Academic Program Description Form

University Name: Al Nahrain University

Faculty/Institute: College .of Science

Scientific Department: Physics

Academic or Professional Program Name: higher education

Final Certificate Name:Diploma,MSc,Ph.D

Academic System: Semester

Description Preparation Date: 2025–2026

File Completion Date: 2025/11/3

Signature: Saad N. Abood

Head of Department Name:

Prof.Dr Saad Naji Abood

Date: 2025/11/

Signature:

Scientific Associate Name:

Manal Adnan Saleh

Date: 3/ 11/ 2025

The file is checked by:

Department of Quality Assurance and University Performance

Director of the Quality Assurance and University Performance Department:

Date:

Signature:

Approval of the Dean

Prof. Dr. Asmaa H. Mohammed

Ministry of Higher Education and Scientific Research
Al-Nahrain University / College of Science
Republic of Iraq
Dean's office

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**			ماجستير
				ماجستير
				ماجستير
				ماجستير
				ماجستير
				ماجستير
	2	English Language II	MSc.	ماجستير
	2	Advanced Nuclear physics	MSc.	ماجستير
	2	Advanced Quantum mechanics	MSc.	ماجستير
	2	Electromagnetic theory	MSc.	ماجستير
	2	Charged particles Optics	MSc.	ماجستير
	2	Advanced Plasma physics	Ph.D	دكتوراه
	2	Statistical mechanics	Ph.D	دكتوراه
	2	Advance Solid state physics II	Ph.D	دكتوراه
	2	English Language	Ph.D	دكتوراه
	2	Nuclear models	Ph.D	دكتوراه
	2	Radiological physics	Ph.D	دكتوراه

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

م.د.احمد شاكر	مدرس دكتور	علوم الفيزياء	نظرية			1	
أ.م.نور محمد حسن	استاذ مساعد	علوم الفيزياء	بصريات			1	
م.د.عمر اياد	مدرس دكتور	علوم الفيزياء	نظرية			1	
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.ابتسانم 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				
								✔	✔	✔	✔	اساسی	English Language I	MSc	ماجستير
								✔	✔	✔	✔	اساسی	Advanced Nuclear physics		
								✔	✔	✔	✔	اساسی	Advanced Quantum mechanics		
								✔	✔	✔	✔	اساسی	Electromagnetic theory		
								✔	✔	✔	✔	اختياري	Charged particles optics		

دكتوراه	Ph.D																		
		English Language	اساسي	✔	✔	✔	✔												
		Advanced Plasma physics	اساسى	✔	✔	✔	✔												
		Advance Solid state physics II	اساسى	✔	✔	✔	✔												
		Radiological physics	اختياري	✔	✔	✔	✔												
		Nuclear models	اختياري	✔	✔	✔	✔												
		Statistical mechanics	اساسى	✔	✔	✔	✔												

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

الكورس الاول

Course Description Form

1. Course Name:
English Language
2. Course Code:
3. Semester / Year:
Diploma degree
4. Description Preparation Date:
1/9/2025
5. Available Attendance Forms:
In person or Online
6. Number of Credit Hours (Total) / Number of Units (Total)
2 hours weekly (2 H theoretical)
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	**Develop Reading Skills** • **Understand main ideas and supporting details in academic texts.** • **Use effective reading strategies such as skimming and scanning.** **Improve Writing Skills** • **Write clear and well-organized academic paragraphs and short essays.** • **Use linking words and correct grammar in formal writing.** **Enhance Study Skills** • **Take effective notes and summarize key information.** • **Manage study time and organize academic tasks efficiently.** **Build Academic Confidence** • **Express ideas clearly in both written and spoken English.** • **Develop independent learning and critical thinking abilities.**

9. Teaching and Learning Strategies	
Strategy	• Discussing textbook topics and supporting references. • Theoretical lectures including solutions to examples and homework discussions. • Asking students to pose a series of reflective questions during lectures on specific topics. • Assigning students homework that requires their own solutions.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1.	2	Learning	Introduction	Theoretical	Oral and written
2.	2	Learning	Unit 1: The Natural World	Theoretical	Oral and written
3.	2	Learning	Unit 2: Language and Communication	Theoretical	Oral and written
4.	2	Learning	Unit 3: Education and Learning	Theoretical	Oral and written
5.	2	Learning	Unit 4: Health and Medicine	Theoretical	Oral and written
6.	2	Learning	Unit 5: Business and Money	Theoretical	Oral and written
7.	2	Learning	Unit 6: The Media	Theoretical	Oral and written
8.	2	Learning	Unit 7: Science and Technology	Theoretical	Oral and written
9.	2	Learning	Unit 8: The Environment	Theoretical	Oral and written
10.	2	Learning	Unit 9: Culture and Society	Theoretical	Oral and written
11.	2	Learning	Unit 10: The Future	Theoretical	Oral and written
12.	1	Learning	Test	Theoretical	Oral and written
13.	2	Learning	Summary	Theoretical	Oral and written
14.	2	exam	Final Examination	Theoretical	Oral and written

11. Course Evaluation

50 points (10 homework + 40 mid exam)
50 points (50 final exam)

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	*Headway Academic Skills: Reading, Writing, and Study Skills – Level 2 (Student's Book)* Richard Harrison & Terry Phillips Second Edition (الطبعة الثانية) Oxford University Press 2011 ISBN: 978-0-19-474159-2

Main references (sources)	**Harrison, R., & Phillips, T. (2011).** *Headway Academic Skills: Reading, Writing, and Study Skills – Level 2 (2nd ed.).* Oxford University Press. **Soars, L., & Soars, J. (2019).** *New Headway: Intermediate Student's Book (5th ed.).* Oxford University Press. **Jordan, R. R. (1999).** *Academic Writing Course: Study Skills in English (3rd ed.).* Longman.
Recommended books and references (scientific journals, reports…)	○ *ELT Journal* – Oxford University Press ○ *English for Specific Purposes* – Elsevier ○ *TESOL Quarterly* – Wiley ○ *British Council Teaching English Reports* ○ *Cambridge Assessment English Research Papers*
Electronic References, Websites	1 www.oxfordlearnersdictionaries.com 2 www.britishcouncil.org/learnenglish 3 www.cambridgeenglish.org 4 www.esl-lab.com

Course Description Form

1. Course Name:
Mathematical Physics
2. Course Code:
3. Semester / Year:
Diploma of physics / 1st semester
4. Description Preparation Date:
12/10/2025
5. Available Attendance Forms:
Attendance is mandatory
6. Number of Credit Hours (Total) / Number of Units (Total)
30 hours / 2 hours weekly
7. Course administrator's name (mention all, if more than one name)
Name: **Assist. Prof. Dr. Hassan N. Hashim** Email: hassan.hashim@nahrainuniv.edu.iq
8. Course Objectives

Course Objectiv	• Teaching the students the principles of Mathematical Physics. • Give the Students the ability and experience to solve and discuss the problems related with Mathematical Physics. • Make a connection between the theoretical principles and the experimental applications.

9. Teaching and Learning Strategies

Strategy	1. Discussing the topics of the methodological book and auxiliary references. 2. Theoretical lectures including problem solving and discussion of homework 3. Asking students for a set of thinking questions during lectures on specific topics. 4. Giving students homework requires finding solutions on their own. 5.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2		**Matrices and Determinants**	Theoretical	
2	2		**Special functions: The Factorial Function and Gamma Function**	Theoretical	Quiz
3	2		**The Gamma function of negative number**	Theoretical	Quiz
4	2		**Some important formulas involving Gamma Function**	Theoretical	Quiz
5	2		**Solutions of some Examples**	Theoretical	Quiz
6	2		**Beta Function**	Theoretical	Quiz
7	2		**Other forms of Beta Function**	Theoretical	Quiz
8	2		**The Relation between Gamma and Beta functions**	Theoretical	Quiz
9	2		**Test #1**	Theoretical	Written Exam
10	2		**The Error function**	Theoretical	Quiz
11	2		**Series: Solutions of Differential Equations**	Theoretical	Quiz
12	2		**Legendre's Equation**	Theoretical	Quiz
13	2		**Test #2**	Theoretical	Written Exam
14	2		**Summary**	Theoretical	Quiz
15	2		**Preparatory Week**	Theoretical	
16	3		**Final Exam**	Theoretical	Written Exam

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)	Mathematical Methods in the Physical Sciences" By: Mary L. Boas, 3rd Edition, 2006. https://www.christs.cam.ac.uk/sites/default/files/inline-files/0a187866618ca3049030ec5014860ae8-original.pdf
Main references (sources)	**Advanced Calculus**, 3rd Edition, Angus E. Taylor, and W. Robert Mann, 1983.
Recommended books and references (scientific journals, reports…)	Any Book entitled "Mathematical Physics"
Electronic References, Websites	Any website dealing with math. Physics or the subjects that covered in the course

Course Description Form

1. Course Name:

Quantum Mechanics

2. Course Code:

3. Semester / Year:

First Semester/ Diploma

4. Description Preparation Date:

01/09/2025

5. Available Attendance Forms:

1) Classroom Lecture , 2) Electronic Classroom

2) Number of Credit Hours (Total) / Number of Units (Total)

2 Hrs. a week (30 Hrs. Total) / 2 untis

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

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

4) Course Objectives

Course Objectives	For a postgraduate diploma in physics with a focus on Quantum Mechanics (QM), the syllabus should strike a balance between deepening foundational understanding and introducing advanced concepts and applications. Here's a suggested 15-week semester syllabus tailored for students who already hold a BSc in physics: • Mathematical Foundations & Postulates • Angular Momentum & Spin • Hydrogen Atom & Atomic Structure • Quantum Statistics & Identical Particles • Approximation Methods • Scattering Theory • Nuclear Applications & Safety

5)

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

6) Course Structure

Week	Hrs.	Unit title / Subjective	Learning method	Evaluation method
1	2	Hilbert spaces, operators, eigenvalues	Classroom lecture	
2	2	Dirac notation and bra-ket formalism	Classroom lecture	
3	2	Unbounded State and Bound states	Classroom lecture	
4	2	Harmonic oscillator	Classroom lecture	
5	2	Tunneling and Quantum Barriers	Classroom lecture	
6	2	Orbital angular momentum and spin operators	Classroom lecture	
7	2	Spin-½ systems, Pauli matrices	Classroom lecture	
8	2	Addition of angular momentum	Classroom lecture	
9	2	Fine structure and Zeeman effect	Classroom lecture	
10	2	Atomic energy levels and transitions	Classroom lecture	
11	2	Bosons vs. fermions Pauli exclusion principle	Classroom lecture	
12	2	Fermi-Dirac and Bose-Einstein statistics	Classroom lecture	
13	2	Applications in nuclear shell model and reactor	Classroom lecture	
14	2	physics	Classroom lecture	
15	2	Approximation Methods Scattering Theory & Nuclear Applications	Classroom lecture	

7) 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: Classroom Discussion (5 Marks) Quizzes (5 Marks) Midterm Exam (20 Marks)	
8) 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:

Scientific Methodology

2. Course Code:

3. Semester / Year:

Diploma Physics / 1st semester

4. Description Preparation Date:

12/10/2025

5. Available Attendance Forms:

Attendance is mandatory

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

30 hours / 2 hours weekly

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

Name: **Assist. Prof. Dr. Hassan N. Hashim**
Email: hassan.hashim@nahrainuniv.edu.iq

8. Course Objectives

1. **Understanding the Nature of Scientific Inquiry**
   - Explain what science is and how it differs from other ways of knowing.
   - Understand the goals, assumptions, and limitations of the scientific method.

2. **Developing Skills in Research Design**
   - Learn how to formulate research questions and hypotheses.
   - Understand different types of research (e.g., experimental, observational, qualitative, quantitative).
   - Design basic experiments or studies with appropriate controls and variables.

3. **Master Data Collection and Analysis Techniques**
   - Learn methods of gathering reliable and valid data.
   - Gain introductory skills in statistical or qualitative analysis.
   - Interpret and present data objectively.

4. **Critical Thinking and Problem Solving**
   - Evaluate the quality of scientific literature and research reports.
   - Identify biases, logical fallacies, and methodological flaws.

5. **Ethical and Responsible Research Conduct**

- Understand the ethical principles governing research (e.g., informed consent, confidentiality, integrity).
- Learn about institutional review boards (IRBs) and ethical approval processes.

6. **Effective Scientific Communication**
   - Develop skills to write scientific reports and papers.
   - Learn how to cite sources properly and avoid plagiarism.
   - Practice presenting scientific findings clearly and accurately.
7. **Application of Scientific Thinking in Real-World Contexts**
   - Encourage application of the scientific method to everyday problems and professional practice.
   - Foster interdisciplinary thinking where scientific methods can be applied to various fields.

9. Teaching and Learning Strategies

Strategy	
	1. **Lectures** to explain key concepts and theories. 2. **Problem-based learning** to apply the scientific method to real-world scenarios. 3. **Research projects** for hands-on experience. 4. **Group work** to encourage collaboration. 5. **Case studies** to analyze real research. 6. **Workshops** on tools like statistics and citation. 7. **Use of technology** (e.g., virtual labs, online quizzes). 8. **Assessments** like quizzes, presentations, and reports. 9. **Ethics role-plays** to explore responsible research conduct. 10. **Reflection activities** for self-assessment and critical thinking.

10. Course Structure

Week	Hours	Unit or subject name	Learning method	Evaluation method
1	2	**Introduction to Science and Scientific Method** • What is science? • The nature and goals of scientific inquiry • Steps in the scientific method	Theoretical	
2	2	**Philosophy of Science**	Theoretical	Quiz
3	2	**Formulating Research Questions and Hypotheses** • Identifying problems • Operational definitions • Developing testable hypotheses	Theoretical	Quiz
4	2	**Literature Review and Sources of Information** • Academic databases • Critical reading and synthesis • Avoiding plagiarism	Theoretical	Quiz
5	2	**Research Design I: Quantitative Methods** • Experimental, quasi-experimental, and correlational designs	Theoretical	Quiz

6	2	**Research Design II: Qualitative Methods.**	Theoretical	Quiz
7	2	**Variables, Measurement, and Sampling** • Types of variables • Scales of measurement	Theoretical	Quiz
8	2	**Data Collection Techniques** • Surveys, observations, experiments, and secondary data	Theoretical	Quiz
9	2	**Data Analysis and Interpretation (Quantitative)**	Theoretical	Written Exam
10	2	**Data Analysis and Interpretation (Qualitative)**	Theoretical	Quiz
11	2	**Ethics in Scientific Research**	Theoretical	Quiz
12	2	**Writing the Research Proposal** • Structure (Introduction, Method, Expected Results, References)	Theoretical	Quiz
13	2	**Presenting Scientific Work** • Oral and poster presentations • Peer review process	Theoretical	Written Exam
14	2	**Peer Review and Feedback** •Reviewing others' proposals • Incorporating feedback effectively	Theoretical	Quiz
15	2	**Course Wrap-Up and Final Project Submission** • Reflection on the scientific process • Future directions in research	Theoretical	
16	3	**Final Exam**	Theoretical	Written Exam

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 boo if any)	There is not a specific text book for scientific methodology.
Main references (sources)	Any related books or papers deals with scientific methodology.
Recommended books and references (scientific journals, reports…)	Any Book entitled "Scientific methodology"
Electronic References, Websites	Any website dealing with Scientific methodology or the subjects that covered in the course

Course Description Form

1. Course Name: **Advanced Nuclear Physics**

2. Course Code:

3. Semester / Year: First / 2025-2026

4. Description Preparation Date: September 2025

5. Available Attendance Forms: Attendance in class

6. Number of Credit Hours (Total) / Number of Units (Total): 35 hours /2 units

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

Name: Prof. Dr. Saad Naji Abood
Email: Saad.Abood@nahrainuniv.edu.iq

8. Course Objectives

Course Objectives	The objectives of teaching Advanced Nuclear Physics to graduate students include: 1. Understanding basic concepts: Enhancing students' knowledge of basic concepts in nuclear physics, such as nuclear reactions and particle physics. 2. Applying theories: Training students to apply theories and models to analyze nuclear phenomena. 3- Developing research skills: Encouraging students to conduct independent research in specific areas of nuclear physics. 4- Using modern technologies: Teaching students to use modern tools and techniques in nuclear experiments. 5- Data analysis: Developing skills in analyzing quantitative and qualitative data related to nuclear experiments. 6- Scientific Communication: Enhancing students' ability to write scientific reports and deliver oral presentations on their research findings. 7- Understanding Practical Applications: Exploring the practical applications of nuclear physics in fields such as nuclear energy, nuclear medicine, and scientific research. These objectives aim to prepare students to meet the challenges in the field of nuclear physics and contribute to scientific developments.

