage collaborative learning through group projects that focus on designing or testing new materials, fostering teamwork and problem-solving skills. • **Simulations and Modeling**: Computer simulations are used to visualize complex concepts and predict material behavior under different conditions. • **Flipped Classroom**: Assign readings or video lectures for students to review at home, freeing up class time for discussions, problem-solving, and hands-on activities. • **Guest Lectures and Industry Visits**: Invite professionals from the materials science field or organize visits to relevant industries to provide real-world insights. • **Problem-Based Learning**: Present students with real-life problems related to materials and encourage them to propose solutions based on their understanding of physics principles. • **Peer Teaching**: Allow students to teach certain topics to their peers, reinforcing their own understanding and enhancing communication skills. • **Assessment and Feedback**: Use varied assessment methods, including quizzes, lab reports, and presentations, to gauge understanding and provide timely feedback.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	Give the students a general idea about the properties of materials.	Properties of materials	Whiteboard	Oral and written exams

2	2	Make the student able to understand the characteristics of dislocations and slip systems	Dislocations	Whiteboard	Oral and written exams
3	2	Make the student able to understand the Mechanisms of Strengthening in Metals,	Mechanisms of Strengthen in Metals		Oral and written exams
4	2	Make the student understand the fundamentals of fractures in addition to fracture types.	Failure: simple fracture	Whiteboard	Oral and written exams
5	2	Make the student understand the Fatigue, cyclic stress, and S-N curve.	Fatigue	Whiteboard	Oral and written exams
6	2	exam	Mid exam 1	Whiteboard	Oral and written exams
7		Learning about Creep, stress, and temperature effects	Creep		
8	2	Learning about the Phases, Unary, and Binary phases.	Phase diagrams	Whiteboard	Oral and written exams
9	2	Learning about the Applications and processing of metal alloys, types of metal alloys, Ferrous alloys.	Applications and processing of metal alloys: Ferrous alloys	Whiteboard	Oral and written exams
10	2	Learning about the Non-Ferrous alloys.	Non-Ferrous alloys	Whiteboard	Oral and written exams
11	2	Learning about the Structures and Properties of Ceramics	Structures and Properties of Ceramics	Whiteboard	Oral and written exams
12	2	Learning about the Polymer Structures	Polymer Structures	Whiteboard	Oral and written exams
13	2	Discussing reports	Reports discussion	Whiteboard	Oral and written exams
14	2	Make the students learn about Composites	Composites	Whiteboard	Oral and written exams
15	2	Preparation for final exam	Preparation for final exam	Whiteboard	Oral and written exams

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 -Daily exams and attendance 10 Marks -Mid term exams 25 Marks -Home works and reports 5 Marks - Final exam 60 Marks

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Fundamentals of Materials Science and Engineering: An Integrated Approach By: WILLIAM D. CALLISTER, JR. & DAVID G. RETHWISCH, 2015 John Wiley & Sons, Inc.
Main references (sources)	Introduction to Solid State Physics, by Kittel 2005
Recommended books and references (scientific journals, reports…)	MIT lectures about materials
Electronic References, Websites	Internet websites, Like edx and others.

Course Description Form

1. Course Name: Physical optics

2. Course Code:

3. Semester / Year: second 2024/2025

4. Description Preparation Date: 15/1/2025

5. Available Attendance Forms: present

6. Number of Credit Hours (Total) / Number of Units (Total) 4 hrs. per week/ 5 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. Course Objectives

Course Objectives	• Understand the basics of optical elements • Linking a theoretical concept with the practical • Giving the student the opportunity to choose the research project that qualifies hin obtain higher students .

9. Teaching and Learning Strategies

Strategy	1- Seminar presentation by students to enhance their skills 2- help students on the scientific discussion during lectures 3- help the student in the solving the problems

10. Course Structure

Week	Hours	Unit or subject name
1	5	Introduction
2	5	LIGHT WAVES AND PHYSICAL OPTICS
3	5	Physics of waves and wave motion
4	5	The mathematics of sinusoidal waveforms
5	5	Diffraction
6	5	Plane diffraction grating
7	5	Polarization
8	5	Linear polarization
9	5	Elliptical polarization
10	5	Cylindrical polarization
11	5	Interference
12	5	Constrictive interference
13	5	Distractive interference
14	5	Young"s experiments
15	5	Selected Examples III

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
50% mid exam+ discussion+ solving homework
50% final exam

11. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Fundamental of optics , janckes 1986
Main references (sources)	➢ Supplementary Books: ✓ Optical engineering , smith. First edition, 1998

	✓ Optical engineering , smith. second edition, 2007 ➢	
Recommended books and references (scientific journals, reports…)	All papers or books in the optics	
Electronic References, Websites	www.opticka.com	

كادر المختبر

م.د غفران محمد جسام
م. رؤى تحسين عبدالله
م.د ندى عبدالكريم

Course Description Form

1. Course Name:

Molecule physics

2. Course Code:

3. Semester / Year: 2nd 2024/2025

4. Description Preparation Date: 19/1/2025

5. Available Attendance Forms: present

6. Number of Credit Hours (Total) / Number of Units (Total) 2 hrs. per week / 2 units

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

Name: Ass. Prof. Dr. Nissan soud oribi
Email: nissan.oribi@nahrainuniv.edu.iq

8. Course Objectives

Course Objectives	• Understand the concepts in science of molecule physics and spectrum • Linking a theoretical concept with the application • Giving the student the opportunity to solve all the equation in molecule physics

9. Teaching and Learning Strategies

Strategy	1- Seminar presentation by students to enhance their skills 2- help students on the scientific discussion during lectures 3- help the student in the solving the problems

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	Academic	Introduction of molecular physics	Lecture	discussion
2	2	Academic	Classification of molecule	Lecture	discussion
3	2	Academic	Atomic and molecule spectra	Lecture	discussion
4	2	Academic	Rotation of molecule-diatomic rigid molecule	Lecture	discussion
5	2	Academic	Rotation of molecule-diatomic non rigid molecu	Lecture	discussion
6	2	Academic	Population of Rotation levels Rotational spectrumof liner polyatomic molecu	Lecture	discussion
7	2	Academic	Exam	Lecture	Exam