9. Teaching and Learning Strategies

Strategy	Teaching advanced nuclear physics to graduate students requires effective and advanced educational strategies. Here are some strategies that can be used: **1. Active Learning**

- **Group Discussions**: Encourage students to discuss nuclear concepts in small groups.
- **Project-Based Learning**: Assign research projects related to advanced topics in nuclear physics.

2. Directed Teaching

- **Individual Guidance**: Provide personal support to students through advisory sessions.
- **Seminars**: Organize seminars to discuss current research and developments in the field of nuclear physics.

3. Technology

- **Simulations**: Use simulation software to illustrate nuclear phenomena.
- **Multimedia**: Present educational content through videos and interactive presentations.

4. Diverse Assessment

- **Quizzes**: Use periodic short quizzes to assess students' understanding.
- **Self-Assessment**: Encourage students to evaluate their progress and identify areas for improvement.

5. Practical Application

- **Laboratory Experiments**: Conduct hands-on experiments to reinforce theoretical understanding.
- **Industry Applications**: Discuss practical applications of nuclear physics in fields such as medicine and energy.

6. Critical Thinking

- **Problem Solving**: Encourage students to tackle complex problems requiring critical thinking.
- **Analytical Thinking**: Analyze previous research and studies to develop research skills.

7. Student Collaboration

- **Peer Teaching**: Encourage students to share knowledge and experiences.
- **Building a Learning Community**: Create a learning environment that encourages collaboration and mutual support.

Using these strategies together can enhance the learning experience and develop students' skills in advanced nuclear physics.

10. Course Structure

Week	Hours	Required Learning	Unit or subject	Learning method	Evaluation method

		Outcomes	name		
1	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Background and basic nuclear properties	Theoretical	Written exams and homework
2	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Basic nuclear properties	Theoretical	Written exams and homework
3	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Yukawa's mesons field theory, Nuclear binding energy, average binding energy	Theoretical	Written exams and homework
4	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Nuclear forces, Separation energy of nuclear particle	Theoretical	Written exams and homework
5	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Nuclear models, Liquid Drop Model, mass parabola	Theoretical	Written exams and homework
6	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Shell model, Single particle Shell Model	Theoretical	Written exams and homework
7	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Collective Models, Bohr-Mottelson Model, Nilsson Model	Theoretical	Written exams and homework
8	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Collective Models, Dynamic Deformation Model, Interacting Boson Model	Theoretical	Written exams and homework
9	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Radiation Interaction with matter	Theoretical	Written exams and homework

10	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Radiation Interaction with matter	Theoretical	Written exams and homework
11	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Decay Modes, Alpha Decay, Beta Decay	Theoretical	Written exams and homework
12	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Gamma Emission , Selection rules, Transition Probability	Theoretical	Written exams and homework
13	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Nuclear Reaction	Theoretical	Written exams and homework
14	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Elementary Particles	Theoretical	Written exams and homework
15	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Elementary Particles	Theoretical	Written exams and homework
16	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Cosmic Rays	Theoretical	Written exams and homework

11.Course Evaluation

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

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	Introductory Nuclear Physics by Kenneth S. Krane
Main references (sources)	Nuclear Physics: Principles and Applications by John Lilley
Recommended books and references	

(scientific journals, reports…)	
Electronic References, Websites	

Course Description Form

1. Course Name:
English Language 1
2. Course Code:
3. Semester / Year:
M.Sc./1st Sem. 2025-2026
4. Description Preparation Date:
1/10/2025
5. Available Attendance Forms:
Physical Attendance
6. Number of Credit Hours (Total) / Number of Units (Total)
2 Hour/ 2 Unit
7. Course administrator's name (mention all, if more than one name)
Name: Assis. Prof. Dr. Jazeel Hussein Azeez Email: Jazeel.azeez@nahrainuniv.edu.iq

8. Course Objectives	
Course Objectives	• Students can conduct a conversation in English and use the appropriate dialogue style. • Enhancing students' abilities to communicate with other people around the world. • Students can understand articles and dialogues in English and translate them into their mother language, Arabic. • Enhancing students' abilities in how to use English grammar in conversation

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

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

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

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

		essays on certain subjects			
14	**1**	The students will be exposed to different audio assays and then they are requested to answer the questions	Listening Practice 1	Whiteboard and LCD	Oral and written exams
15	**1**	The students will be exposed to different audio assays and then they are requested to answer the questions	Listening Practice 2	Whiteboard and LCD	Oral and written exams

11. Course Evaluation

30 Marks (Mid exam + Homework+ Quizzes)
70 Marks Final Exam

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Headway Academic Skills Reading, Writing, and Study Skills Level 2 Student Book
Main references (sources)	
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	https://elt.oup.com/student/headway/advanceddownload?cc=us&selLanguage=en

Course Description Form

1. Course Name:

2. Course Code: Advance solid state physics

3. Semester / Year: First / 2025-2026

4. Description Preparation Date: 7 /2025

5. Available Attendance Forms: In presence

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

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

Name: wasan ali mousa al-taa'y
Email: wassan.ali.mousa@nahrainunive.edu.iq

8. Course Objectives

Course Objectives	Make the student able to: 1-Understand definition of solid state physics. 2-Understand importance of solid state physics. 3-Identify the crystal lattices. 4-Identify the crystal defects 5-Identify the band theory. 6-Identify the electrical conductivity 7-Identify the magnetic properties. 8. Identify the thermal properties 9. Identify the acoustic waves in solid.. 10. Identify the elasticity and deformation 11. Identify the superconducting materials 12. Identify the spectroscopic analysis

9. Teaching and Learning Strategies

Strategy	1. Understand the definition of solid state physics. 2. Understand the importance of solid state physics 3. Know the the crystal lattices. 4. Know the the types of crystal lattices 5. Know the the properties of crystal lattices 6. Identify the crystal defects

	7. Identify the types of crystal defects 8. Understand the energy levels. 9. Understand the types of materials. 1. Identify the electrical conductivity 2. Understand the mechanisms of conduction 12. Understand effect of defect on conductivity. 13. Identify the thermal conductivity. 14. Identify the thermal expansion 15. Understand the frequency of waves in solid. 16. Learn laws of elasticity 17. learn analysis of deformations 18 Understand the properties of superconducting of materials. 19- learn the spectroscopic analysis.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Enable the student understand the types crystal lattices and t properties.	crystal lattices.	blackboard + display screen	Oral and written exams + homework
2	3	To enable the studer understand the types crystal defects.	Crystal defect	blackboard + display screen	Oral and written exams + homework
3	3	Make the student abl understand ene packages	Band theory	blackboard + display screen	Oral and written exams + homework
4	3	Enable the student understand the electr properties of material	Electrical conductivity	blackboard + display screen	Oral and written exams + homework
5	3	Enable the studen understand magnetic propertie materials.	Magnetic properties	blackboard + display scree	Oral and written exams + homework
6	3	Enable the studen understand the ther properties of materi	Thermal properties	blackboard display scree	Oral and written exams + homework
7		Mid exam			
8	3	Make the student a to understand so waves	Acoustic waves in solid	blackboard display scree	Oral and written exams + homework
9	3	To enable the stud to understand mechanical proper of materials.	Mechanical properties	blackboard display scree	Oral and written exams + homework
10	3	Enable the studen understand superconducting materials.	superconducting materials.	blackboard display scree	Oral and written exams + homework

11	3	Enable the studen identify the workin some optical devic	Spectroscopic analysis	blackboard display scree	Oral and written exams + homework	
12	3	Monthly exam				
13	3	Final exam				
14						

11. Course Evaluation

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

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	[Charles_Kittel]_Introduction_to_Solid_State_Physi
Main references (sources)	
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	

Course Description Form

1. Course Name:
Statistical Physics/ M.Sc. students
2. Course Code:
3. Semester / Year:
First Course / 2025 – 2026
4. Description Preparation Date:
2/10/2025
5. Available Attendance Forms:
In presence
6. Number of Credit Hours (Total) / Number of Units (Total)
2 hours
7. Course administrator's name (mention all, if more than one name)
Name: **Prof.Dr.Khalid Abbas Yahya** Email: **khalid.abbass@nahrainuniv.edu.iq**
8. Course Objectives

Course Objectives	• **The course aims to teach graduate students the subject of statistical physics by studying general theories in this subject. Among the models of statistics such as Maxwell-Boltzmann statistics, Bose-Einstein statistics, and Fermi-Dirac statistics, and the comparison between these models.** • **Benefiting from this course in assigning the rest of the other courses postgraduate students.** • **Keeping up with scientific curricula and courses in international universities.**

9. Teaching and Learning Strategies

Strategy	**•Activating students and activating educational attitudes by accustoming students to respecting different opinions, appreciating others, and benefiting from others' ideas and information.** **• Exchanging ideas (dialogical method) and encouraging acceptance of others' ideas.** **•Asking questions to a specific student, with the aim of developing several skills, the most important of which are constructing questions, exchanging ideas, and reading.** **•The student is asked to write a report/research on a specific topic, and this method develops the student's research, analysis, expression, and presentation skills.** **Questions related to the lecture are asked as homework to activate and deepen the learning objectives and follow up with the student in correcting errors in the assignment**

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

10	2	Application of the Fermi-Dirac statistics model	Fermi-Dirac gas	In presence	Exams and assignments
11	2	Applying entropy to the model	Entropy and temperature	In presence	Exams and assignments
12	2	Fermi-Dirac application using free energy	Free energy	In presence	Exams and assignments
13	2	Statistical application	Gibbs paradox	In presence	Exams and assignments
14	2	Types of systems	Open system	In presence	Exams and assignments
15	2	Types of systems	Closed system	In presence	Exams and assignments

11. Course Evaluation

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

Evaluation is done through

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

12. Learning and Teaching Resources

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

Course Description Form

1. Course Name: Mathematical Physics – M. Sc.

2. Course Code:

3. Semester / Year: 1st /2025−2026

4. Description Preparation Date: 1 / 9 / 2025

5. Available Attendance Forms: Attendance \ Courses

1. Number of Credit Hours (Total) / Number of Units (Total) 2h/w total (30h)

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

Name: Prof. Laith Abdul Aziz Al-Ani
Email: laithalani2003@gmail.com

3. Course Objectives

Course Objectives	• Making the students familiar with a range of mathematical methods that are essential for solving advanced problems in theoretical physics. • The emphasis will be done on the special functions involved in the solution of these equations. • Improving the understanding of the mathematical principles that form the foundation of theoretical physics.

4. Teaching and Learning Strategies

Strategy	A- Cognitive goals. After successfully completed course, student will be able to: A1. Solve ordinary and partial differential equations of second order that are common in the physical sciences A2. Use the orthogonal polynomials and other special functions; A3. Know the properties and how to use in practice the Gamma and Beta function, Bessel functions, Legendre polynomials, associative Legendre polynomial's, Laguerre, and Hermit polynomials, A4. Fourier series, and Fourier and Laplace transformation **B**. The skills goals special to the course. B1. Demonstrate the practical application and limitations of various techniques, B2. Improving the understanding of the mathematical principles that form the foundation of theoretical physics.

5. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1st	2	Increase knowledge, skill and competence	Back ground Special Function: Gamma and Beta Function	• Lecture-based learning. • Technology-based learning. • Group learning. • Individual learning	Performance Test (Home Work) Challenge Test Report Test
2nd	2		Special Function: Bessel Function		
3rd	2		Special Function: Bessel Function		
4th	2		Special Function: Legendre Function		
5th	2		Special Function: Hermite Function		
6th	2		Examination -1		
7th	2		Special Function: Laguerre Function		
8th	2		Special Function: Laguerre Function		
9th	2		Special Function Application		
10th	2		Matrices		
11th	2		Fourier series and Fourier Transform		
12th	2		Fourier series and Fourier Transform		
13th	2		Examination -2		
14th	2		Laplace Transform		
15th	2		Dirac Delta Function		

6. 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 90%
- (Home Work) 4%
- Challenge Test 3%
- Report Test 3%

7. Learning and Teaching Resources

Required textbooks (curricular books any)	• Mathematical Methods for Physicists, George Arfken, 2008, Addison Wesley
Main references (sources)	• Mathematical Methods in the Physical Sciences, Mary L. Boas, 1983, John Wiley & Sons
Recommended books and references (scientific journals, reports…)	• Mathematical Methods for Physics and Engineering © K. F. Riley, M. P. Hobson and S. J. Bence, 2006, 3rd Edition
Electronic References, Websites	

Course Description Form

1. Course Name:
Scientific Methodology
2. Course Code:
3. Semester / Year:
MSc Physics / 1st semester
4. Description Preparation Date:
12/10/2025
5. Available Attendance Forms:
Attendance is mandatory
6. Number of Credit Hours (Total) / Number of Units (Total)
30 hours / 2 hours weekly
7. Course administrator's name (mention all, if more than one name)
Name: **Assist. Prof. Dr. Hassan N. Hashim** Email: hassan.hashim@nahrainuniv.edu.iq
8. Course Objectives

1. **Understanding the Nature of Scientific Inquiry**
   - Explain what science is and how it differs from other ways of knowing.
   - Understand the goals, assumptions, and limitations of the scientific method.

2. **Developing Skills in Research Design**
   - Learn how to formulate research questions and hypotheses.
   - Understand different types of research (e.g., experimental, observational, qualitative, quantitative).
   - Design basic experiments or studies with appropriate controls and variables.

3. **Master Data Collection and Analysis Techniques**
   - Learn methods of gathering reliable and valid data.
   - Gain introductory skills in statistical or qualitative analysis.
   - Interpret and present data objectively.

4. **Critical Thinking and Problem Solving**
   - Evaluate the quality of scientific literature and research reports.
   - Identify biases, logical fallacies, and methodological flaws.

5. **Ethical and Responsible Research Conduct**

- Understand the ethical principles governing research (e.g., informed consent, confidentiality, integrity).
- Learn about institutional review boards (IRBs) and ethical approval processes.

6. **Effective Scientific Communication**
   - Develop skills to write scientific reports and papers.
   - Learn how to cite sources properly and avoid plagiarism.
   - Practice presenting scientific findings clearly and accurately.
7. **Application of Scientific Thinking in Real-World Contexts**
   - Encourage application of the scientific method to everyday problems and professional practice.
   - Foster interdisciplinary thinking where scientific methods can be applied to various fields.

9. Teaching and Learning Strategies

Strategy	
	1. **Lectures** to explain key concepts and theories. 2. **Problem-based learning** to apply the scientific method to real-world scenarios. 3. **Research projects** for hands-on experience. 4. **Group work** to encourage collaboration. 5. **Case studies** to analyze real research. 6. **Workshops** on tools like statistics and citation. 7. **Use of technology** (e.g., virtual labs, online quizzes). 8. **Assessments** like quizzes, presentations, and reports. 9. **Ethics role-plays** to explore responsible research conduct. 10. **Reflection activities** for self-assessment and critical thinking.