Course Description Form

1. Course Name:
Laser physics (2)
2. Course Code:
3. Semester / Year:
2 nd −2025
4. Description Preparation Date:
2025
5. Available Attendance Forms:
Attending
6. Number of Credit Hours (Total) / Number of Units (Total)
2 hours per week (theoretical)
7. Course administrator's name (mention all, if more than one name)
Name: Dr. Wildan Wohammed Awad Email: wildan.awad@nahrainuniv.edu.iq
8. Course Objectives

Course Objectives	• **Teaching the student the basics of laser physics .** • **Teaching the student the properties of the laser beam and the possibility of entering the applied fields**

9. Teaching and Learning Strategies	
Strategy	iscuss the topics of the methodological book and auxiliary eferences Theoretical lectures including problem solutions and discussion of homework sk students a set of thinking questions during lectures for specific topics. Giving students homework that requires finding self-solutions.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method

1.	2	Study Laser mode	Laser mode	theoretical	Daily oral and writte exam
2.	2	Distinguish between longitudinal and transverse patterns	longitudinal and transverse patterns	theoretical	Daily oral and writte exam
3.	2	Knowledge of the nature of laser beams	the nature of laser beams	theoretical	Daily oral and writte exam
4.	2	Natural line broadening	Natural line broadening	theoretical	Daily oral and writte exam
5.	2	Q switching	Q switching	theoretical	Daily oral and writte exam
6.	2	Understand quality factor switching methods	quality factor switching methods	theoretical	Daily oral and writte exam
7.	2	mood looking	mood looking	theoretical	Daily oral and writte exam
8.	2	Methods of mood looking	Methods of mood looking	theoretical	Daily oral and writte exam
9.	2	Laser types	Laser types	theoretical	Daily oral and writte exam
10.	2	Study Solid state laser	Solid state laser	theoretical	Daily oral and writte exam
11.	2	Study Gas laser	Gas laser	theoretical	Daily oral and writte exam
12.	2	Study Liquid laser	Liquid laser	theoretical	Daily oral and writte exam
13.	2	Study Semiconductor laser	Semiconductor laser	theoretical	Daily oral and writte exam
14.	2	Study laser application	Laser application	theoretical	Daily oral and writte exam
15.	2	How to protect against laser rays	Laser safety	theoretical	Daily oral and writte exam

11. Course Evaluation

Distributing the score out of 100 according to the tasks assigned to the student such as : 15 daily preparation, daily oral, and 25 written exams, 60 final exams

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	
Main references (sources)	Fundemantial of laser physics (20
Recommended books and references (scientific journals, reports…)	Principles of laser (o.svelto 1989)
Electronic References, Websites	

Course Description Form

1. Course Name:
Physical Spectra
2. Course Code:
3. Semester / Year:
2024–2025
4. Description Preparation Date:
2025
5. Available Attendance Forms:
Attending
6. Number of Credit Hours (Total) / Number of Units (Total)
2 hours per week
7. Course administrator's name (mention all, if more than one name)
Name: Dr. Narjis Zamil Abdulzahra, Email: Narjis .Zamil@nahrainuniv.edu.iq
8. Course Objectives

Course Objectives	• Provide an advanced understanding of spectrum physics and its applications. • Study atomic and molecular spectroscopy techniques. • Explore the role of spectroscopy in laser diagnostics, material analysis, and astrophysics. • Analyze spectral line broadening mechanisms and their significance. • Develop experimental skills in spectroscopic techniques and data analysis.

9. Teaching and Learning Strategies	
Strategy	• Theoretical lectures covering advanced spectroscopy topics. • Problem-solving sessions and discussions on assignments and research. • Laboratory experiments on spectroscopy techniques and applications. • Research projects on recent developments in spectral analysis. • Research projects and reports on recent developments in laser technology.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1.	2	Review of fundamental spectroscopy concepts	Introduction to Advanced Spectrum Physics	Lecture	Assignments Exams
2.	2	Understanding spectral line broadening	Natural, Doppler and Pressure Broadening	Lecture	Reports & Exa
3.	2	Exploring atomic transitions	Selection Rules and Quantum Numbers	Lecture	Homework Quizzes
4.	2	Understanding molecular spectra	Rotational and Vibrational Spectroscopy	Lecture	Reports & Exa
5.	2	Analyzing electronic transitions	UV-Vis Spectroscopy and Absorption Mechanisms	Lecture	Assignments Exams
6.	2	Investigating fluorescence and phosphorescence	Time-Resolved and Steady-State Spectroscopy	Lecture	Lab Reports Quizzes
7.	2	Studying Raman spectroscopy	Raman Scattering and Applications	Lecture	Reports & Exa
8.	2	Exploring infrared spectroscopy	Fourier Transform Infrared (FTIR) Spectroscopy	Lecture	Homework Reports
9.	2	Understanding X-ray spectroscopy	X-ray Fluorescence and Absorption	Lecture & Rese Presentations	Lab Reports Exams
10.	2	Investigating laser spectroscopy	Laser-Induced Breakdown Spectroscopy (LIBS)	Lecture & C Studies	Practical Demonstration Reports
11.	2	Studying mass spectrometry principles	Ionization Techniques and Mass Analysis	Lecture Discussion	Research Repo Exams
12.	2	Exploring spectroscopy in astrophysics	Spectroscopic Analysis of Stars and Galaxies	Lecture & C Studies	Assignments Exams
13.	2	Investigating optical coherence spectroscopy	Low-Coherence Interferometry an Biomedical Applications	Lecture Discussion	Lab Reports Quizzes
14.	2	Studying future trends in spectroscopy	Advanced Spectroscopy and	Lecture & C Studies	Research Pape Oral Exam

			Quantum Applications		
15.	2	Final project presentations	Student Research Projects on Spectroscopy Applications	Lecture Discussion	Final Evaluatio Grading

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 a	
Main references (sources)	• *Molecular Spectroscopy* – (2006)
Recommended books and references (scientific journals, reports…)	• *Atomic Spectroscopy and Applications* – (2010)
Electronic References, Websites	

Course Description Form

1. Course Name: Introduction to Special Relativity
2. Course Code:
3. Semester / Year: 2024 / 2025
4. Description Preparation Date: 15 / 3 / 2025
5. Available Attendance Forms: In-person / Full-time
6. Number of Credit Hours (Total) / Number of Units (Total): 30h / 2 units
7. Course administrator's name (mention all, if more than one name)
Name: Prof. Dr. Laith A. Al-Ani Email: laithalani2003@nahrainuniv.edu.iq
8. Course Objectives

Course Objectives	1. Understand the foundational principles of special relativity. 2. Derive and apply key equations like Lorentz transformations. 3. Exploring physical phenomena such as time dilation, length contraction, and relativistic energy. 4. Gain confidence in solving problems and understanding real-world applications.
9. Teaching and Learning Strategies	
Strategy	• Lecture-based learning. • Technology-based learning. • Group learning. • Individual learning

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1st	2	What students will learn in the lecture The syllabus outlines the topics the course will cover, helping students understand its scope. It clarifies the learning objectives and what they are expected to achieve by the end of the course. Assessment and Grading: Students will know how they will be evaluated (e.g., exams, problem sets, projects) and the weight of each component in their final grade. This transparency helps students plan their efforts and prioritize their work.	Special Relativity Syllabus Structure		
2nd	2	students will Understand: the concept of reference frames and their role in describing motion. Grasp the law of inertia and its implications for the behavior of objects.	**1.** Concept of Reference Frames 2. The Law of Inertia (Newton's First Law	○ Lecture-based learning. ○ Technology-based learning.	Quick test
3rd	2	Students will learn Galilean and Newtonian laws governing motion, distinguish between inertial and non-inertial frames, and explore Galilean relativity and transformations. They will understand fictitious forces like the Coriolis force and see how classical mechanics' limitations lead **to** special relativity**.**	1. Galilean and Newtonian Laws 2. Distinction Between Inertial and Non-Inertial Reference Frames 3. Assumptions of Galilean Relativity		

4th	2	Students will learn about the **luminiferous ether**, a hypothetical medium for light propagation, and how **Maxwell's equations** predicted a constant speed of light, conflicting with Galilean relativity. The **Michelson-Morley experiment** failed to detect the ether, showing light speed is invariant. This led Einstein to develop **special relativity**	1. Concept of the "Luminiferous ether 2. Maxwell's Equations and the Conflict 3. The Michelson-Morley Experiment 4. How the Experiment Led to Special Relativity	○ Group learning.	
5th	2	Students will learn that simultaneity is relative, and depends on the observer's motion. They will explore Einstein's postulates—the laws of physics are the same in all inertial frames, and the speed of light is constant—leading to time dilation, length contraction, They will understand the importance of relativity in modern physics, and use light cones in spacetime diagrams to visualize causality and the limits of communication.	1. What is Simultaneity? 2. The Terms Absolute and Relative 3. Transition to Relativity: Einstein's Two Postulates of Special Relativity 4. What is the Importance of Relativity? 5. Light Cones in a 3D Diagram and Their Justifications	○ Individual learning	
6th	2	Mid Exam 1			
7th	2	Students will learn the **main effects of Einstein's theories**, including **time dilation**, where moving clocks run slower, and the **twin paradox**, which illustrates this effect. They will explore the **light clock thought experiment** to derive the time dilation formula and understand how it arises from the invariance of the speed of light.	1. Main Effects Einstein's Theories 2. Time Dilation 3. What is a Light Clock 4. The Light Clock Thought Experiment 5. Derivation of Time Dilation 6. The Twin Paradox		

8th	2	Students will learn that length contraction means moving objects appear shorter in the direction of motion, quantified by They will derive this using Lorentz transformations and explore related concepts like the ladder paradox, which highlights the role of simultaneity. These ideas challenge classical notions of space and are crucial for understanding relativistic effects.	1. Concept of Length Contraction 2. Definition of Length Contraction 3. Derivation of Length Contraction 4. What is the Ladder Paradox		
9th	2	Students will understand the mathematical derivation of relativistic momentum. In addition, the student will be able to understand how momentum is conserved in relativity..	1. Limitations of Newtonian Momentum 2. Relativistic Momentum: 3. Derivation of Relativistic Momentum		
10th	2	They will learn the definition of relativistic momentum and its dependence on the Lorentz factor. They will understand the mathematical derivation of relativistic momentum. They will understand how momentum is conserved in relativity.	1. Relativistic Energy and Mass-Energy Equivalence 2. Relativistic Kinetic Energy 3. Derivation of Relativistic Energy 4. Energy-Momentum Relation		
11th	2	Students will understand how relativity redefines momentum and energy. They will learn to solve problems related to high-speed motion and energy conversions. These concepts are fundamental to understanding particle accelerators, cosmic rays, and nuclear reactions. relativity unifies mass, energy, and momentum.	1. Applications of Relativistic Momentum and Energy • Particle Accelerators: • Relativistic Collisions: • Astrophysical Phenomena 2. Problem-Solving and Thought Experiments		
12th	2	Mid Exam 2			

13th	2	Students will learn the relativistic Doppler effect, which describes how the frequency of light changes for moving observers, They will explore its applications in astronomy, such as redshift, Hubble's Law, and cosmic microwave background analysis. Through exercises, they will solve problems involving frequency shifts and velocities, applying these concepts to real-world astronomical observations.	1. Relativistic Doppler Effect 2. Applications in astronomy and cosmology 3. Exercises on the relativistic Doppler effect		
14th	2	Students will review key concepts and equations in special relativity, engage in group discussions to solve advanced problems, and demonstrate their understanding through a summative assessment (test or project presentation). The course concludes with a Q&A session to address final questions and reflect on the material, ensuring a comprehensive understanding of relativity and its applications.	1. Comprehensive Review of Key Concepts and Equations 2. Group discussions on advanced problems 3. Question and Answer Session		
15th	2	Students will learn the basics of general relativity, including gravity as spacetime curvature and gravitational time dilation. They will explore theoretical implications like the twin paradox and the impossibility of faster-than-light travel, and discuss philosophical insights on how relativity reshapes our understanding of space, time, and reality	1. Introduction to general relativity (basic concepts). 2. Discussion of gravitational time dilation and curvature of spacetime 3. Theoretical implications: Twin paradox and faster-than-light travel.		

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.