10. Course Structure

Week	Hours	Unit or subject name	Learning method	Evaluation method
1	2	**Introduction to Science and Scientific Method** • What is science? • The nature and goals of scientific inquiry • Steps in the scientific method	Theoretical	
2	2	**Philosophy of Science**	Theoretical	Quiz
3	2	**Formulating Research Questions and Hypotheses** • Identifying problems • Operational definitions • Developing testable hypotheses	Theoretical	Quiz
4	2	**Literature Review and Sources of Information** • Academic databases • Critical reading and synthesis • Avoiding plagiarism	Theoretical	Quiz
5	2	**Research Design I: Quantitative Methods** • Experimental, quasi-experimental, and correlational designs	Theoretical	Quiz

6	2	**Research Design II: Qualitative Methods.**	Theoretical	Quiz
7	2	**Variables, Measurement, and Sampling** • Types of variables • Scales of measurement	Theoretical	Quiz
8	2	**Data Collection Techniques** • Surveys, observations, experiments, and secondary data	Theoretical	Quiz
9	2	**Data Analysis and Interpretation (Quantitative)**	Theoretical	Written Exam
10	2	**Data Analysis and Interpretation (Qualitative)**	Theoretical	Quiz
11	2	**Ethics in Scientific Research**	Theoretical	Quiz
12	2	**Writing the Research Proposal** • Structure (Introduction, Method, Expected Results, References)	Theoretical	Quiz
13	2	**Presenting Scientific Work** • Oral and poster presentations • Peer review process	Theoretical	Written Exam
14	2	**Peer Review and Feedback** •Reviewing others' proposals • Incorporating feedback effectively	Theoretical	Quiz
15	2	**Course Wrap-Up and Final Project Submission** • Reflection on the scientific process • Future directions in research	Theoretical	
16	3	**Final Exam**	Theoretical	Written Exam

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 boo if any)	There is not a specific text book for scientific methodology.
Main references (sources)	Any related books or papers deals with scientific methodology.
Recommended books and references (scientific journals, reports…)	Any Book entitled "Scientific methodology"
Electronic References, Websites	Any website dealing with Scientific methodology or the subjects that covered in the course

Course Description Form

1. Course Name: **Advanced Classical Electrodynamics**

2. Course Code:

3. Semester / Year: First / 2025-2026

4. Description Preparation Date: September 2025

5. Available Attendance Forms: Attendance in class

6. Number of Credit Hours (Total) / Number of Units (Total): 35 hours /3 units

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

Name: Prof. Dr. Saad Naji Abood
Email: Saad.Abood@nahrainuniv.edu.iq

8. Course Objectives

Course Objectives	Teaching advanced classical mechanics to graduate students aims to achieve several educational and scientific objectives, including: 1- **Deepening Understanding**: Enhancing a thorough understanding of the principles of classical mechanics, including fundamental laws and mathematical analyses related to motion and forces. 2- **Developing Analytical Skills**: Improving the ability to analyze complex physical systems and apply theoretical concepts to practical problems. 3- **Exploring Dynamic Systems**: Studying dynamic systems such as nonlinear mechanical systems and analyzing their behavior. 4- **Applying Advanced Mathematics**: Utilizing advanced mathematics, such as calculus and differential equations, in the analysis of mechanical problems. 5- **Enhancing Critical Thinking**: Encouraging critical and creative thinking in problem-solving and developing new approaches to scientific research. 6- **Preparing for Research**: Equipping students for advanced research projects in various engineering and scientific fields using principles of classical mechanics. 7- **Understanding Engineering Applications**: Connecting theory with engineering applications in areas such as mechanical engineering, aerospace engineering, and civil engineering.

	8- **Facilitating Scientific Interaction**: Promoting interaction among students through group discussions and collaborative projects, enhancing teamwork skills. These objectives help students build a strong foundation of knowledge and skills that enhance their academic and professional capabilities in the future.

9. Teaching and Learning Strategies

Strategy	The study of advanced mechanics can include the following: 1- Learning: Encouraging students to engage professionally through work, such as improving improvements, which helps optimize investment 2- Project exposure: Assigning students research or applied projects related to mechanical topics, which develops research and critical thinking skills. 3- Group Discussions: Organizing group discussion sessions on key concepts and complex challenges, which helps exchange ideas and enhance collective understanding 4- Use of Technology: Integrating technological tools such as software simulators and computer modeling to enable students to explore mechanical systems interactively. 5- Continuous Assessment: Conducting periodic assessments, including short tests and homework, to reinforce learning and ensure students' understanding of the material. 6- Individual Tutoring: Providing individual support and guidance to students who need additional assistance, helping to enhance their learning.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Calculus of Variables	Theoretical	Written exams and homework
2	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Review of Mechanics for a System of Particles	Theoretical	Written exams and homework
3	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	The Lagrange Formulation	Theoretical	Written exams and homework
4	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	The Lagrange Formulation of Conservation Theorems	Theoretical	Written exams and homework
5	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	The Hamiltonian Formulation	Theoretical	Written exams and homework

6	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	The Physical Significant of the Hamiltonian Function	Theoretical	Written exams and homework
7	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Canonical Transformations	Theoretical	Written exams and homework
8	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	The Hamilton – Jacobi Theory	Theoretical	Written exams and homework
9	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Brackets, Poisson Brackets	Theoretical	Written exams and homework
10	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Lagrange Brackets	Theoretical	Written exams and homework
11	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Relation between Poisson and Lagrange Brackets	Theoretical	Written exams and homework
12	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Equation of Motion in Poisson Brackets	Theoretical	Written exams and homework
13	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Hamilton Equations of Motion in Poisson Brackets	Theoretical	Written exams and homework
14	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	action and Angle Variables	Theoretical	Written exams and homework

15	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Rigid Body	Theoretical	Written exams and homework
16	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Canonical Perturbation Theory	Theoretical	Written exams and homework

11. Course Evaluation

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

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Classical Mechanics by Goldstein, Safko & Poole
Main references (sources)	Mechanics: Volume 1 (Course of Theoretical Physics) by Landau & Lifshitz
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	

Course Description Form

1. Course Name:
Radiology
2. Course Code:
3. Semester / Year:
1st course / doctorate degree
4. Description Preparation Date:
1/9/2025
5. Available Attendance Forms:
In person or Online
6. Number of Credit Hours (Total) / Number of Units (Total)
7 hours weekly (2 H theoretical
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	• Teaching students the basic concepts of radiation physics. • Providing students with the skills to discuss and solve practical problems rela to this subject. • Linking theoretical concepts with practical applications.
9. Teaching and Learning Strategies	
Strategy	• Discussing textbook topics and supporting references. • Theoretical lectures including problem solutions and homework discussion. • Asking students to pose a series of reflective questions during lectures on specific topics. • Assigning students homework that requires their own solutions.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Learning	Introduction to nanomaterials	Theoretical	Oral and written
2	3	Learning	Understanding Nanomaterials Occurrence and Applications of Nanomaterials	Theoretical	Oral and written
3	3	Learning	Evolution of Nanomaterials Structural Classification of Nanomaterials	Theoretical	Oral and written
4	3	Learning	Importance of Nanomaterials Synthesis and Processing of Nanomaterials	Theoretical	Oral and written
5	3	Learning	Characterization Methods	Theoretical	Oral and written
6	3	Learning		Theoretical	Oral and written
7	3	Learning		Theoretical	Oral and written
8	3	Learning		Theoretical	Oral and written
9	3	Learning		Theoretical	Oral and written
10	3	Learning		Theoretical	Oral and written
11	3	Learning		Theoretical	Oral and written
12	3	Learning		Theoretical	Oral and written
13	3	Learning		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

50 points (10 homework +40 mid exam)
50 points (50 final exam)

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	1. **"Radiation Effects in Nanostructures"** C. S. Jayanth Wiley, 2019 2. **"Nanomaterials under Ionizing Radiation: Fundamentals and Applications"** S. Kumar, P. K. Sharma Elsevier, 2020 3. **"Radiation Physics: For Medical Physicists"** (nanoscale effects) E. B. Podgorsak Springer, 2016
Main references (sources)	"Introduction to Radiation Physics for Nanomaterials"

	By: K. Singh Springer, 2021
Recommended books and references (scientific journals, reports…)	ScienceDirect – Elsevier Nanomaterials & Radiation Physics. Nano.gov – National Nanotechnology Initiative (NNI) ResearchGate – Physics of Nanomaterials and Radiation Studies
Electronic References, Websites	https://www.iaea.org https://www.sciencedirect.com https://www.nano.gov https://www.researchgate.net

Course Description Form

1. Course Name: **Advanced Classical Electrodynamics**

2. Course Code:

3. Semester / Year: First / 2025-2026

4. Description Preparation Date: September 2025

5. Available Attendance Forms: Attendance in class

6. Number of Credit Hours (Total) / Number of Units (Total): 35 hours /3 units

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

Name: Prof. Dr. Saad Naji Abood
Email: Saad.Abood@nahrainuniv.edu.iq

8. Course Objectives

Course Objectives	**Objectives of Teaching Advanced Electrodynamics to PhD Students** **1-Understanding Fundamental Theories:** • Enable students to grasp the basic concepts of electrodynamics, such as Maxwell's equations, and the electric and magnetic fields. 2- **Developing Analytical Skills:** • Enhance mathematical analysis and modeling skills for advanced electrical and magnetic systems. 3- **Application of Concepts in Research:** • Encourage students to apply their acquired knowledge in their research, whether in theoretical physics or engineering applications. 5- **Exploring Cosmic Phenomena:** • Study cosmic phenomena that require a deep understanding of electrodynamics, such as the motion of charged particles in strong fields. 6- **Developing Scientific Research Skills:** • Cultivate research and critical analysis skills through reading and discussing

	current literature. 6- **Encouraging Interdisciplinary Collaboration:** • Promote collaboration between fields such as physics, engineering, computational sciences, and other related disciplines. 7- **Practical Applications:** Provide knowledge about practical applications of electrodynamics in areas communications, energy technology, and electromagnetic systems.

9. Teaching and Learning Strategies

Strategy	**Teaching and Learning Strategy for Advanced Electrodynamics** 1- **Active Learning:** • Encourage students to actively participate through discussions, presentations, and group work. 2- **Project-Based Learning:** • Assign students applied research projects that enhance their understanding of theoretical concepts. 3- **Personalized Instruction:** • Provide individual support tailored to students' levels and research interests. 4- **Diverse Resources:** • Utilize a variety of resources, including lectures, scientific articles, and digital content. 5- **Continuous Assessment:** • Conduct regular assessments to measure student progress and understanding, allowing for adjustments in teaching strategies as needed. 6- **Research-Based Learning:** • Encourage students to explore research questions in the field of electrodynamics and develop scientific research skills. 7- **Linking Theory to Practice:** • Provide practical examples and real-world applications of theoretical concepts to enhance student understanding. 8- **Feedback:**

	• Offer continuous feedback to students to improve their performance and enhance their learning. With this strategy, an effective learning environment can be created, enabling students to better understand and grasp advanced concepts in electrodynamics.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Electric field, charge density, Dirac delta-functions	Theoretical	Written exams and homework
2	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Gauss' Law, electrostatic potential, field energy.	Theoretical	Written exams and homework
3	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Poisson, Laplace Eqns., and Green's Function approach.	Theoretical	Written exams and homework
4	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Surface Charge Density, Method of Images. Green function construction from image solutions.	Theoretical	Written exams and homework
5	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Laplace Equation in Spherical coordinates, general analysis.	Theoretical	Written exams and homework
6	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Electrostatic potential problems with Azimuthally symmetry.	Theoretical	Written exams and homework
7	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Electrostatic Potential Problems Lacking Azimuthally Symmetry, Laplace Equation in Cylindrical	Theoretical	Written exams and homework

			Coordinates; Bessel functions		
8	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	On finding Green's functions in 3D and using eigenfunction expansions. Multipoles, polarization, susceptibility, and dielectrics	Theoretical	Written exams and homework
9	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Molecular polarizability (SI & CGS); Dielectric electrostatic energy. Differences in CGS and SI units in Magnetism.	Theoretical	Written exams and homework
10	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Coupling of E and B: Faraday's Law, Maxwell's displacement current. Magnetic moments; magnetic boundary conditions.	Theoretical	Written exams and homework
11	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Vector and scalar potentials. Green function for wave equation. Magnetic field energy, momentum, and their conservation.	Theoretical	Written exams and homework

12	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Magnetic moments; magnetic boundary conditions. Magnetic materials and boundary value problems.	Theoretical	Written exams and homework
13	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Coupling of E and B: Faraday's Law, Maxwell's displacement current.	Theoretical	Written exams and homework
14	**2**	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Harmonic EM fields, energy conservation and EM device impedance.	Theoretical	Written exams and homework
15	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Symmetries under orthogonal transformations	Theoretical	Written exams and homework
16	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Symmetries under orthogonal transformations.	Theoretical	Written exams and homework

11.Course Evaluation

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

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	Classical Electrodynamics by David Jackson
Main references (sources)	Introduction to Electrodynamics by David J. Griffiths
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	

Course Description Form

1. Course Name: Quantum Optics

2. Course Code:

3. Semester / Year: First / 2025-2026

4. Description Preparation Date: September 2025

5. Available Attendance Forms: Attendance in class

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

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

Name: Prof. Dr. Oday Ali Hussein
Email: oday.hussein@nahrainuniv.edu.iq

8. Course Objectives

Course Objectives	This course is given to graduate students in Ph.D. stage in physics department to cover the postulates and principles of quantum optics.

9. Teaching and Learning Strategies

Strategy	A- Cognitive goals. A1- Understanding the basics of quantum optics. A2- Understand Maxwell's equations more deeply and accurately. A3- Understand the basic principles governing the interaction between radiation and matter. A4- Understanding the principles governing the interaction between radiation and matter from a quantum theoretical perspective. A5- Understand and apply the principles of quantum optics to some systems and understand how some practical applications such as detectors work

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

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	Introduction and Review		Theoretical	Written exams and homework
2	2	Classical Oscillator in Classical Field.		Theoretical	Written exams and homework
3	2	Two-level system Driven by a classical Field		Theoretical	Written exams and homework
4	2	Classical electrodynamics: - Maxwell's equations in coordinate space and Fourier space. - Longitudinal and transverse Fields.		Theoretical	Written exams and homework
5	2	Classical electrodynamics: - Vector Potential and gauge transformation Coulomb gauge.		Theoretical	Written exams and homework
6	2	Momentum and Energy of Field and particles: - Total momentum and energy. - Longitudinal – field contributions.		Theoretical	Written exams and homework

7	2	Momentum and Energy of Field and particles: Transverse – - field contributions and normal variables. - Periodic boundary conditions and discrete modes.		Theoretical	Written exams and homework
8	2	Hamiltonian and Quantization: Dynamical variables and equations of motion.		Theoretical	Written exams and homework
9	2	Hamiltonian and Quantization: - Quantization of the system of particles and fields.		Theoretical	Written exams and homework
10	2	Hamiltonian and Quantization: Separation of the Hamiltonian and the momentum operators.		Theoretical	Written exams and homework
11	2	Hamiltonian and Quantization: Unperturbed states of particles and fields.		Theoretical	Written exams and homework
12	2	Hamiltonian and Quantization: - Evolution of states and observables.		Theoretical	Written exams and homework
13	2	The Free Radiation Field: - Time dependence of field operators.		Theoretical	Written exams and homework

		- Vacuum state.			
14	2	Introduction and Review		Theoretical	Written exams and homework
15	2	Classical Oscillator in Classical Field.		Theoretical	Written exams and homework

11. Course Evaluation

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

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Introductory Quantum Optics, C. Gerry and P. Knight, Cambridge University Press, 2005.
Main references (sources)	Elements of Quantum Optics, P. Meystre and M. Sargent, Springer, Berlin, 1990.
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	

Course Description Form

1. Course Name: PHOTONIC/ Ph.D

2. Course Code:

3. Semester / Year:2025/2026

4. Description Preparation Date: 1/9/2025

5. Available Attendance Forms: PRESENT

6. Number of Credit Hours (Total) / Number of Units (Total) 2 Hr/ week

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

Name: Prof.Dr. SUHA MOUSA ALAWSI
Email:suha.korsheed@nahrainuniv.edu.iq

8. Course Objectives

Course Objectives	• Understand the basics of photonic • Linking a theoretical concept with the practical Giving the student the opportunity to choose the research project that qualifies him to 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	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1		Academic	Introduction to Photoni	Educational	Discussion