- Performance Test (Home Work) (15%)
- Challenge Test (10%)
- Mid Exam (75%)

12. Learning and Teaching Resources	
Required textbooks (curricular books, if any)	Not available
Main references (sources)	1) *Spacetime Physics: Introduction to Special Relativity by Edwin F. Taylor and John Archibald Wheeler (1992).* ISBN 13: 9780716723271 :Publisher: W. H. Freeman, 2) *Introduction to Special Relativity by Robert Resnick (1991).* ISBN: 978-0-471-71725-6: :Publisher: Wiley
Recommended books and references (scientific journals, reports…)	1) *Special Relativity by A.P. French (1968)*
Electronic References, Websites	/

8	2	Academic	Vibrational energy Harmonic vibration of diatomic	Lecture	discussion
9	2	Academic	AnHarmonic vibration of diatomic ''Morse potential''	Lecture	discussion
10	2	Academic	Examples	Lecture	discussion
11	2	Academic	Vibration-Rotation of molecule	Lecture	discussion
12	2	Academic	Electronic energy and spectra	Lecture	discussion
13	2	Academic	Raman spectra	Lecture	discussion
14	2	Academic	Examples	Lecture	discussion
15	2	Academic	Exam	Lecture	Exam

11.

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
40% mid exam+ discussion+ solving homework+ reports
60% final exam

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Fundamental of molecule spectroscopy By :w.s.struve
Main references (sources)	الفيزياء الجزيئة د.عصام احمد محمود , د.خالد عبدالله
Recommended books and references (scientific journals, reports…)	All related international lectures and researcl were dependent
Electronic References, Websites	All books and global sites in the internet

Course Description Form

1. Course Name:
First
2. Course Code:
3. Semester / Year:
2024–2025
4. Description Preparation Date:
5. Available Attendance Forms:
6. Number of Credit Hours (Total) / Number of Units (Total)
45
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	• **Identifying the concept of nanotechnology and the historical development of Nano science and technology, forming the energy gap, and estimating energy levels.** • **The most important methods used to measure nanomaterial** • **Formation and characterization of nano layers, nano applications,** • **Synthesis and fabrication of nanoparticles, characterization and application of nanoparticles,** • **Top–down nanostructure techniques, Nano devices and applications.** • **The most important nanomaterials and how to prepare them**

9. Teaching and Learning Strategies	
Strategy	Lectures taught in person in halls as well as electronic lectures

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2		Identifying the concept of nanotechnology and the historical development of Nano science and technology, forming the energy gap, and estimating energy levels.	In presence method	Participation
2	2		The most important methods used to measure nanomaterial	In presence method	Daily Quiz & participation
3	2		Formation and characterization of nano layers, nano applications,	In presence method	Daily Quiz & participation
4	2		Mid Examination	In presence method	
5	2		Top-down synthesis and fabrication of nanoparticles, characterization and application of nanoparticles, nanostructure techniques, nanodevices and applications.	In presence method	Daily Quiz & participation
6	2		The most important nanomaterials and how to prepare them	In presence method	Daily Quiz & participation
7	2		Getting to know the concept of nanotechnology and the historical development of nanoscience and technology, forming the energy gap, and estimating energy levels.	In presence method	Daily Quiz & participation
8	2		Examination	In presence method	
9	Final examination				

11. Course Evaluation
1.Daily exams 10% 2.Homework assignments 10% 3.mid exam 10% 4. Try exam 10% 5. (1.+2.+3.+4.)Quarterly quest 40% 6. Final exam 60%

12. Learning and Teaching Resources	
Required textbooks (curricular books, if any)	1.Nanotechnology and Nanoelectronics Materials, Devices, Measurement Technique
Main references (sources)	2.Fundamentals of Nanotechnology
Recommended books and references (scientific journals, reports…)	3.Nanostructures and Nanomaterial's synthesis, properties and application
Electronic References, Websites	4. New trends in Nanotechnology and Nanoelectronics Materials, Devices, Measurement Technique

First Course- Nuclear physics -

Course description

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

أ. Pro. Dr. Kareem Khalaf Mohammad (theoretical)

ب. Essam. mohamed Rasheed (practical)

ت. Saja hazem(practical)

ث. Suhaeeb abd allha(practical)

1. Educational Institution	University Al-Nahrain- College Science
2. University Department / Center	Department Physics
3. Course name/code	Nuclear Physics
4. Programs in which it enters	-
5. Forms of attendance available	mandatory attendance
6. Semester/year	Quarterly
7. Number of hours of study ((total	hours per week total 60 hours 3
8. Date this description was prepared	2024-2025
9. Course objectives	

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.

10. Learning outcomes and methods of teaching, learning and assessment
أ- knowledge and understanding 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 - Subject-specific skills
Teaching and learning methods
- Theoretical lectures - Asking students a set of thinking questions during the lectures for specific topics. - Giving students homework that requires finding self-solutions.
Evaluation methods
- daily tests - Monthly exams - Homework and student interaction in discussion sessions
Thinking skills: Scientific problem solving skills- Giving students problems that need to be solved by referring to external references that can be found via the Internet
- General and transferable skills (other skills related to employability and personal development). - Follow up on the scientific development of curricula for international universities via the Internet

Course Structure .11

Evaluation method	education method	Unit/course or topic name	Required learning outcomes	Hours	Week
Oral and written exam	theoretical) (	Background and basic nuclear properties	Historical review and general introduction The atomic mass unit Energy unit Basic nuclear properties	4	1
Oral and written exam	theoretical) (	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	4	2
Oral and written exam	theoretical) (	Yukawa's mesons field theory, Nuclear binding energy, average binding energy	Yukawa's mesons field theory, Nuclear binding energy	4	3
Oral and written exam	theoretical) (	Nuclear forces, Separation energy of nuclear particle	Nuclear forces, Separation energy of nuclear particle (alpha neutron, proton), Abundance systematic of the stable nuclides	4	4
Oral and written exam	theoretical) (	Nuclear models	Nuclear models, Electron proton hypothesis, Prout hypothesis	4	5
Oral and written exam	theoretical) (	Liquid drop model, mass parabola	Liquid drop model, Mass parabola	4	6
		Mid Exam-1	Mid Exam		7
Oral and written exam	theoretical) (	Shell model	Shell model , potential, Finite and infinite square potential, harmonic potential	4	8
Oral and written exam	theoretical) (	Shell model and optical model	Spin orbit potential, Predictions of shell model, Optical model	4	9
Oral and written exam	theoretical) (	Interaction of radiation with matter	Interaction of radiation with the matter, Statistical nature of radiation	4	10
Oral and written exam	theoretical) (	Interaction of radiation with matter	Heavy charge particles, Light charge particles,	4	11
Oral and written exam	(theoretical	Interaction of radiation with matter	Neutrons, Electromagnetic radiation,	4	12
Oral and written exam	theoretical) (	Exposure and dose	Exposure and dose principles,	4	13
Oral and written exam	theoretical) (	Shielding	Shielding principles	4	14
		Mid Exam-2	Mid Exam-2	4	15

Infrastructure	
➢ 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	:Required readings Basic Texts Course Books Other ▪
/	Special requirements (including, for example, workshops, courses, software (and websites
NON	Social services (including guest lectures, professional training (and field studies

Acceptance .12	
NON	Prerequisites
10	Less number of students
40	More number of students

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.