2		Academic	Photonics Opportunitie	Educational	Discussion
3		Academic	Dual Nature of Light	educational	Discussion
4		Academic	Dual Nature of Light	educational	Discussion
5		Academic	Spectra of Light Sources	educational	Discussion
6		Academic	ractions of Light with Matter	educational	Discussion
7		Academic	ht Sources and Laser Safety	educational	Discussion
8		Academic	NLASER LIGHT SOURCES	educational	Discussion
9		Academic	CONCEPTS OF LASER SAFETY	educational	Discussion
10		Academic	Laser Safety Standards and Safety Classifications	educational	Discussion
11		Academic	TYPES OF CONTROLS: ENGINEERING, DMINISTRATIVE, PERSONAL PROTECTIVE	educational	Discussion
12		Academic	SAFETY RULES FOR A LASERS, REGARDLESS OUTPUT POWER LEVEL	educational	Discussion
13		Academic	PHOTONIC CRYSTAL	educational	Discussion
14		Academic	NONLINEAR CRYSTAL	educational	Discussion
15		Academic	**Exam**	educational	exam

Course Evaluation .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

30% mid exam+ discussion+ solving homework
70% final exam

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	1] PHOTONIC CRYSTAL, MODELING THE FLOW LIGHT BY JOUN D. JOANNPOL 2] INTRODUCTION OF NONPHOTONIC BY SERGRY V.
Main references (sources)	Electromagnetic Fields and Waves, Paul Lorr Uniuersite de Montreal and McGill University, 1987

Recommended books and references (scientific journals, reports…)	ALL THE PAPERS OR LECTURES RELATI WITH THE COURSE
Electronic References, Websites	ALL THE PAPERS OR LECTUR RELATION WITH THE COURSE

Course Description Form

1. Course Name:	
English	
2. Course Code:	
3. Semester / Year:	
2025−2026	
4. Description Preparation Date:	
1/9/2025	
5. Available Attendance Forms:	
Attendance	
6. Number of Credit Hours (Total) / Number of Units (Total)	
30 Hours	
7. Course administrator's name (mention all, if more than one name)	
Name: Dr. Asmaa Hadi Mohammed Email: asmaa.hadi@nahrainuniv.edu.iq	
8. Course Objectives	
Course Objectives	1- Introducing students to English and emphasizing its role as the most used language in the world to describe and understand different types of science, especially modern physics. 2- Encouraging students to use the English language in their daily lives by visiting websites that help them deal with daily developments in the fields of education, family, and society. 3- Increasing students' self-confidence in their ability to learn English, improving their skills in reading, writing and semantics, and eliciting the idea of the main topic of research and scientific publications.
9. Teaching and Learning Strategies	
Strategy	1- Curriculum for innovation Knowledge of the rules and principles of the English language. 2- Adoption of blended learning through the use of multimedia technology, curricula and extra-curricular assignments. 3- Transferred general and qualification skills (other skills related to employability and personal. development).

	4- Training students to use modern teaching methods and methods, including blended learning using technology. 5- Assigning students to conduct research related to all areas of the English language. 6- Enabling students to use their personal skills.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
Week 1 **Week 2** **Week 3** **Week 4** **Week 5** **Week 6** **Week 7** **Week 8** **Week 9** **Week 10** **Week 11** **Week 12** **Week 13** **Week 14** **Week 15**	30	**Students can learn how to understand and translate articles written in English into their native language.** **Students will understand how to avoid citing papers that have been cited.** **Allow students to conduct research and write research reports in English.** **Learn about the English language and its role in transferring and understanding different types of science and technology.**	**-Introduction** **-Feats of engineering.** **-Water, water everywhere** **-The Terracotta army.** **-The Olympic games.** **-Exam** **-Work.** **-Communication technology.** **-Writing: Keeping healthy.** **-Writing: source of energy.** **-Writing: examples of fair trade** **-Writing: population trends.** **-Research: Crediting sources** **-Language for writing for speaking: interpreting and translating.** **-Final exam**	**Giving students a detailed lecture on the origins and grammar of the English language.** **Listen to, understand, and translate the articles and conversations in the course correctly.** **Using dialogue and active participation to consolidate concepts and deepen understanding.** **Giving students homework that includes an exercise in avoiding textual hijacking.** **Students compose scien articles in English by t writing them in Arabic then translating them i English**	Exams Quizzes Assignments Homework

11. Course Evaluation

daily preparation: 10, daily oral:10, monthly:30, or written exams:40, reports:10

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Headway- Academic Skills Reading, Writing, and Study Skills level 3

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

Course Description Form

1. Course Name:
Scientific Methodology
2. Course Code:
3. Semester / Year:
PhD Physics / 1st semester
4. Description Preparation Date:
12/10/2025
5. Available Attendance Forms:
Attendance is mandatory
6. Number of Credit Hours (Total) / Number of Units (Total)
30 hours / 2 hours weekly
7. Course administrator's name (mention all, if more than one name)
Name: **Assist. Prof. Dr. Hassan N. Hashim** Email: hassan.hashim@nahrainuniv.edu.iq
8. Course Objectives

1. **Understanding the Nature of Scientific Inquiry**
   - Explain what science is and how it differs from other ways of knowing.
   - Understand the goals, assumptions, and limitations of the scientific method.

2. **Developing Skills in Research Design**
   - Learn how to formulate research questions and hypotheses.
   - Understand different types of research (e.g., experimental, observational, qualitative, quantitative).
   - Design basic experiments or studies with appropriate controls and variables.

3. **Master Data Collection and Analysis Techniques**
   - Learn methods of gathering reliable and valid data.
   - Gain introductory skills in statistical or qualitative analysis.
   - Interpret and present data objectively.

4. **Critical Thinking and Problem Solving**
   - Evaluate the quality of scientific literature and research reports.
   - Identify biases, logical fallacies, and methodological flaws.

5. **Ethical and Responsible Research Conduct**

- Understand the ethical principles governing research (e.g., informed consent, confidentiality, integrity).
- Learn about institutional review boards (IRBs) and ethical approval processes.

6. **Effective Scientific Communication**
   - Develop skills to write scientific reports and papers.
   - Learn how to cite sources properly and avoid plagiarism.
   - Practice presenting scientific findings clearly and accurately.
7. **Application of Scientific Thinking in Real-World Contexts**
   - Encourage application of the scientific method to everyday problems and professional practice.
   - Foster interdisciplinary thinking where scientific methods can be applied to various fields.

9. Teaching and Learning Strategies

Strategy	
	1. **Lectures** to explain key concepts and theories. 2. **Problem-based learning** to apply the scientific method to real-world scenarios. 3. **Research projects** for hands-on experience. 4. **Group work** to encourage collaboration. 5. **Case studies** to analyze real research. 6. **Workshops** on tools like statistics and citation. 7. **Use of technology** (e.g., virtual labs, online quizzes). 8. **Assessments** like quizzes, presentations, and reports. 9. **Ethics role-plays** to explore responsible research conduct. 10. **Reflection activities** for self-assessment and critical thinking.

10. Course Structure

Week	Hours	Unit or subject name	Learning method	Evaluation method
1	2	**Introduction to Science and Scientific Method** • What is science? • The nature and goals of scientific inquiry • Steps in the scientific method	Theoretical	
2	2	**Philosophy of Science**	Theoretical	Quiz
3	2	**Formulating Research Questions and Hypotheses** • Identifying problems • Operational definitions • Developing testable hypotheses	Theoretical	Quiz
4	2	**Literature Review and Sources of Information** • Academic databases • Critical reading and synthesis • Avoiding plagiarism	Theoretical	Quiz
5	2	**Research Design I: Quantitative Methods** • Experimental, quasi-experimental, and correlational designs	Theoretical	Quiz

6	2	**Research Design II: Qualitative Methods.**	Theoretical	Quiz
7	2	**Variables, Measurement, and Sampling** • Types of variables • Scales of measurement	Theoretical	Quiz
8	2	**Data Collection Techniques** • Surveys, observations, experiments, and secondary data	Theoretical	Quiz
9	2	**Data Analysis and Interpretation (Quantitative)**	Theoretical	Written Exam
10	2	**Data Analysis and Interpretation (Qualitative)**	Theoretical	Quiz
11	2	**Ethics in Scientific Research**	Theoretical	Quiz
12	2	**Writing the Research Proposal** • Structure (Introduction, Method, Expected Results, References)	Theoretical	Quiz
13	2	**Presenting Scientific Work** • Oral and poster presentations • Peer review process	Theoretical	Written Exam
14	2	**Peer Review and Feedback** •Reviewing others' proposals • Incorporating feedback effectively	Theoretical	Quiz
15	2	**Course Wrap-Up and Final Project Submission** • Reflection on the scientific process • Future directions in research	Theoretical	
16	3	**Final Exam**	Theoretical	Written Exam

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 boo if any)	There is not a specific text book for scientific methodology.
Main references (sources)	Any related books or papers deals with scientific methodology.
Recommended books and references (scientific journals, reports…)	Any Book entitled "Scientific methodology"
Electronic References, Websites	Any website dealing with Scientific methodology or the subjects that covered in the course

Course Description Form

1. Course Name: Relativistic Quantum Mechanics

2. Course Code:

3. Semester / Year: First / 2025-2026

4. Description Preparation Date: September 2025

5. Available Attendance Forms: Attendance in class

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

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

Name: Prof. Dr. Oday Ali Hussein
Email: oday.hussein@nahrainuniv.edu.iq

8. Course Objectives

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

9. Teaching and Learning Strategies

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

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

10. Course Structure

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

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

11. Course Evaluation

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

12. Learning and Teaching Resources

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

Course Description Form

1. Course Name:

Nuclear Models

2. Course Code:

3. Semester / Year:

Second semester / PhD stage

4. Description Preparation Date:

2025-2026

5. Available Attendance Forms:

Weekly

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

30 hours

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

Name: Dr. prof. Ghaith Naima Flaiyh

Email: ghaith.flaiyh@sc.uobaghdad.edu.iq

8. Course Objectives

Course Objectives	● Teaching PhD students theories of nuclear models

9. Teaching and Learning Strategies

Strategy	● To enable the student to understand and grasp the fundamentals of nuclear physics. ● To enable the student to understand physical phenomena from a mathematical perspective. ● To enable the student to understand and grasp the fundamentals of nuclear physi through the use of modern software and keeping pace with scientific developments ● To enable the student to acquire knowledge and understanding of the scientific la of physics and practical applications. ● To develop logical and scientific analysis and interpretation of physical phenome

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	**2 hours**	**Independent Particle Model**	Definition of IPM	**Daily and monthly tests and reports**	**Theoretical**

2	**2 hours**	**Shell Model**	Nucleon-nucleon interaction	Daily and monthly tests and reports	**Theoretical**
3	**2 hours**	**Shell Model**	One particle system Two particle system	Daily and monthly tests and reports	**Theoretical**
4	**2 hours**	**Shell Model**	L-S coupling J-J coupling	Daily and monthly tests and reports	**Theoretical**
5	**2 hours**	**Perturbation Theory and Configuration Mixing**	Perturbation Theory	Daily and monthly tests and reports	**Theoretical**
6	**2 hours**	=	Binding Energy Excitation Energy	Daily and monthly tests and reports	**Theoretical**
7	**2 hours**	=	Application	Daily and monthly tests and reports	**Theoretical**
8	**2 hours**	=	-State of mixed configuration -Application	Daily and monthly tests and reports	**Theoretical**
9	**2 hours**	**Monthly Exam**	Monthly Exam	Daily and monthly tests and reports	**Theoretical**
10	**2 hours**	**Collective model**	Nuclear rotational motion	Daily and monthly tests and reports	**Theoretical**
11	**2 hours**	=	Collective vibrational Collective oscillations	Daily and monthly tests and reports	**Theoretical**
12	**2 hours**	**Interacting Boson Model**	Introduction	Daily and monthly tests and reports	**Theoretical**
13	**2 hours**	=	Dynamical Symmetries	Daily and monthly tests and reports	**Theoretical**
14	**2 hours**	=	SU(5), SU(3), O(6)	Daily and monthly tests and reports	**Theoretical**
15	**2 hours**	**Monthly Exam**	**Monthly Exam**	Daily and monthly tests and reports	**Theoretical**

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)	References: 1. Nuclear Physics , By R.R. Roy and B.P.Nigam 2. Nuclear Models, By D. A. Bromley
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

الكورس الثاني

Course Description Form

1. Course Name: Elementary Particles

2. Course Code:

3. Semester / Year: First / 2025-2026

4. Description Preparation Date: January 2026

5. Available Attendance Forms: Attendance in class

6. Number of Credit Hours (Total) / Number of Units (Total): 35 hours /2 units

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

Name: Prof. Dr. Saad Naji Abood
Email: Saad.Abood@nahrainuniv.edu.iq

8. Course Objectives

Course Objectives	The objectives of teaching the subject of elementary particles to fourth-year students in the Physics Department include: 1. **Understanding Theoretical Foundations**: Introducing students to concepts of elementary particles, such as quarks and leptons, and the fundamentals of physical models. 2. **Developing Analytical Skills**: Enhancing the ability to analyze data and experiments related to elementary particles. 3. **Practical Applications**: Connecting theoretical concepts to practical applications in fields such as nuclear physics and particle physics. 4. **Critical Thinking**: Encouraging students to engage in critical thinking and explore complex questions about the structure of matter and the universe. 5. **Scientific Research**: Motivating students to participate in research and scientific projects related to elementary particles. 6. **Interaction with Technology**: Exposing students to the latest technologies and devices used in the study of elementary particles, such as particle colliders. These objectives aim to prepare students well for their academic and professional fu in the field of physics.

9. Teaching and Learning Strategies

Strategy	**The teaching and learning strategy for the subject of elementary particles includes several key aspects:** 1. **Active Learning**: Encouraging students to participate actively through

discussions, workshops, and interactive activities.

2. **Project-Based Learning**: Assigning students research projects related to elementary particles, which enhances their deep understanding of the subject.

3. **Technology in Education**: Utilizing computer simulations and educational applications to enhance visual understanding of complex concepts.

4. **Collaborative Learning**: Forming small work groups to promote collaboration among students and knowledge sharing.

5. Continuous Assessment: Implementing diverse assessment methods, such as quizzes, presentations, and self-assessments, to ensure understanding of concepts.

6. Interaction with Experts: Inviting guest lecturers or organizing visits to research centers or particle physics laboratories to enhance the educational experience.

7. Providing Diverse Resources: Offering a variety of educational resources, such as books, articles, and videos, to deepen understanding.

These strategies aim to enhance the learning experience and make it more interactive and suitabl students' needs in the field of elementary particles.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Particle and anti particles	Theoretical	Written exams and homework
2	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Four Forces and Examples	Theoretical	Written exams and homework
3	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Classification of Elementary Particles	Theoretical	Written exams and homework
4	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Properties of Elementary Particles	Theoretical	Written exams and homework
5	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Properties of Elementary Particles	Theoretical	Written exams and homework

6	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Conservation Laws of Elementary Particles	Theoretical	Written exams and homework
7	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Conservation Laws of Elementary Particles	Theoretical	Written exams and homework
8	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Strange Particles	Theoretical	Written exams and homework
9	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Quarks	Theoretical	Written exams and homework
10	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Quarks	Theoretical	Written exams and homework
11	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Quark Models	Theoretical	Written exams and homework
12	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Quark Models	Theoretical	Written exams and homework
13	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Quantum field for describing mutually interacting particles	Theoretical	Written exams and homework
14	**2**	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Quantum Chromodynamics	Theoretical	Written exams and homework

15	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Cosmic Rays	Theoretical	Written exams and homework
16	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Cosmic Rays	Theoretical	Written exams and homework
17	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Cosmic Rays	Theoretical	Written exams and homework

11. Course Evaluation

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

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Introduction to Elementary Particles by David Griffiths
Main references (sources)	Particle Physics: A Very short Introduction by: Frank Close
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	

Course Description Form

1. Course Name: Reactor and Accelerator

2. Course Code: physics

3. Semester / Year: Quarterly 2026/2027

4. Description Preparation Date: 2026/2027

5. Available Attendance Forms: mandatory attendance

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

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

Name: Prof.Dr.Kareem Khalaf Mohammad AL-Jabori
Email: kareem.mohammad@nahrainuniv.edu.iq

8. Course Objectives

Course Objectives	The main objectives of this course is hopefully be achieved in the following steps: • An overview of the history of the reac accelerator and physics of the nucleu • A review of elements of quantum mechanics necessary to understand reactor , accelerator and nuclear physics. • Introduction of the reactor and accelerator • Applications to the study of reactor, accelerator and nuclear reactions.

9. Teaching and Learning Strategies

Strategy	a- knowledge and understanding To provide students with an opportunity to develop knowledge and understanding of the key principles applications of reactor, accelerator, Nuclear Physics, and their relevance to current developments in physic b - Subject-specific skills

	c- 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. d- 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 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

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Nuclear physics principles for water reactors and covers conc such as fission, cross-sec neutron flux, and radioact Basic nuclear properties	Nuclear physics principles for water reactors and covers conc such as fission, cross-sec neutron flux, and radioactivity. B nuclear properties	(theoretical)	Oral and written exan
2	3	technical terms such as critic reactivity, and the four-fa formula, and how these affect dynamics of a light water rea are discussed.	technical terms such as critic reactivity, and the four-fa formula, and how these affect dynamics of a light water reactor discussed.	(theoretical)	Oral and written exan
3	3	The course addresses how diffe materials are used to control energy and spatial distributio the neutron flux in different par the reactor, and how this affect thermal power	The course addresses how diffe materials are used to control energy and spatial distribution o neutron flux in different parts o reactor, and how this affects thermal power	(theoretical)	Oral and written exan
4	3	other reactor types and how differ from light water reactors provided.	other reactor types and how differ from light water reactors provided.	(theoretical)	Oral and written exan
5		Mid Exam-1	Mid Exam-1	(theoretical)	Oral and written exan
6	3	Basic properties of diffe accelerators	Basic properties of diffe accelerators	(theoretical)	Oral and written exan
7	3	Transverse beam dynamics single particles and system particles including calculation t	Transverse beam dynamics for s particles and systems of part including calculation tools	(theoretical)	Oral and written exan
8	3	Methods for acceleration diagnostics	Methods for acceleration diagnostics	(theoretical)	Oral and written exan
9	3	Radiation and interaction charged and neutral particles.	Radiation and interaction charged and neutral particles.	(theoretical)	Oral and written exan
10	3	Radiation detectors	Radiation detectors	(theoretical)	Oral and written exan
11	3	scintillation detectors and neu detectors, semiconductor detec	scintillation detectors and neu detectors, semiconductor detect	theoretical)	Oral and written exan
12	3	Experimental methods accelerator and detectors.	Experimental methods accelerator and detectors.	(theoretical)	Oral and written exan
		Mid Exam-2	Mid Exam-2		

13 14 15	 3 3	Seminar of the reactor Seminar of the accelerator	Seminar of the reactor Seminar of the accelerator	(theoretical) (theoretical)	Oral and written exan Oral and written exam

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)	• LA marsh and Baratta-Introduction to nuclear engineerin • Livingston and Blewett-particle Accelerators
Main references (sources)	• LA marsh and Baratta-Introduction to nuclear engineerin • Livingston and Blewett-particle Accelerators
Recommended books and references (scientific journals, reports…)	Text Book: • Walter E. Meyerhof: elements of nuclear physics • Duderstadt and Hamilton-nuclear reactor analysis • Kenneth S. Krane: Introductory nuclear physics • Henry Semat and John R. Albright: Introduction to atomic nuclear physics • IAEA Training manuals and technical reports • Beiser: Concept of modern physics • Irving Kaplan: Nuclear physics • Cohen: Concepts of Nuclear Physics • Kupta: Concepts of Modern Physics
Electronic References, Websites	Internet

Course Description Form

1. Course Name:

Radiological Physics

2. Course Code:

Diploma

3. Semester / Year:

second semester 2025-2026

4. Description Preparation Date

2026

5. Available Attendance Forms:

In personal

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

3/3

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

Name:prof.Dr. Asmaa Hadi Mohammed

Email: asmaa.hadi@nahrainuniv.edu.iq

8. Course Objectives

Course Objectives	• Understand principles of radiological physics • Explain X-ray production and interaction • Describe radiation-induced DNA damage and repair mechanisms • Analyze image formation and quality • Apply radiation protection principles

9. Teaching and Learning Strategies

Strategy	• Lectures • PowerPoint presentations • Problem-solving sessions • Case studies • Assignments and quizzes

10. Course Structure

Week	H	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	Understand basic radiological physics concepts	Introduction to Radiological Physics	Lecture	Quiz
2	2	Explain principles of X-ray production	X-ray Production	Lecture	Quiz
3	2	Describe X-ray tube	X-ray Tube	Lecture	Assignment

		components			
4	2	Analyze X-ray spectrum and beam quality	X-ray Spectrum and Beam Quality	Lecture	Quiz
5	2	Explain radiation interaction with matter	Radiation Interaction with Matter	Lecture	Assignment
6	2	Understand image formation principles	Image Formation	Lecture	Quiz
7	2	Evaluate image quality factors	Image Quality	Lecture	Midterm Exam
8	2	Explain scattered radiation effects	Scattered Radiation	Lecture	Quiz
9	2	Analyze radiation dose concepts	Radiation Dose	Lecture	Assignment
10	2	Apply radiation protection principles	Radiation Protection	Lecture	Assignment
11	2	Understand quality assurance concepts	Quality Assurance	Lecture	Quiz
12	2	Review radiological imaging systems	Radiological Imaging Systems	Lecture	Quiz
13	2	Explain digital radiography basics	Digital Radiography	Lecture	Assignment
14	2	Integrate course concepts	Revision	Discussion	Quiz
15	2	Assess overall course outcomes	Final Examination	Exam	Final Exam

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)	IAEA. Diagnostic Radiology Physics: A Handbook for Teachers and Students. Bushberg et al. The Essential Physics of Medical Imaging.
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	IAEA. Diagnostic Radiology Physics: A Handb for Teachers and Students,

Course Description Form

1. Course Name:
English course
2. Course Code:
0000000
3. Semester / Year:
diploma
4. Description Preparation Date:
15/01/2026
5. Available Attendance Forms:
Attendance
6. Number of Credit Hours (Total) / Number of Units (Total)
2 hours
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	**• Understanding main ideas and supporting details in academic tex** **• Using effective reading strategies such as speed reading a scanning.** **• Improving writing skills.** **• Writing clear and organized academic paragraphs and short essa** **• Using conjunctions and correct grammar in formal writing.** **• Improving study skills.** **• Taking effective notes and summarizing key information.** **• Managing study time and organizing academic tasks efficiently.** **• Building academic confidence.** **• Expressing ideas clearly in written and spoken English.** **• Developing self-learning and critical thinking skills.**
9. Teaching and Learning Strategies	
Strategy	• Discussion of the topics covered in the textbook and supplementary references. • Theoretical lectures including solutions to examples and discussion of homework assignments. • Asking students to pose a series of thought-provoking questio during lectures on specific topics.

	• Assigning homework assignments that require students to f their own solutions.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	Unit 1: The Nat World			
2	2	Unit 2: Language Communication			
3	2	Unit 3: Education Learning			
4	2	Unit 4: Health Medicine			
5	2	Unit 5: Business Money			
6	2	Unit 6: The Media			
7	2	Unit 7: Science Technology			
8	2	Unit 8: Environment			
9	2	Unit 9: Culture Society			
10	2	Unit 10: The Future			
11	2	Test			
12	2	Summary			
13	2	Final Examination			

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)	*Headway Academic Skills: Reading, Writing, and Study Skills – Level 2 (Student's Book)* Richard Harrison & Terry Phillips Second Edition (الطبعة الثانية) Oxford University Press 2011 ISBN: 978-0-19-474159-2
Main references (sources)	**Harrison, R., & Phillips, T. (2011).** *Headway Academic Skills: Reading, Writing, and Study Skills – Level 2 (2nd ed.).* Oxford University Press.

	Soars, L., & Soars, J. (2019). *New Headway: Intermediate Student's Book (5th ed.).* Oxford University Press. **Jordan, R. R. (1999).** *Academic Writing Course: Study Skills in English (3rd ed.).* Longman.
Recommended books and references (scientific journals, reports…)	○ *ELT Journal* – Oxford University Press ○ *English for Specific Purposes* – Elsevier ○ *TESOL Quarterly* – Wiley ○ *British Council Teaching English Reports* ○ *Cambridge Assessment English Research Papers*
Electronic References, Websites	1 www.oxfordlearnersdictionaries.com 2 www.britishcouncil.org/learnenglish 3 www.cambridgeenglish.org 4 www.esl-lab.com

Course Description Form

1. Course Name: **Electromagnetic Theory /Master**
2. Course Code:
3. Semester / Year: second 2025/2026
4. Description Preparation Date: 20/1/2026
5. Available Attendance Forms: present
6. Number of Credit Hours (Total) / Number of Units (Total) 2 hrs. per week/ 2 units per week
7. Course administrator's name (mention all, if more than one name)
Name: Prof. Dr. Suha Mousa Khorsheed Email: suha.korsheed@nahrainuniv.edu.iq
8. Course Objectives

Course Objectives	• Understand the advanced concepts in electromagnatic theory • Linking a theoretical concept with the application • Giving the student the opportunity to choose the research project that qualifies hin obtain higher students .
9. 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	3	VECTOR OPERATORS
2	3	PHASORS
3	3	ELECTRIC FIELDS I Coulomb's Law and Gauss's Law
4	3	ELECTRIC FIELDS II The Equations of Poisson and Laplace.
5	3	Charge Conservation, conductors
6	3	ELECTRIC FIELDS III Electric Multipoles
7	3	ELECTRIC FIELDS IV Energy,
8	3	Exam
9	3	, Capacitance, and Forces
10	3	ELECTRIC FIELDS V Electric Circuits A
11	3	RC Circuits
12	3	ELECTRIC FIELDS VI
13	3	Electric Circuits B
14	3	Circuit Theorems
15	3	**Exam**

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

11. Learning and Teaching Resources

Required textbooks (curricular books, if any)	1] Electromagnetic Fields and Waves, Paul Lorrain, Uniuersite de Montreal and McGill University, 1987
Main references (sources)	Electromagnetic Fields and Waves, Paul Lorra Uniuersite de Montreal and McGill University, 1987
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:Advanced Quantum Mechanics

2. Course Code:

3. Semester / Year:Second / 2025-2026

4. Description Preparation Date:January 2026

5. Available Attendance Forms:Attendance in class

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

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

Name: Prof. Dr. Oday Ali Hussein
Email:oday.hussein@nahrainuniv.edu.iq

8. Course Objectives

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

9. Teaching and Learning Strategies

Strategy	A- Cognitive goals. A!-Understand the basics of advanced quantum mechanics A2- The ability to deal with advanced issues that include a greater degree of complexity compared to what he learned previously. A3- The ability to understand and deal with complex quantum systems on their own or subject to external influences that make dealing with them in traditional ways impossible. A4- The ability to use advanced solution methods in dealing with quantitative problems.. B. The skills goals special to the course. B1.Theoretical and mathematical skills. B2.Applied skills. B3.Developmental skills

10. Course Structure					
Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**
1	3		Introduction and Review	Theoretical	Written exams and homework
2	3		Matrix representation of Kets, Bras, and Operators	Theoretical	Written exams and homework
3	3		Angular Momentum	Theoretical	Written exams and homework
4	3		Angular Momentum in Cartesian coordinates	Theoretical	Written exams and homework
5	3		Angular Momentum in Spherical coordinates	Theoretical	Written exams and homework
6	3		Spin Angular Momentum	Theoretical	Written exams and homework
7	3		Matrix representation of angular momentum operators	Theoretical	Written exams and homework
8	3		Matrix Formalism for Spin operators	Theoretical	Written exams and homework
9	3		Systems with spin one-half	Theoretical	Written exams and homework
10	3		A vector Model for Spin One-half Particle	Theoretical	Written exams and homework
11	3		Electron-Spin precession	Theoretical	Written exams and homework
12	3		Systems with spin zero	Theoretical	Written exams and homework
13	3		Coherent States of Simple Harmonic Oscillator	Theoretical	Written exams and homework
14	3		The Number Operator and Number	Theoretical	Written exams and homework

			Eigenstate		
15	3		The Coherent States	Theoretical	Written exams and homework

11. Course Evaluation

Distributing the score out of 100 according to the tasks assigned to the student such as d ily preparation, dailyoral, monthly, or written exams, reports .... etc

12. Learning and Teaching Resources

Required textbooks (curricular books, any)	Quantum Mechanics, L. I. Schiff, 3rd Edition (Mc Graw-Hill Inc., NY)
Main references (sources)	Advanced Quantum Mechanics, J. J. Sakurai, (Addison-Wesley)
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	

Course Description Form

1. Course Name: **Advanced Nuclear Physics**

2. Course Code:

3. Semester / Year: First / 2025-2026

4. Description Preparation Date: January 2026

5. Available Attendance Forms: Attendance in class

6. Number of Credit Hours (Total) / Number of Units (Total): 35 hours /2 units

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

Name: Prof. Dr. Saad Naji Abood
Email: Saad.Abood@nahrainuniv.edu.iq

8. Course Objectives

Course Objectives	The objectives of teaching Advanced Nuclear Physics to graduate students include: 1. Understanding basic concepts: Enhancing students' knowledge of basic concepts in nuclear physics, such as nuclear reactions and particle physics. 2. Applying theories: Training students to apply theories and models to analyze nuclear phenomena. 3- Developing research skills: Encouraging students to conduct independent research in specific areas of nuclear physics. 4- Using modern technologies: Teaching students to use modern tools and techniques in nuclear experiments. 5- Data analysis: Developing skills in analyzing quantitative and qualitative data related to nuclear experiments. 6- Scientific Communication: Enhancing students' ability to write scientific reports and deliver oral presentations on their research findings. 7- Understanding Practical Applications: Exploring the practical applications of nuclear physics in fields such as nuclear energy, nuclear medicine, and scientific research. These objectives aim to prepare students to meet the challenges in the field of nuclear physics and contribute to scientific developments.

9. Teaching and Learning Strategies

Strategy	Teaching advanced nuclear physics to graduate students requires effective and advanced educational strategies. Here are some strategies that can be used: **1. Active Learning**

- **Group Discussions**: Encourage students to discuss nuclear concepts in small groups.
- **Project-Based Learning**: Assign research projects related to advanced topics in nuclear physics.

2. Directed Teaching

- **Individual Guidance**: Provide personal support to students through advisory sessions.
- **Seminars**: Organize seminars to discuss current research and developments in the field of nuclear physics.

3. Technology

- **Simulations**: Use simulation software to illustrate nuclear phenomena.
- **Multimedia**: Present educational content through videos and interactive presentations.

4. Diverse Assessment

- **Quizzes**: Use periodic short quizzes to assess students' understanding.
- **Self-Assessment**: Encourage students to evaluate their progress and identify areas for improvement.

5. Practical Application

- **Laboratory Experiments**: Conduct hands-on experiments to reinforce theoretical understanding.
- **Industry Applications**: Discuss practical applications of nuclear physics in fields such as medicine and energy.

6. Critical Thinking

- **Problem Solving**: Encourage students to tackle complex problems requiring critical thinking.
- **Analytical Thinking**: Analyze previous research and studies to develop research skills.

7. Student Collaboration

- **Peer Teaching**: Encourage students to share knowledge and experiences.
- **Building a Learning Community**: Create a learning environment that encourages collaboration and mutual support.

Using these strategies together can enhance the learning experience and develop students' skills in advanced nuclear physics.