Course Description Form

1. Course Name:
Solid State Physics I
2. Course Code:
PHYS4102
3. Semester / Year:
1st course / 4th year
4. Description Preparation Date:
1/9/2024
5. Available Attendance Forms:
In person or Online
6. Number of Credit Hours (Total) / Number of Units (Total)
6 hours weekly (3 H theoretical + 3 H practical)
7. Course administrator's name (mention all, if more than one name)
Name: Dr. Mohammed Tariq Email: Mohammed.albaidhani@nahrainuniv.edu.iq

8. Course Objectives	
Course Objectives	• Teach the student the basic concepts of solid state physics. • Providing the student with the skills to discuss and solve applied problems related to solid state physics. • Linking theoretical concepts with practical applications.

9. Teaching and Learning Strategies	
Strategy	• Discussing the topics of the methodological book and auxiliary references • Theoretical lectures including problem solving and discussion of homework • Asking students for a set of thinking questions during lectures on specific topics. • Giving students homework that requires finding solutions on their own.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Learning	Introduction	Theoretical	Oral and writ
2	3	Learning	Condensed matter	Theoretical	Oral and written

3	3	Learning	Crystal structure Primitive cell	Theoretical	Oral and written
4	3	Learning	Bravais lattice Primitive Wigner Seitz	Theoretical	Oral and written
5	3	Learning	Amorphous, poly and single phases	Theoretical	Oral and written
6	3	Learning	Symmetry operation	Theoretical	Oral and written
7	3	Learning	Lattice types and Miller Indices	Theoretical	Oral and written
8	3	Learning	Inter planer distance	Theoretical	Oral and written
9	3	Learning	Properties of cubic systems	Theoretical	Oral and written
10	3	Learning	Planes in Hexagonal crystal	Theoretical	Oral and written
11	3	Learning	Direction in crystal	Theoretical	Oral and written
12	3	Learning	Filling factor	Theoretical	Oral and written
13	3	Learning	Some structures diamond, Nacl, ZnS	Theoretical	Oral and written
14	1	Learning	Test	Theoretical	Oral and written
15	3	Learning	Summary	Theoretical	Oral and written
16	3	exam	Final Examination	Theoretical	Oral and written

11. Course Evaluation

40 points (10 laboratory + 10 homework + 20 mid exam)
60 points (10 laboratory exam + 50 final exam)

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	1. Introduction to Solid State Physics (Wiley, Global Edition) By: Charles Kittel ISBN: 978-1-119-45620-9 (August 2018) (712 Pages). 2. Introduction to Solid State Physics (Wiley, India Edition) By: Charles Kittel ISBN-13: 978-8-126-57843-6 (2019) (712 Pages).
Main references (sources)	Solid State Physics (Revised Edition, Cengage Learning Asia Pte Ltd) By: Neil W. Ashcroft ISBN-13: 978-981-4369-89-3 (2016) (1294 Pages).
Recommended books and references (scientific journals, reports…)	Einfuhrung in die Festkorperphysik (6th Edition, Teubner GmbHWiesbaden) By: K. Kopitzki ISBN:978-3-8351-0144-9 (2007) (483 Pages).
Electronic References, Websites	Any website with the above titles. View solid state physics courses at reputable universities.

Solid State Physics Laboratory:

1. Assistant Lecturer Wsan Ali Khudair
2. Assistant Lecturer Zina Mowafaq Qaddouri
3. Assistant Lecturer Norhan Sabah Juma'a
4. Assistant Lecturer Mais Atallah Wahsh

Course Description Form

1. Course Name:
Laser physics (1)
2. Course Code:
3. Semester / Year:
2024-2025
4. Description Preparation Date:
2024
5. Available Attendance Forms:
Attending
6. Number of Credit Hours (Total) / Number of Units (Total)
8 hours per week (3 theoretical + 6 practical)
7. Course administrator's name (mention all, if more than one name)
Name: Dr. Narjis Zamil Abdulzahra Email: narjis.zamil@nahrainuniv.edu.iq
8. Course Objectives

Course Objectives	**1. Understand Laser Principles: Grasp the fundamental concepts of stimulated emission, population inversion, and the workings of different types of lasers.** **2. Analyze Laser Systems: Analyze the structure and functioning of laser cavities, optical components, and beam propagation.** **3. Apply Laser Technologies: Apply knowledge of lasers to real-world applications in medicine, communications, and industry.** **4. Experiment with Laser Setups: Conduct experiments to measure laser properties like wavelength, power, and coherence.** **5. Evaluate Advances in Laser Technology: Critically evaluate modern laser**

	technologies and emerging trends in laser research and development.

9. Teaching and Learning Strategies

Strategy	To teach Laser Physics, use hands-on experiments like optical alignment, problem-based learning for real-world laser issues, and simulations to visualize laser processes. Employ flipped classrooms for deeper in-class discussions and group projects for collaborative learning. Leverage diagrams, animations, and virtual labs for conceptual clarity, and assess through project-based work and student presentations for practical application.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1.	9	Laser physics and Principle of laser work	Laser physics and Principle of laser worl		
2.	9	The law of conservation of energy	Energy can never be created or destroyed		
3.	9	Bohr model of the atom	Energy Levels of the atoms		
4.	9	Understand the Rate of Stimulated Emission and Absorption	Absorption, Spontaneous emission Stimulated emission		
5.	9	Boltzmann distributions and thermal equilibrium	thermal equilibrium, Norma Population		
6.	9	Population inversion	Three Level Laser , Four Level Laser		
7.	9	Laser Generation	Requirements for Laser Action		
8.	9	Pumping Plan and Methods	Pumping Plan and Methods		
9.	9	Continuous wave and pulse operation	Pulsed and continuous laser output types		
10.	9	Lasers types	1. Gas Lasers A. CO_2 Laser: Used in cutting, engraving, and		