10. Course Structure

Week	Hours	Required Learning	Unit or subject	Learning method	Evaluation method

		Outcomes	name		
1	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Background and basic nuclear properties	Theoretical	Written exams and homework
2	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Basic nuclear properties	Theoretical	Written exams and homework
3	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Yukawa's mesons field theory, Nuclear binding energy, average binding energy	Theoretical	Written exams and homework
4	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Nuclear forces, Separation energy of nuclear particle	Theoretical	Written exams and homework
5	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Nuclear models, Liquid Drop Model, mass parabola	Theoretical	Written exams and homework
6	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Shell model, Single particle Shell Model	Theoretical	Written exams and homework
7	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Collective Models, Bohr-Mottelson Model, Nilsson Model	Theoretical	Written exams and homework
8	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Collective Models, Dynamic Deformation Model, Interacting Boson Model	Theoretical	Written exams and homework
9	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Radiation Interaction with matter	Theoretical	Written exams and homework

10	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Radiation Interaction with matter	Theoretical	Written exams and homework
11	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Decay Modes, Alpha Decay, Beta Decay	Theoretical	Written exams and homework
12	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Gamma Emission , Selection rules, Transition Probability	Theoretical	Written exams and homework
13	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Nuclear Reaction	Theoretical	Written exams and homework
14	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Elementary Particles	Theoretical	Written exams and homework
15	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Elementary Particles	Theoretical	Written exams and homework
16	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Cosmic Rays	Theoretical	Written exams and homework

11.Course Evaluation

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

12.Learning and Teaching Resources

Required textbooks (curricular books, if any)	Introductory Nuclear Physics by Kenneth S. Krane
Main references (sources)	Nuclear Physics: Principles and Applications by John Lilley
Recommended books and references	

(scientific journals, reports…)	
Electronic References, Websites	

Course Description Form

1. Course Name:
English Language II
2. Course Code:
3. Semester / Year:
M.Sc./2nd Sem. 2025-2026
4. Description Preparation Date:
30/1/2026
5. Available Attendance Forms:
Physical Attendance
6. Number of Credit Hours (Total) / Number of Units (Total)
2 Hours
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 Objectiv	• Students can understand articles and dialogues in English and translate them into their mother languages, Arabic. • Students can write scientific articles of their own, taking into account the rules of the language and the words used. • Students can quote from written articles and rephrase them to avoid plagiarism in their research and articles.

9. Teaching and Learning Strategies

Strategy	The strategies followed in this curriculum are: • Providing detailed lectures to students, including external paragraphs and writing skills. • Providing listening lectures • Giving students homework that includes practicing writing skills to avoid paraphrasing. • Students participate in discussion and conversation using “English vocabulary” words in the classroom.

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

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

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

12	1	Evaluate the student	Second Mid Exam	Whiteboard and LCD	Oral and written exams
13	1	The students are requested to write essays on certain subjects	Writing essays on selecting subject	Whiteboard and LCD	Oral and written exams
14	1	The students will be exposed to different audio assays and then they are requested to answer the questions	Listening Practice 1	Whiteboard and LCD	Oral and written exams
15	1	The students will be exposed to different audio assays and then they are requested to answer the questions	Listening Practice 2	Whiteboard and LCD	Oral and written exams

11. Course Evaluation

30 Marks (Mid exam + Homework+ Quizzes)
70 Marks Final Exam

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Headway Academic Skills Reading, Writing, and Study Skills Level 2 Student Book
Main references (sources)	
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	https://elt.oup.com/student/headway/advanceddownload?cc=us&selLanguage=en

Course Description Form

1. Course Name:
Lasers and Applications (Elective)
2. Course Code:
3. Semester / Year:
Second Semester / 2025-2026
4. Description Preparation Date:
2026
5. Available Attendance Forms:
Attending
6. Number of Credit Hours (Total) / Number of Units (Total)
3 Hours per week (Theoretical)
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	• **Mastering Quantum Interactions:** Develop a deep understanding of the quantum mechanical interaction between radiation and matter. • **Advanced Cavity Analysis:** Analyze the stability and modes of complex optical resonators and Gaussian beam propagation. • **Ultrafast Dynamics:** Study the physics of ultra-short pulse generation, including advanced Q-switching and Mode-locking techniques. • **Advanced Applications:** Evaluate the use of lasers in high-precision material processing, medicine, and non-linear optics. • **Research Integration:** Enhance the ability to critique recent research papers and conduct independent research projects in laser technology.

9. Teaching and Learning Strategies	
Strategy	• Advanced Theoretical Lectures: Covering complex concepts in laser physics and non-linear optics.

	• Research-Based Learning: Analysis of recent scientific publications and case studies. • Computational Modeling: Simulations of beam propagation and resonator stability. • Seminars and Presentations: Student-led discussions on specialized laser applications.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1.	3	Learning Quantum Theory of Radiation	Quantum Theory of Radiation	Interactive Lecture	Classroom Discussion
2.	3	Line Broadening Mechanisms	Line Broadening Mechanisms	Presentation	Homework
3.	3	Optical Resonator Stability	Optical Resonato Stability	Mathematical Derivations	Quiz
4.	3	Gaussian Beam Propagation	Gaussian Beam Propagation	Computer Simulation	Technical Report
5.	3	Advanced Rate Equations	Advanced Rate Equations	Problem Solving	First Monthly Exam
6.	3	Q-Switching & Mode-Locking	Q-Switching & Mode-Locking	Theoretical Lecture	Research Discussion
7.	3	High Power Gas Lasers (CO2, Excimer)	High Power Gas Lasers (CO2, Excimer)	Case Study	Comparative Report
8.	3	Advanced Solid-State Systems (Ti:Sapphire)	Advanced Solid-State Systems (Ti:Sapphire)	Data Analysis	Quiz
9.	3	Advanced Fiber Laser Technology	Advanced Fiber Laser Technology	Presentation	Presentation Evaluation
10.	3	Lasers in Medicine & Surgery	Lasers in Medicine & Surgery	Mini-Seminar	Term Paper
11.	3	Remote Sensing & LiDAR	Remote Sensing & LiDAR	Lecture	Homework
12.	3	Laser Material Processing	Laser Material Processing	Field Study / Video	Second Monthly Exam
13.	3	Non-linear Optics & Harmonic Generation	Non-linear Optic & Harmonic Generation	Derivations	Discussion

14.	3	Laser in Nanotechnology	Laser in Nanotechnology	Research Paper Review	Scientific Critique
15.	8	Future Trends in Laser Research	Future Trends in Laser Research	Discussion Session	Final Presentation

11. Course Evaluation

Semester Work (40/100):

Monthly Written Exams: 20%

Research Paper & Seminar: 10%

Assignments & Quizzes: 10%

Final Examination (60/100): Comprehensive theoretical exam.

12. Learning and Teaching Resources

Required textbooks (curricular books any)	
Main references (sources)	1. *Principles of Lasers* by Orazio Svelto (5th Edition, 2010). 2. *Laser Fundamentals* by William T. Silfvast (2nd Edition, 2004).
Recommended books and references (scientific journals, reports…)	*Lasers* by Anthony E. Siegman. 2. Scientific Journals: *Na* *Photonics*, *Optics Expre*
Electronic References, Websites	IEEE Xplore, ScienceDirect, and specialized laser simulation softw websites.

Course Description Form

1. Course Name: **advance optics /Master**

2. Course Code:

3. Semester / Year: second 2025/2026

4. Description Preparation Date: 20/1/2026

5. Available Attendance Forms: present

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

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

Name: Prof. Dr. Suha Mousa Khorsheed
Email: suha.korsheed@nahrainuniv.edu.iq

8. Course Objectives

Course Objectives	• Understand the advanced concepts in advance optics • Linking a theoretical concept with the application • Giving the student the opportunity to choose the research project that qualifies hir 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	2	The ray –tracing equation using matrices
2	2	The Fourier transform and Fourier optics
3	2	Rectangle function
4	2	Dirac delta function
5	2	Fourier transform in two- dimensions
6	2	Convolution operation
7	2	Correlation of functions
8	2	Thin lens as a phase transformation
9	2	Fourier transforming properties of lenses
10	2	Transfer function
11	2	Measurement of OTF
12	2	MODULATION TRANSFER FUNCTION MTF
13	2	Matrix representation of polarization state of light
14	2	Matrix representation of polarization state
15	2	**Exam**

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

11. Learning and Teaching Resources

Required textbooks (curricular books, if any)	1-optical metrology, 3rd edition ,2002,John Wiley & Sons Ltd. 2-Optics: principle and application, 2006,Elsevier Inc.
Main references (sources)	Introduction of Fourier optics,2nd 1996,Mc Graw-Hill Series in Electrical and Computer engineering, Jouseph W. Goodman
Recommended books and references (scientific journals, reports...)	All related international lectures and researches w dependent
Electronic References, Websites	All books and global sites in the internet

Course Description Form

1. Course Name:

Laser Produced Plasma / M.Sc. students

2. Course Code:

3. Semester / Year:

Second Course / 2025 – 2026

4. Description Preparation Date:

25/1/2026

5. Available Attendance Forms:

In presence

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

2 hours

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

Name: **Prof.Dr.Khalid Abbas Yahya**
Email: **khalid.abbass@nahrainuniv.edu.iq**

8. Course Objectives

Course Objectives	• **The course aims to teach graduate students the subject of Laser Produced Plasma by studying general theories in this subject. Among the models of laser interaction with solid target and generation plasma and other phenomena in this process.** • **Benefiting from this course in assigning the rest of the other courses postgraduate students.** • **Keeping up with scientific curricula and courses in international universities.**

9. Teaching and Learning Strategies

Strategy	**•Activating students and activating educational attitudes by accustoming students to respecting different opinions, appreciating others, and benefiting from others' ideas and information.** **• Exchanging ideas (dialogical method) and encouraging acceptance of others' ideas.** **•Asking questions to a specific student, with the aim of developing several skills, the most important of which are constructing questions, exchanging ideas, and reading.** **•The student is asked to write a report/research on a specific topic, and this method develops the student's research, analysis, expression, and presentation skills. Questions related to the lecture are asked as homework to activate and deepen the learning objectives and follow up with the student in correcting errors in the assignment**

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2		Introduction to laser beam.	In presence	Exams and assignments
2	2		Introduction to plasma physics.	In presence	Exams and assignments
3	2		Methods of generation plasma.	In presence	Exams and assignments
4	2		Tunnel ionization	In presence	Exams and assignments
5	2		Multiphoton ionization .	In presence	Exams and assignments
6	2		Physical principles of laser – material interaction regions	In presence	Exams and assignments
7	2		Plasma production by laser ablation heavy metals.	In presence	Exams and assignments
8	2		Interaction laser with metals.	In presence	Exams and assignments
9	2		Interaction laser with dielectrics	In presence	Exams and assignments

10	2		Charged particle dynamic in laser-produced plasma.	In presence	Exams and assignments
11	2		Laser absorption and propagation in plasma.	In presence	Exams and assignments
12	2		Waves in laser-produced plasma.	In presence	Exams and assignments
13	2		Laser –induced electric field in plasma.	In presence	Exams and assignments
14	2		The pondermotive force	In presence	Exams and assignments
15	2		Applications of laser produced plasma.	In presence	Exams and assignments

11. Course Evaluation

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

Evaluation is done through

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

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Femtosecond Laser-Matter Interactions Solid-Plasma-Solid Transformations at the Extreme Energy Density Eugene G. Gamaly, 2022
Main references (sources)	All sources on the subject of Laser Produced Plasma
Recommended books and references (scientific journals, reports…)	All books specialized in Laser Produced Plasma
Electronic References, Websites	Official websites of scientific libraries

Course Description Form

1. Course Name: Electron Optics

2. Course Code:

3. Semester / Year:First / 2025-2026

4. Description Preparation Date:January 2026

5. Available Attendance Forms:Attendance in class

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

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

Name: Prof. Dr. Oday Ali Hussein
Email:oday.hussein@nahrainuniv.edu.iq

8. Course Objectives

Course Objectives	The student acquires basic knowledge of the electron optics and learns the importance of the subject and that it is an essential part in the design and operation of many important applications, especially in the field of high energies such as accelerators, electric and magnetic storage rings, electron microscopes, and other applications. As well as acquiring skills in dealing with applications in which the subject of charg particle optics is a basis in terms of design and operation

9. Teaching and Learning Strategies

Strategy	A- Cognitive goals. A1- Understanding the basics of electron optics A2- Knowing the methods of dealing with charged particles in electric and magnetic fields A3- Identify applications in which charged particle optics are an active part in their design and operation A4- Knowing the defects and how to avoid them in these systems and applications.

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

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	Gain the required background	Introduction to electron optics	Theoretical	Written exams and homework
2	2	Enable the student to derive equations and know the relative effect	The relativistic corrected of accelerating voltage	Theoretical	Written exams and homework
3	2	The student knows the importance of electronic microscopes digitally	Advantage of high voltage electron microscopy	Theoretical	Written exams and homework
4	2	Enable the student to derive equations	Trajectory of an electron beam in magnetic field	Theoretical	Written exams and homework
5	2	Enable the student to derive equations	Trajectory of an electron beam in electric field	Theoretical	Written exams and homework
6	2	The student learns about magnetic lenses, their types, and their importance	Magnetic lenses	Theoretical	Written exams and homework
7	2	The student learns about these lenses, their specifications	Weak lens approximation	Theoretical	Written exams and homework
8	2	The student learns about these lenses, their specifications	Strong lens (objective lens)	Theoretical	Written exams and homework
9	2	The student learns the distribution of fields in magnetic lenses	Axial field distribution in magnetic lens	Theoretical	Written exams and homework
10	2	The student learns about magnetic lenses, their types,	Electrostatic lenses	Theoretical	Written exams and homework

		and their importance			
11	2	The student learns these concepts	Brightness and electron-probe current	Theoretical	Written exams and homework
12	2	The student learns these concepts	Magnification (operation) conditions of electron lenses	Theoretical	Written exams and homework
13	2	Learning another application	Electron gun	Theoretical	Written exams and homework
14	2	The student learns these concepts	Resolution (Resolving power)	Theoretical	Written exams and homework
15	2	The student learns these concepts	Resolution of the electron microscopy	Theoretical	Written exams and homework

11. Course Evaluation

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

12. Learning and Teaching Resources

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

Course Description Form

1. Course Name:
Crystallography
2. Course Code:
00000
3. Semester / Year:
2025-2026 second course
4. Description Preparation Date:
15/01/2026
5. Available Attendance Forms:
Attendance
6. Number of Credit Hours (Total) / Number of Units (Total)
2 Hours
7. Course administrator's name (mention all, if more than one name)
Name: Mohammed Al-Baidhani Email: Mohammed.albaidhani@nahrainuniv.edu.iq
8. Course Objectives
By the end of this course, students will be able to: • **Understand crystal structures, lattices, and unit cells.** • **Identify crystal systems and Bravais lattices.** • **Explain symmetry operations and space groups.** • **Apply Miller indices to crystal planes and directions.** • **Understand X-ray diffraction (XRD) principles and Bragg's law.** • **Analyze diffraction patterns to determine crystal structure.** • **Relate crystallographic structure to physical properties of materials.** • **Use basic crystallography software/tools for structure analysis.**
9. Teaching and Learning Strategies

Strategy	Master's Degree in Physics – First Year – Second Course

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Understand the scope and importance of crystallography	Introduction to Crystallography	Lecture	Quiz
2	3	Describe crystal lattices and unit cells	Crystal Lattices & Unit Cells	Lecture	Assignment
3	3	Identify crystal systems and Bravais lattices	Crystal Systems	Lecture	Quiz
4	3	Apply symmetry operations in crystals	Symmetry Elements	Lecture + Tutorial	Homework
5	3	Classify space groups	Space Groups	Lecture	Mid-term Test
6	3	Use Miller indices for planes and directions	Miller Indices	Lecture + Exercises	Assignment
7	3	Explain reciprocal lattice concepts	Reciprocal Lattice	Lecture	Quiz
8	3	Understand X-ray generation and interaction with matter	X-ray Fundamentals	Lecture	Homework
9	3	Apply Bragg's Law	X-ray Diffraction & Bragg's Law	Lecture + Problems	Quiz
10	3	Interpret diffraction patterns	Diffraction Patterns	Lecture	Assignment
11	3	Analyze crystal structures using XRD data	Structure Determination	Lecture + Case Study	Project
12	3	Relate crystal structure to physical properties	Structure–Property Relationship	Lecture	Presentation
13	3	Use crystallographic software tools	Crystallography Software	Practical Session	Practical Evaluation
14	3	Review and integrate course concepts	Course Review	Discussion	Final Exam

11. Course Evaluation

The total course score (100 marks) will be distributed based on the student's performance in assigned tasks, including but not limited to:

- Daily preparation
- Daily oral participation
- Quizzes and short tests
- Monthly or written examinations
- Reports and assignments
- Other academic activities

This continuous assessment ensures that all aspects of the student's engagement, understanding, and practical skills in crystallography are fairly evaluated.