			medical applications like dermatology. B. Helium-Neon (He-Ne) Laser: Commonly used in alignment, holography, and scientific research. C. Argon Ion Laser: Used in medical treatments, such as ey surgery, and in scientific research. D. Nitrogen Laser: Used in pulsed UV ligh applications like spectroscopy and laser-induced fluorescence.		
11.	9	Solid-State Lasers	A. Nd Laser: Widely used in industrial applications like welding and medical procedures. B. Ruby Laser: One of the first lasers ever created, used in dermatology and tattoo removal. C. Ti Laser: Often used in femtosecond pulse generation for spectroscopy and imaging. D. Er Laser: Primarily used in dentistry and dermatology for precise cutting and ablation.		
12.	9	Semiconductor (Diode) Lasers	A. Red Diode Laser: Commonly found in laser pointers and barcode scanners. B. Infrared Diode Laser: Used in optical communication and night vision systems. C. Blue Diode Laser: Employed in Blu-ray		

			players and high-definition optical storage. D. Green Diode Laser: Often used in visual displays, laser light shows and scientific applications		
13.	9	Fiber Lasers	A. Erbium-Doped Fiber Laser (EDFA): Used in optical communications for signal amplification. B. Ytterbium-Doped Fiber Laser: Popular for material processing, welding, and cutting. C. Thulium-Doped Fiber Laser: Used in medical applications, such as tissue ablation and laser surgery. D. Raman Fiber Laser: Use for high-power laser system and spectroscopy.		
14.	9	Dye Lasers	A. Rhodamine 6G Dye Laser: Used in fluorescence and spectroscopy due to its tunable range. B. Coumarin Dye Laser: Tunable into the UV range, often used in biological and chemical research. C. Fluorescein Dye Laser: Applied in ophthalmology for laser treatments like retinal photocoagulation. D. Pyrromethene Dye Laser: Used in pulsed applications and high-energy experiments.		
15.	9	Excimer Lasers .	A. Argon Fluoride (ArF) Laser: Used in LASIK eye surgery and lithography for semiconductor manufacturing. B. Krypton Fluoride (KrF) Laser: Common in UV lithography for microelectronics and eye surgeries. C. Xenon Chloride (XeCl) Laser: Applied in		

			dermatology and ndustrial surface reatments. D. Xenon Fluoride (XeF) Laser: Utilized in researcl applications for UV light production and spectroscopy		

11. Course Evaluation

Course evaluation for a Laser Physics course typically includes a combination of assessments designed to gauge both theoretical understanding and practical skills. Students may be evaluated through written exams covering core laser concepts, quizzes on specific topics, and problem-solving assignments. Hands-on lab work plays a crucial role, where students are assessed based on their ability to conduct experiments, analyze data, and properly handle laser equipment. Additionally, project-based assessments and presentations allow students to demonstrate their understanding of laser applications in real-world scenarios. Participation in group projects and discussions also contributes to evaluating teamwork and communication skills.

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	
Main references (sources)	1.Laser Fundamentals" by William T. Silfvast (2nd Edition, 2004) 2." Lasers" by Anthony E. Siegman (1986)
Recommended books and references (scientific journals, reports…)	"Laser Fundamentals" by William T. Silfvast (2nd Edit 2004)
Electronic References, Websites	

كادر المختبر

1.زينه كميل

2.زينب حازم

3.زهراء سلمان

Module Aims, Learning Outcomes and Indicative Contents الإرشادية والمحتويات التعلم ونتائج الدراسية المادة أهداف	
Module Aims **المادة أهداف الدراسية**	1- Introducing students to the general basic concept of Medical Physics. 2- Understanding Mechanics of the Body. 3- Focusing on the theoretical aspects of the discussed subject material, with some examples added for clarification. 4- Introducing the student to the medical effects of the forces acting on the body.
Module Learning Outcomes **التعلم مخرجات الدراسية للمادة**	1- Students can understand the general concept of Medical Physics. 2- Students will understand the Mechanics of the Body. 3- Allow students to know about Fundamental Forces. 4- Learn about the Medical effects of gravitation forces. 5- Students can understand the Static Equilibrium, Stability and Elasticity of the body. 6- The ability to know about the Pressure System of the Body.
Indicative Contents **المحتويات الإرشادية**	Indicative content includes the following. 1- Introduction to Medical Physics. 2- The Fundamental Physical Constants. 3- The Mechanics of the Body. 4- Medical effects of gravitation forces. 5- Stability & Elasticity. 6- Friction.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	1- Discussing the topics of the curriculum book and supporting references 2- Theoretical lectures including problem solving and discussion of homework 3- Asking students, a set of thinking questions during the lectures for specific topics. 4-Giving students homework that requires finding self-solutions. 5-Giving students topics related to the curriculum to prepare a seminar.

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction To Medical Physics
Week 2	The Mechanics of the Body
Week 3	The Energy Household of the Body
Week 4	The Pressure System of the Body
Week 5	The Electrical System of the Body
Week 6	Fundamental Forces
Week 7	Medical effects of gravitation forces
Week 8	Static Equilibrium
Week 9	Stability
Week 10	Elasticity
Week 11	Friction
Week 12	Static friction
Week 13	The Pressure System Of The Body
Week 14	Final exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**

Required Texts	Medical Physics by Hasan Maridi , 3rd edition, 2020 Medical Physics Notes, 2023 https://www.tutorialsduniya.com/notes/medical-physics-notes/	

Course Description Form

1. Course Name:
Solid State Physics II
2. Course Code:
PHYS4202
3. Semester / Year:
2nd course / 4th year
4. Description Preparation Date:
1/9/2024
5. Available Attendance Forms:
In person or Online
6. Number of Credit Hours (Total) / Number of Units (Total)
6 hours weekly (3 H theoretical + 3 H practical)
7. Course administrator's name (mention all, if more than one name)
Name: Asst. Prof. Dr. Mohammed Tariq Email: Mohammed.albaidhani@nahrainuniv.edu.iq

8. Course Objectives	
Course Objectives	• Teach the student the basic concepts of solid state physics. • Providing the student with the skills to discuss and solve applied problems related to solid state physics. • Linking theoretical concepts with practical applications.
9. Teaching and Learning Strategies	
Strategy	• Discussing the topics of the methodological book and auxiliary references • Theoretical lectures including problem solving and discussion of homework • Asking students for a set of thinking questions during lectures on specific topics. • Giving students homework that requires finding solutions on their own.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Learning	Summery for the first semester	Theoretical	Oral and written

2	3	Learning	Introduction to Diffraction X-ray, neutron, electron	Theoretical	Oral and written
3	3	Learning	Methods of diffraction Laue, Rotating method, Powder method	Theoretical	Oral and written
4	3	Learning	Bragg diffraction law	Theoretical	Oral and written
5	3	Learning	Calculation of hkl for cubic systems from XRD patters	Theoretical	Oral and written
6	3	Learning	Brillouin zone Bragg plane	Theoretical	Oral and written
7	3	Learning	Crystal Binding Ionic, electronegativity Covalent, Metallic, Van der Waals, Hydrogen bonds	Theoretical	Oral and written
8	3	Learning	Bulk modulus	Theoretical	Oral and written
9	3	Learning	Compressibility, ductility, malleability, hardness	Theoretical	Oral and written
10	3	Learning	Crystal imperfection (defects)	Theoretical	Oral and written
11	3	Learning	Defects classification All types of defects	Theoretical	Oral and written
12	3	Learning	Lattice vibration Diatomic lattice Acoustic and optic modes	Theoretical	Oral and written
13	3	Learning	Origin of optic and acoustic branches Displacement patterns	Theoretical	Oral and written
14	1	Learning	Test	Theoretical	Oral and written
15	3	Learning	Summary	Theoretical	Oral and written
16	3	exam	Final Examination	Theoretical	Oral and written

11. Course Evaluation

40 points (10 laboratory + 10 homework + 20 mid exam)
60 points (10 laboratory exam + 50 final exam)

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	1. Introduction to Solid State Physics (Wiley, Global Edition) By: Charles Kittel ISBN: 978-1-119-45620-9 (August 2018) (712 Pages). 2. Introduction to Solid State Physics (Wiley, India Edition) By: Charles Kittel ISBN-13: 978-8-126-57843-6 (2019) (712 Pages).

Main references (sources)	Solid State Physics (Revised Edition, Cengage Learning Asia Pte Ltd) By: Neil W. Ashcroft ISBN-13: 978-981-4369-89-3 (2016) (1294 Pages).
Recommended books and references (scientific journals, reports…)	Einfuhrung in die Festkorperphysik (6th Edition, Teubner GmbHWiesbaden) By: K. Kopitzki ISBN:978-3-8351-0144-9 (2007) (483 Pages).
Electronic References, Websites	Any website with the above titles. View solid state physics courses at reputable universities.

Solid State Physics Laboratory:

1. Assistant Lecturer Wsan Ali Khudair
2. Assistant Lecturer Zina Mowafaq Qaddouri
3. Assistant Lecturer Norhan Sabah Juma'a
4. Assistant Lecturer Mais Atallah Wahsh

Course Description Form

1. Course Name:	
Healthy Physics	
2. Course Code:	
3. Semester / Year:	
2\ 4th	
4. Description Preparation Date:	
2025	
5. Available Attendance Forms:	
Traditional attendance and electronic attendance	
6. Number of Credit Hours (Total) / Number of Units (Total)	
2\ 2	
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. Understanding the Fundamentals of Radiation** Study different types of ionizing and non-ionizing radiation and their effects on living matter. Identify natural and artificial sources of radiation. **2. Interaction of Radiation with Living Tissues** Analyze the effects of radiation on cells and tissues. Understand mechanisms of radiation damage and cellular repair. **3. Radiation Protection** Apply radiation safety standards in medical and industrial environments. Learn methods to minimize radiation exposure and protect workers and the public. **4. Medical Applications of Radiation** Explore the use of X-rays and nuclear medicine in diagnosis and treatment. Understand the principles of radiation therapy for cancer treatment. **5. Radiation Measurement and Monitoring** Learn about devices used for radiation dose measurement. Apply techniques for environmental and radiation monitoring.

9. Teaching and Learning Strategies

Strategy	**1. Deep Understanding Approach** Connecting physics concepts to health and medical applications, such as understanding radiation effects on living tissues. Using real-world examples to illustrate the role of physics in healthcare. **2. Active and Interactive Learning** Group discussions: Engaging in conversations about radiation safety. **3. Utilizing Modern Technology** Using interactive presentations and 3D visualizations to explain radiation interactions with the human body. **4. Collaborative Learning** Forming team-based studies on topics like radiation detection devices or X-ray imaging techniques. **5. Continuous Assessment** Conducting regular quizzes that include analytical and application-based questions. Assigning students to deliver short presentations explaining specific topics in a simplified manner.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
First	2	Understanding the basic principles of radiation therapy, its techniques, and its effects on tissues	Introduction to Radiotherapy Physics	1.Lectures and theoretical presentations. 2. Interactive learning: Engaging in group discussions, Q&A sessions to strengthen understanding and link concepts together. 3. Assessments	1.Quizzes. 2.Assignments and seminars. 3. Final exams. 4.Class discussions. 5.Formative assessment.
Second	2				
Third	2				
Fourth	2	Understanding the types of radiation interactions with matter, such as absorption, scattering, and	Interactions of Radiation with Matter		
Fifth	2				

		decay, and their effects on cells and tissues.		and tests: Conducting short quizzes or projects to evaluate deep understanding of the learned concepts.	
Sixth	2	Understanding the fundamentals and techniques of projection X-ray imaging and how to use them to obtain accurate images of internal organs.	Projection Radiography		
Seventh	2				
Eighth	2	Understanding the techniques of mammography and using them for the early detection and diagnosis of breast cancer.	Mammography		
Ninth	2				
tenth	2	Understanding the techniques of computed tomography (CT) imaging and how to use them to obtain detailed cross-sectional images of internal organs.	Computed Tomography		
eleventh	2				
Twelfth	2	Understanding the physical principles of ultrasound techniques and their use in medical imaging for diagnosing various conditions.	Physics of Ultrasound		

Thirteenth	2	Understanding ultrasound imaging techniques and how to use them for diagnosing various medical conditions.	Ultrasound Imaging		
Fourteenth	2	Understanding the physical principles of magnetic resonance imaging and its use in medical imaging to obtain detailed images of organs and tissues.	Physics of Magnetic Resonance		
Fifteenth	2	review	review		

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)	
Main references (sources)	"Introduction to Radiological Physics and Radiation Dosimetry", Frank H. Attix
Recommended books and references (scientific journals, reports…)	"Radiation Therapy Physics", William R. Hendee & E. Russell Ritenour
Electronic References, Websites	

Course Description Form

1. Course Name:
Laser physics (II)
2. Course Code:
3. Semester / Year:
2024–2025
4. Description Preparation Date:
2025
5. Available Attendance Forms:
Attending
6. Number of Credit Hours (Total) / Number of Units (Total)
8 hours per week (2 theoretical + 1 Toterial)
7. Course administrator's name (mention all, if more than one name)
Name: Dr. Narjis Zamil Abdulzahra, Zeinah Kumail Abdaldeen Email: Narjis .Zamil@nahrainuniv.edu.iq
8. Course Objectives

Course Objectives	• Develop an advanced understanding of laser physics and its applications. • Explore different types of lasers and their operational principles. • Analyze the interaction of laser beams with matter and its applications. • Understand laser stability, modes, and amplification processes. • Apply laser technologies in industrial, medical, and scientific fields.