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	– Fundamentals of Crystallography – C. Giacovazzo (or equivalent curricular book) – Any other textbooks prescribed by the curriculum
Main references (sources)	– International peer-reviewed crystallography bo – Lecture notes provided by the instructor
Recommended books and references (scientific journals, reports…)	• *Introduction to Solid State Physics* – C. Kittel • Scientific journals, research articles, and reports on crystallography and X-ray diffraction • Specialized publications in materials science and solid-state physics
Electronic References, Websites	• International Union of Crystallography (IUCr) • Crystallography Open Database • Online lecture materials, PDFs, and databases recommended by the instructor

Course Description Form

1. Course Name: Elementary Particles

2. Course Code:

3. Semester / Year: First / 2025-2026

4. Description Preparation Date: January 2026

5. Available Attendance Forms: Attendance in class

6. Number of Credit Hours (Total) / Number of Units (Total): 35 hours /2 units

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

Name: Prof. Dr. Saad Naji Abood
Email: Saad.Abood@nahrainuniv.edu.iq

8. Course Objectives

Course Objectives	The objectives of teaching the subject of elementary particles to fourth-year students in the Physics Department include: 1. **Understanding Theoretical Foundations**: Introducing students to concepts of elementary particles, such as quarks and leptons, and the fundamentals of physical models. 2. **Developing Analytical Skills**: Enhancing the ability to analyze data and experiments related to elementary particles. 3. **Practical Applications**: Connecting theoretical concepts to practical applications in fields such as nuclear physics and particle physics. 4. **Critical Thinking**: Encouraging students to engage in critical thinking and explore complex questions about the structure of matter and the universe. 5. **Scientific Research**: Motivating students to participate in research and scientific projects related to elementary particles. 6. **Interaction with Technology**: Exposing students to the latest technologies and devices used in the study of elementary particles, such as particle colliders. These objectives aim to prepare students well for their academic and professional fu in the field of physics.

9. Teaching and Learning Strategies

Strategy	**The teaching and learning strategy for the subject of elementary particles includes several key aspects:** 1. **Active Learning**: Encouraging students to participate actively through

discussions, workshops, and interactive activities.

2. **Project-Based Learning**: Assigning students research projects related to elementary particles, which enhances their deep understanding of the subject.

3. **Technology in Education**: Utilizing computer simulations and educational applications to enhance visual understanding of complex concepts.

4. **Collaborative Learning**: Forming small work groups to promote collaboration among students and knowledge sharing.

5. Continuous Assessment: Implementing diverse assessment methods, such as quizzes, presentations, and self-assessments, to ensure understanding of concepts.

6. Interaction with Experts: Inviting guest lecturers or organizing visits to research centers or particle physics laboratories to enhance the educational experience.

7. Providing Diverse Resources: Offering a variety of educational resources, such as books, articles, and videos, to deepen understanding.

These strategies aim to enhance the learning experience and make it more interactive and suitabl students' needs in the field of elementary particles.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Particle and anti particles	Theoretical	Written exams and homework
2	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Four Forces and Examples	Theoretical	Written exams and homework
3	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Classification of Elementary Particles	Theoretical	Written exams and homework
4	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Properties of Elementary Particles	Theoretical	Written exams and homework
5	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Properties of Elementary Particles	Theoretical	Written exams and homework

6	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Conservation Laws of Elementary Particles	Theoretical	Written exams and homework
7	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Conservation Laws of Elementary Particles	Theoretical	Written exams and homework
8	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Strange Particles	Theoretical	Written exams and homework
9	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Quarks	Theoretical	Written exams and homework
10	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Quarks	Theoretical	Written exams and homework
11	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Quark Models	Theoretical	Written exams and homework
12	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Quark Models	Theoretical	Written exams and homework
13	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Quantum field for describing mutually interacting particles	Theoretical	Written exams and homework
14	**2**	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Quantum Chromodynamics	Theoretical	Written exams and homework

15	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Cosmic Rays	Theoretical	Written exams and homework
16	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Cosmic Rays	Theoretical	Written exams and homework
17	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Cosmic Rays	Theoretical	Written exams and homework

11. Course Evaluation

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

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Introduction to Elementary Particles by David Griffiths
Main references (sources)	Particle Physics: A Very short Introduction by: Frank Close
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	

Course Description Form

1. Course Name:

Condensed Matter Physics

2. Course Code:

3. Semester / Year:

Second Semester/ Diploma

4. Description Preparation Date:

Jan. 2026

5. Available Attendance Forms:

1) Classroom Lecture, 2) Electronic Classroom

2) Number of Credit Hours (Total) / Number of Units (Total)

2 Hrs. a week (30 Hrs. Total) / 2 untis

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

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

4) Course Objectives

Course Objectives	**For a postgraduate diploma in physics, the syllabus should strike a balance between deepening foundational understanding and introducing advanced concepts and applications. Here's a suggested 15-week semester syllabus tailored on "Condensed Matter Physics" for students who already hold a BSc in physics. The course pre-requests are: Quantum Mechanics, Electromagnetic Theory and Statistical Physics**
Strategy	**Classroom Attendance and Discussion, Exercises and solved problems, Home Assessments, Quizzes**

6) Course Structure

Week	Hrs.	Unit title / Subjective	Learning method	Evaluation method
1	2	**What is Condensed Matter?**	Classroom lecture	
2	2	**Order, Symmetry, and Broken Symmetry**	Classroom lecture	
3	2	**Phase Transitions & Critical Phenomena**	Classroom lecture	
4	2	**Collective Excitations**	Classroom lecture	
5	2	**Strongly Correlated Systems**	Classroom lecture	
6	2	**Quantum Many-Body Systems**	Classroom lecture	
7	2	**Superconductivity as a Condensed Matter Phenomenon**	Classroom lecture	
8	2	**Quantum Phase Transitions**	Classroom lecture	
9	2	**Topological Phases of Matter**	Classroom lecture	
10	2	**Low-Dimensional Systems**	Classroom lecture	
11	2	**Disorder, Glasses, and Localization**	Classroom lecture	
12	2	**Soft Condensed Matter**	Classroom lecture	
13	2	**Non-equilibrium Condensed Matter**	Classroom lecture	
14	2	**Experimental Probes in Condensed Matter**	Classroom lecture	
15	2	**Review**		

7) 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:
Classroom Discussion (5 Marks), Quizzes (5 Marks), Midterm Exam (20 Marks)
Final Exam (70 Marks)

8) Learning and Teaching Resources	
Required textbooks (curricular books, if any)	
Main references (sources)	1. **P. M. Chaikin & T. C. Lubensky – *Principles of Condensed Matter Physics* (selected chapters)** 2. **Philip Ball – *Condensed Matter Physics: A Very Short Introduction*** 3. **Anderson, "More Is Different"** 4. **Popular science articles (Nature, Physics Today)**
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

1. Course Name:

Radiological Physics

2. Course Code:

Master

3. Semester / Year:

second semester 2025-2026

4. Description Preparation Date

2026

5. Available Attendance Forms:

In personal

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:prof.Dr. Asmaa Hadi Mohammed

Email: asmaa.hadi@nahrainuniv.edu.iq

8. Course Objectives

Course Objectives	• Understand principles of radiological physics • Explain X-ray production and interaction • Describe radiation-induced DNA damage and repair mechanisms • Analyze image formation and quality • Apply radiation protection principles

9. Teaching and Learning Strategies

Strategy	• Lectures • PowerPoint presentations • Problem-solving sessions • Case studies • Assignments and quizzes

10. Course Structure

Week	H	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	Understand basic radiological physics concepts	Introduction to Radiological Physics	Lecture	Quiz
2	2	Explain principles of X-ray production	X-ray Production	Lecture	Quiz
3	2	Describe X-ray tube components	X-ray Tube	Lecture	Assignment

4	2	Analyze X-ray spectrum and beam quality	X-ray Spectrum and Beam Quality	Lecture	Quiz
5	2	Explain radiation interaction with matter	Radiation Interaction with Matter	Lecture	Assignment
6	2	Understand image formation principles	Image Formation	Lecture	Quiz
7	2	Evaluate image quality factors	Image Quality	Lecture	Midterm Exam
8	2	Explain scattered radiation effects	Scattered Radiation	Lecture	Quiz
9	2	Analyze radiation dose concepts	Radiation Dose	Lecture	Assignment
10	2	Apply radiation protection principles	Radiation Protection	Lecture	Assignment
11	2	Understand quality assurance concepts	Quality Assurance	Lecture	Quiz
12	2	Review radiological imaging systems	Radiological Imaging Systems	Lecture	Quiz
13	2	Explain digital radiography basics	Digital Radiography	Lecture	Assignment
14	2	Integrate course concepts	Revision	Discussion	Quiz
15	2	Assess overall course outcomes	Final Examination	Exam	Final Exam

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)	IAEA. Diagnostic Radiology Physics: A Handbook for Teachers and Students. Bushberg et al. The Essential Physics of Medical Imaging. التشخيصية الإشعاعية الفيزياء – الذرية للطاقة الدولية الوكالة.
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	IAEA. Diagnostic Radiology Physics: A Handb for Teachers and Students,

Course Description Form

1. Course Name: Digital Image Processing – M. Sc.

2. Course Code:

3. Semester / Year: 2`nd /2025–2026

4. Description Preparation Date: 1 / 2 / 2026

5. Available Attendance Forms: Attendance \ Courses

6. Number of Credit Hours (Total) / Number of Units (Total) 2h/w total (30h)

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

Name: Prof. Dr. Laith Abdul Aziz Al-Ani
Email: laithalani2003@gmail.com

8. Course Objectives

Course Objectives	• To introduce the concepts of image processing and basic analytical methods to be used in image processing. • To familiarize students with image enhancement and restoration techniques, • To explain different image compression techniques. • To introduce segmentation and morphological processing techniques

9. Teaching and Learning Strategies

Strategy	After completing the curriculum, the student will be able to: A- Describe the basics of digital images and how to process them. B- Use techniques to enhance images in both spatial and frequency domains. C- Understand the mathematical relationships behind image optimization and categorization. D- Implement image splitting concepts. E- Identify methods of detecting and identifying objects. F- Identify the right filter to perform a specific operation on the image and choose the correct dimensions for that filter.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1st	3	Increase knowledge, skill and competence	Back ground	- Lecture-based learning. - Technology-based learning. - Group learning. - Individual learning	- Performance Tes - (Home Work) - Challenge Test - Report Test
2nd	3		• Digital image fundamentals • An image models • Uniform and non-uniform image sampling and quantization • Basic relationship between pixel (neighbours of pixel) • Connectivity distance measures		
3rd	3		• Camera model • How do we see the world? • Pinhole camera • From retina plane to images • Coordinate systems (centering pixels) • Homogeneous coordinates • Projective transformation in the homogenous coordinate system		
4th	3		• Introduction to Fourier transform • The discrete Fourier transform • Some properties of 2D dimensional Fourier transform • Separability, Translation, Rotation, Scaling, Average, value, • Convolution, Correlation, Sampling		
5th	3		• Fast Fourier transform • FFT algorithm • The inverse FFT		
6th	3		Mid Examination -1		
7th	3		• Walsh transform • Hadamard transform		
8th	3		• Discrete cosine transforms • Hotelling transform		
9th	3		Image enhancement • Spatial domain method • Frequency domain method • Enhancement by histogram modification • Histogram equalization • Histogram specification		
10th	3		Image smoothing • Linear averaging		

			• Median filtering • Low pass filtering • Averaging of multiple images		
11th	3		I Image sharpening • Sharpening by differentiation • High pass filtering • Butterworth high pass filter • Gaussian high pass filter • The Laplacian in frequency domain		
12th	3		Mid Examination -2		
13th	3		• Texture Analysis		
14th	3		• Seminar I		
15th	3		• Seminar II		

1. 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 70%
- (Home Work) : 10%
- Test : 10%
- Seminar: 10%

2. Learning and Teaching Resources

Required textbooks (curricular books any)	• Digital Image Processing, Rafael C. Gonzalez and Richard E. Wood 2008, Academic Press, New York.
Main references (sources)	• Andrews H. C. 1970, Academic Press, New York.
Recommended books and references (scientific journals, reports…)	• Computer Vision, Ballard D. H. and Brown C. M. 1982, Prentice Hall, Englewood Cliffs, N. J.
Electronic References, Websites	

Course Description Form

1. Course Name:
Advanced Plasma / M.Sc students
2. Course Code:
3. Semester / Year:
Second Course / 2025 – 2026
4. Description Preparation Date:
25/1/ 2026
5. Available Attendance Forms:
In presence
6. Number of Credit Hours (Total) / Number of Units (Total)
2 hours
7. Course administrator's name (mention all, if more than one name)
Name: Assist.Prof. Dr.Nissan Soud Oribi Email: nissan.oribi@nahrainuniv.edu.iq
8. Course Objectives

Course Objectives	• **The course aims to teach graduate students the subject of plasma physics by studying general theories in this subject. Among the models of plasma physics such as Single particle motions , Plasma as fluid and Kinetic theory of plasma, and the comparison between these models..** • **Benefiting from this course in assigning the rest of the other courses postgraduate students.** • **Keeping up with scientific curricula and courses in international universities.**

9. Teaching and Learning Strategies

Strategy	**•Activating students and activating educational attitudes by accustoming students to respecting different opinions, appreciating others, and benefiting from others' ideas and information.** **• Exchanging ideas (dialogical method) and encouraging acceptance of others' ideas.** **•Asking questions to a specific student, with the aim of developing several skills, the most important of which are constructing questions, exchanging ideas, and reading.** **•The student is asked to write a report/research on a specific topic, and this method develops the student's research, analysis, expression, and presentation skills.** **Questions related to the lecture are asked as homework to activate and deepen the learning objectives and follow up with the student in correcting errors in the assignment**

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	The forth state of matter, Plasmas in nature, Saha equation, Comparison between real gaseous and plasma, plasma examples.	Fundamental of plasma physics	In presence	Exams and assignments
2	2	Explain Saha equation	**Saha equation**	In presence	Exams and assignments
3	2	The effect of considering single particle motion on plasma properties, Equation of motion, Lorenz forces, Cyclotron motion, Cyclotron frequency, Larmor radios, Diamagnetism of plasma.	**Single particle motion:**	In presence	Exams and assignments
4	2	Drift motion due the effect of electrical field normal to magnetic field, due to external forces, due to gravitational forces.	**Effect of homogeneous magnetic and electrical fields**	In presence	Exams and assignments
5	2	Drifts due to gradient in magnetic field normal and parallel to magnetic field lines, magnetic mirrors and its applications, earth magnetic mirror, The loss cone , The effect of time dependent electric and magnetic	**Effect of inhomogeneous magnetic and electrical fields**	In presence	Exams and assignments
6	2	Introductory, Convective derivative, Equation of motion , force of	**Plasma as fluid**	In presence	Exams and assignments

		magnetic pressure, Static and magnetic pressures, Beta factor, Drifts of fluid plasma, Diamagnetic plasma.			
7	2	Diffusion and mobility in ionized atoms, Collisions and its parameters, diffusion parameters,	**Diffusions and Receptivity in plasmas**	In presence	Exams and assignments
8	2		Examples	In presence	Exams and assignments
9	2		Exam	In presence	Exams
10	2	Electrostatic probes, Magnetic probes,	**Plasma diagnostic**	In presence	Exams and assignments
11	2	Laser diagnostic	**Plasma diagnostic**	In presence	Exams and assignments
12	2	Pinch effect, dense plasma focus	**Plasma apparatuses (systems) and future progress**	In presence	Exams and assignments
13	2	Radio frequency plasma , plasma laboratory apparatuses.	**Plasma apparatuses (systems) and future progress**	In presence	Exams and assignments
14	2		Examples	In presence	Exams and assignments
15	2		Exam	In presence	Exams and assignments