9. Teaching and Learning Strategies

Strategy	• Theoretical lectures covering advanced laser concepts. • Problem-solving sessions and discussions on assignments and research. • Laboratory experiments to demonstrate laser principles. • Research projects and reports on recent developments in laser technology.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1.	3	Understanding laser beam properties	Beam Quality, Divergence, and Gaussian Beams	Lecture	Assignments Exams
2.	3	Studying laser modulation and Q-switching	Q-Switching and Mod Locking	Lecture	Reports & Exam
3.	3	Exploring nonlinear optical effects	Frequency Doubling, Mixing, and Harmonic	Lecture Problem-Solvi	Homework Quizzes
4.	3	Investigating laser pulse generation	Pulsed Laser Operatio and Techniques	Lecture	Reports & Exam
5.	3	Laser material processing	Laser material processing	Lecture	Assignments Exams
6.	3	Understanding laser-material interactions	Laser Welding	Lecture	Lab Reports Quizzes
7.	3	Understanding laser-material interactions	Laser dilling	Lecture Discussion	Reports & Exam
8.	3	Understanding laser-material interactions	Laser Cutting	Lecture	Homework Reports
9.	3	Understanding laser-material interactions	Laser Engraving	Lecture Research Presentations	Lab Reports Exams
10.	3	Exploring medical laser applications	Lasers in Surgery, Dentistry, and Ophthalmology	Lecture & C Studies	Practical Demonstration Reports
11.	3	Understanding laser safety regulations	Eye Safety, Power Control, and Hazards	Lecture Discussion	Research Repor Exams
12.	3	Investigating fiber optics and laser communication	Fiber Lasers and Optic Fiber Systems	Lecture & C Studies	Assignments Exams
13.	3	Exploring cutting-edge laser technologies	Ultrafast Lasers, Free Electron Lasers, and Future Trends	Lecture Discussion	Lab Reports Quizzes
14.	3			Lecture & C Studies	Research Paper Oral Exam
15.	8	Final project presentations	Student Research Projects on Laser Applications	Lecture Discussion	Final Evaluatio Grading

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 any)	

Main references (sources)	Fundemantial of laser physics (2007)
Recommended books and references (scientific journals, reports…)	Principles of laser (o.svelto 1989)
Electronic References, Websites	

Course Description Form

1. Course Name:

Solar Physics

2. Course Code:

PHYS425

3. Semester / Year:

Fourth/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)

2 Hours/2 Units

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	1. Learn the basics of solar physics and study the laws that govern this science. 2. Understanding the structure and composition of the Sun's interior, including its core, radiative zone, and convective zone. 3. Studying the Sun's atmosphere, including its layers such as the photosphere, chromosphere, and corona. 4. Understanding solar phenomena such as sunspots, solar flares, coronal mass ejections (CMEs), and solar prominences. 5. Explaining observational techniques and instruments used in solar physics, including telescopes, and space-based observatories.

9. Teaching and Learning Strategies

Strategy	1. Ask direct oral questions. 2. Scientific reports and daily assignments. 3. Short daily quizzes. 4. Give various problems at the end of each chapter to guide the student to the correct scientific solution. 5. Monthly exams with various questions and multiple choices. 6. Final exams.

10. Course Structure					
Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**
1	2	Students have general knowledge of the solar system	Introduction	Whiteboard and LCD	Oral and written exams
2	2	Students can understand the importance of studying the sun	A Brief Overview of the Sun.	Whiteboard and LCD	Oral and written exams
3	2	Students can learn the basic information and physical properties of the sun	Solar Parameters	Whiteboard and LCD	Oral and written exams
4	2	Students can learn the observation techniques in solar physics	Instrumentation and Observational Techniques in Solar Physics.	Whiteboard and LCD	Oral and written exams
5	2	Students can understand the inner layers of the sun	Solar Interior.	Whiteboard and LCD	Oral and written exams
6	2	Students know about The Active and Explosive Sun	The Active and Explosive Sun.	Whiteboard and LCD	Oral and written exams
7	2	Students can learn the Solar Magnetic field	Solar Magnetic field.	Whiteboard and LCD	Oral and written exams
8	2	Students can understand the outer layers of the sun	Solar Atmosphere.	Whiteboard and LCD	Oral and written exams
9	2	Evaluate the students	First mid exam	Whiteboard and LCD	Oral and written exams
10	2	Students study some activities of the sun like sunspots, solar flares.	Solar Activity-Part 1	Whiteboard and LCD	Oral and written exams
11	2	Students study some activities of the sun like coronal mass ejections	Solar Activity-Part 2	Whiteboard and LCD	Oral and written exams

		(CMEs), and solar prominences			
12	2	Students study the rotation of the sun and compare it to the rotation of the Earth.	Solar Rotation.	Whiteboard and LCD	Oral and written exams
13	2	Students have knowledge about the solar eclipses and its types	Solar Eclipses	Whiteboard and LCD	Oral and written exams
14	2	Evaluate the students	Second mid exam	Whiteboard and LCD	Oral and written exams
15	2	The student prepares a report on some topics related to the sun	Seminar	Whiteboard and LCD	Oral and written exams

11. Course Evaluation

40 Marks (Mid exam + Homework+ Quizzes)
60 Marks Final Exam

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Physics of the Sun By: Dermott J. Mullan @Taylor & Francis Group, LLC 2009
Main references (sources)	New Millennium Solar Physics By : Markus J. Aschwanden @Springer Nature Switzerland AG 2019
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	