11. Course Evaluation

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

Evaluation is done through

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

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	PRINCIPLES OF PLASMA PROCESSING Francis F. Chen *Electrical Engineering Department* Jane P. Chang *Chemical Engineering Department* *University of California, Los Angeles*
Main references (sources)	All sources on the subject of Advance Plasma
Recommended books and references (scientific journals, reports…)	All books specialized in advanced Advance Plasma
Electronic References, Websites	Official websites of scientific libraries

نموذج وصف المقرر

1. اسم المقرر	نبائظ اشباه الموصلات
2. رمز المقرر	
3. الفصل / السنة	الثاني/2025-2026
4. تاريخ إعداد هذا الوصف	2026 /1/29
5. أشكال الحضور المتاحة	حضوري
6. عدد الساعات الدراسية (الكلي)/ عدد الوحدات (الكلي)	/2
7. اسم مسؤول المقرر الدراسي (اذا اكثر من اسم يذكر)	
الاسم: ا.د. وسن علي موسى	الآيميل : wassan.ali.mousa@nahrainuniv.edu.iq
8. اهداف المقرر	
اهداف المادة الدراسية	جعل الطالب قادرا على: • فهم وتعريف فيزياء وخصائص اشباه الموصلات • التعرف على اهم أنواع النبائط • التعرف على مفرق p-n • التعرف على اتصال معدن – شبه موصل. • التعرف على اتصال معدن -عازل -شبه موصل . • التعرف على الترانزستورات ثنائية القطب. • التعرف على الموسفت. • التعرف على كل من **JFETs, MESFETs, and MODFETs** • التعرف على نبائط النفق • التعرف على الخلايا الشمسية والكواشف الضوئية • التعرف على المتحسسات.....
9. استراتيجيات التعليم والتعلم	
الاستراتيجية	- استخدام طريقة المحاضرة في المادة العلمية مع محاولة مشاركة ومناقشة الطلبة للوصول الى تعميق الفهم لديهم. - شرح ادق التفاصيل على السبورة مع التوضيح بالرسوم. - استخدام السورة الالكترونية ايضا في توضيح الشرح والروسم

10. بنية المقرر

الأسبوع	الساعات	مخرجات التعلم المطلوبة	اسم الوحدة او الموضوع	طريقة التعلم	طريقة التقييم
1	2	جعل الطالب قادرا على فهم فيزياء وخصائص اشباه الموصلات	فيزياء وخصائص اشباه الموصلات	السبورة + شاشة عرض	امتحانات شفهية وتحريرية واجبات بيتية
2	2	جعل الطالب قادرا علىفهم أهمية التعرف على اهم أنواع النبائط	فيزياء وخصائص اشباه الموصلات	السبورة+ شاشة عرض	امتحانات شفهية وتحريرية واجبات بيتية
3	2	جعل الطالب قادرا على فهم مفرق p-n	مفرق p-n	السبورة+ شاشة عرض	امتحانات شفهية وتحريرية واجبات بيتية
4	2	جعل الطالب قادرا على فهم اتصال معدن – شبه موصل	اتصال معدن – شبه موصل	السبورة+ شاشة عرض	امتحانات شفهية وتحريرية واجبات بيتية
5	2	جعل الطالب قادرا على فهم اتصال معدن –عازل- شبه موصل.	اتصال معدن –عازل- شبه موصل.	السبورة + شاشة عرض	امتحانات شفهية وتحريرية واجبات بيتية
6	2	جعل الطالب قادرا على فهم الخواص الحرارية للمواد فهم الترانزستورات ثنائية القطب.	الترانزستورات ثنائية القطب.	السبورة + شاشة عرض	امتحانات شفهية وتحريرية واجبات بيتية
7		امتحان mid			
8	2	جعل الطالب قادرا على فهم الموسفت	الموسفت	السبورة + شاشة عرض	امتحانات شفهية وتحريرية واجبات بيتية
9	2	جعل الطالب قادرا على فهم JFETs, MESFETs, and MODFETs	JFETs, MESFETs, and MODFETs	السبورة + شاشة عرض	امتحانات شفهية وتحريرية واجبات بيتية
10	2	جعل الطالب قادرا على فهم نالنفق	نبائط النفق	السبورة+ شاشة عرض	امتحانات شفهية وتحريرية واجبات بيتية
11	2	جعل الطالب قادرا على فهم كل من الخلايا الشمسية والكواشف الضوئية	الخلايا الشمسية والكواشف الضوئية	السبورة+ شاشة عرض	امتحانات شفهية وتحريرية
13	2	امتحان شهري			
14		امتحانات نهائيه			

11. تقييم المقرر	
توزيع الدرجة من 100 على وفق المهام المكلف بها الطالب مثل التحضير اليومي والامتحانات اليومية والشفوية والشهرية والتحريرية والتقارير .... الخ	
12. مصادر التعلم والتدريس	
الكتب المقررة المطلوبة (المنهجية أن وجدت)	Physics of Semiconductor Devices, 3rd Edition by S . M. Sze and Kwok K. Ng
المراجع الرئيسة (المصادر)	
الكتب والمراجع الساندة التي يوصى بها (المجلات العلمية، التقارير....)	
المراجع الإلكترونية ، مواقع الانترنيت	

Course Description Form

1. Course Name: Advanced Statistical Mechanics

2. Course Code:

3. Semester / Year: Second / 2025-2026

4. Description Preparation Date: January 2026

5. Available Attendance Forms: Attendance in class

6. Number of Credit Hours (Total) / Number of Units (Total): 35 hours /3 units

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

Name: Prof. Dr. Saad Naji Abood
Email: Saad.Abood@nahrainuniv.edu.iq

8. Course Objectives

Course Objectives	Teaching statistical mechanics to graduate students aims to achieve several important objectives, including: 1- **Understanding Theoretical Foundations**: Enabling students to grasp the basic principles of statistical mechanics and how to apply them in various fields. 2- **Developing Analytical Skills**: Enhancing students' ability to analyze complex physical systems and apply statistical models to understand their behavior. 3- **Applying Concepts to Real Systems**: Teaching students how to use statistical mechanics to describe and analyze natural phenomena and industrial processes. 4- **Research and Development**: Preparing students to conduct independent research in fields such as physics, chemistry, and engineering, where the use of statistical mechanics is required. 5- **Enhancing Critical Thinking**: Encouraging students to think critically and creatively apply concepts to solve complex problems. 6- **Developing Technological Competencies**: Equipping students with the necessary skills to use modern software and technologies in data analysis and modeling. **7-Preparing Students for the Job Market**: Providing them with the knowledge and skills needed to work in industries that require a deep understanding of

	statistical mechanics. These objectives contribute to developing the knowledge and skills necessary for students to face challenges in their academic and professional fields.

9. Teaching and Learning Strategies

Strategy	The learning strategy for teaching statistical mechanics should be comprehensive and diverse to enhance students' understanding and develop their skills. Here are some key elements of this strategy: 1. **Active Learning**: Encouraging students to participate actively through discussions, group activities, and problem-solving. 2. **Use of Modern Technologies**: Integrating software and technological tools to help students simulate systems and study their behaviour. 3. **Project-Based Learning**: Assigning students practical projects that require them to apply principles of statistical mechanics to solve real-world problems. 4. **Continuous Assessment**: Conducting regular assessments to measure students' understanding and progress, which helps in adjusting teaching methods if necessary. 5. **Student Interaction**: Promoting collaboration among students through group work, facilitating the exchange of ideas and experiences. 6. **Providing Diverse Resources**: Offering various educational resources such as videos, scientific articles, and online lectures to support self-directed learning. 7. **Guidance and Mentoring**: Providing support and guidance to students throughout the learning process, including office hours and individual assistance. 8. **Encouraging Critical Thinking**: Motivating students to ask questions and think critically about the concepts and models presented. This strategy helps create a dynamic learning environment that enhances students' understanding and applications of statistical mechanics.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	How to connect thermodynamics to the statistical approach. Phase space, density function, Liouville equation, and microcanonical ensemble. Maximum configuration, partition function, probabilities, fluctuations.	Theoretical	Written exams and homework

2	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Applications: equipartition, oscillators, paramagnetism. Inverse Laplace transform of Q(β) used to find density of states g(E). Negative temperatures in magnetic systems. Overview of canonical, iso-thermal/isobaric and grand canonical ensembles.	Theoretical	Written exams and homework
3	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Most likely configuration, partition function, probabilities, fluctuations, phases & equilibrium. The basic QM theory for ensembles and density matrix.	Theoretical	Written exams and homework
4	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	A spin-1/2 particle, a particle in a box, harmonic oscillator; systems of many particles. About QM states of free particles, infinite systems.	Theoretical	Written exams and homework
5	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Statistics for ideal gases & occupation numbers. Kinetic pressure and effusion of gases through a hole.	Theoretical	Written exams and homework
6	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Gases with internal degrees of freedom; chemical equilibrium.	Theoretical	Written exams and homework

			Statistics for ideal Bose gas; Bose-Einstein condensation Statistics for blackbody radiation and for vibrations in solids		
7	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Statistics for ideal Fermi gas at weak and strong degeneracy. Pauli exclusion principle	Theoretical	Written exams and homework
8	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	paramagnetism and Landau diamagnetism in ideal fermi gases.	Theoretical	Written exams and homework
9	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Stellar thermodynamics in white dwarf stars and Chadrasekhar's limit.	Theoretical	Written exams and homework
10	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Stellar thermodynamics in white dwarf stars and Chadrasekhar's limit.	Theoretical	Written exams and homework
11	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Stellar thermodynamics in white dwarf stars and Chadrasekhar's limit.	Theoretical	Written exams and homework
12	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Electron gas in metals; Thomas-Fermi model for heavy atoms.	Theoretical	Written exams and homework
13	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Statistics of cluster expansions for no ideal gases.	Theoretical	Written exams and homework
14	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Van der Waals gas	Theoretical	Written exams and homework

15	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Ising model	Theoretical	Written exams and homework
16	3	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	mean-field theory (zeroth approximation).	Theoretical	Written exams and homework

11. Course Evaluation

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

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Fundamentals of Statistical and Thermal Physics by F. Reif
Main references (sources)	Introduction to Statistical Physics by Kerson Huang
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	

Course Description Form

1. Course Name:
Advanced Plasma Physics / Ph.D. students
2. Course Code:
3. Semester / Year:
Second Course / 2025 – 2026
4. Description Preparation Date:
25/1/2026
5. Available Attendance Forms:
In presence
6. Number of Credit Hours (Total) / Number of Units (Total)
2 hours
7. Course administrator's name (mention all, if more than one name)
Name: **Prof.Dr.Khalid Abbas Yahya** Email: **khalid.abbass@nahrainuniv.edu.iq**
8. Course Objectives

Course Objectives	• **The course aims to teach graduate students the subject of plasma physics by studying general theories in this subject. Among the models of plasma physics such as Single particle motions , Plasma as fluid and Kinetic theory of plasma, and the comparison between these models..** • **Benefiting from this course in assigning the rest of the other courses postgraduate students.** • **Keeping up with scientific curricula and courses in international universities.**

9. Teaching and Learning Strategies

Strategy	**•Activating students and activating educational attitudes by accustoming students to respecting different opinions, appreciating others, and benefiting from others' ideas and information.** **• Exchanging ideas (dialogical method) and encouraging acceptance of others' ideas.** **•Asking questions to a specific student, with the aim of developing several skills, the most important of which are constructing questions, exchanging ideas, and reading.** **•The student is asked to write a report/research on a specific topic, and this method develops the student's research, analysis, expression, and presentation skills.** **Questions related to the lecture are asked as homework to activate and deepen the learning objectives and follow up with the student in correcting errors in the assignment**

10. Course Structure					
Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**
1	2	Introduction to defining plasma and its properties	Introduction to plasma physics	In presence	Exams and assignments
2	2	Equation of boundary conditions for plasma	Study of plasma parameters	In presence	Exams and assignments
3	2	Derivation of the equations of motion in the presence of electric and magnetic fields	Single charged particle model	In presence	Exams and assignments
4	2	Study of plasma particle capture	Ponderomotive force	In presence	Exams and assignments
5	2	Study of special equations for fluid plasma	Plasma as fluid	In presence	Exams and assignments
6	2	Derivation of equations for the plasma model as a fluid	Continuity equation	In presence	Exams and assignments
7	2	Derivation of equations for the plasma model as a fluid	Study momentum equation	In presence	Exams and assignments
8	2	Vlasov equation	Kinetic theory of plasma physics	In presence	Exams and assignments
9	2	Boltazmann equation	Study momentum equation	In presence	Exams

10	2	Application in plasma	Plasma conferment	In presence	Exams and assignments
11	2	Applications in plasma	Derivation of plasma pinch equations	In presence	Exams and assignments
12	2	Applications in plasma	Wave in plasma	In presence	Exams and assignments
13	2	Applications in plasma	Ion and electron plasma wave	In presence	Exams and assignments
14	2	Applications in plasma	MHD equations	In presence	Exams and assignments
15	2	Applications in plasma	Diffusion of plasma	In presence	Exams and assignments

11. Course Evaluation

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

Evaluation is done through

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

12. Learning and Teaching Resources

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

Course Description Form

1. Course Name:
Physics of Biological Materials
2. Course Code:
3. Semester /
Year:2026-2025
4. Description Preparation Date:
2026
5. Available Attendance Forms:
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:prof.Dr. Asmaa Hadi Mohammed Email: asmaa.hadi@nahrainuniv.edu.iq
8. Course Objectives

Course Objectives	• Understand the physical structure of biological materials at molecular and cellular levels • Explain the interaction of ionizing radiation with biological matter • Describe radiation-induced DNA damage and repair mechanisms • Differentiate between deterministic and stochastic biological effects • Apply biophysical principles in diagnostic radiology and radiation protection

9. Teaching and Learning Strategies	
Strategy	• Lectures • PowerPoint presentations • Problem-solving sessions • Case studies • Assignments and quizzes

10. Course Structure

Week	H	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	Understand basic concepts of biophysics	Introduction to Physics of Biological Materials	Lecture	Quiz
2	2	Describe structure of biological materials	Structure of Biological Matter	Lecture	Quiz
3	2	Explain physical properties of tissues	Physical Properties of Biological Materials	Lecture	Assignment
4	2	Explain radiation–matter	Interaction of Ionizing Radiation with	Lecture	Quiz

		interaction	Matter		
5	2	Understand DNA damage mechanisms	Radiation Injury to DNA	Lecture	Assignment
6	2	Classify DNA damage types	DNA Damage Types and Quantification	Lecture	Quiz
7	2	Explain DNA repair pathways	DNA Repair Mechanisms	Lecture	Assignment
8	2	Analyze chromosome aberrations	Chromosome Damage & Biodosimetry	Lecture	Midterm Exam
9	2	Explain cell cycle radiosensitivity	Cell Cycle and Radiosensitivity	Lecture	Quiz
10	2	Interpret survival curves	Cell Survival Curves & Models	Lecture	Assignment
11	2	Understand mechanisms of cell death	Cell Death and Recovery	Lecture	Quiz
12	2	Explain RBE concept	Relative Biological Effectiveness	Lecture	Assignment
13	2	Understand radiation carcinogenesis	Radiation-Induced Carcinogenesis	Lecture	Quiz
14	2	Analyze tissue radiation effects	Radiation Injury to Tissues	Lecture	Assignment
15	2	Understand fertility & fetal effects	Radiation Effects on Fertility & Fetus	Lecture	Final Exam

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)	IAEA. Diagnostic Radiology Physics: A Handbook for Teachers and Students, Chapter 20. Hall & Giaccia. Radiobiology for the Radiologist. Bushberg et al. The Essential Physics of Medical Imaging.
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	IAEA. Diagnostic Radiology Physics: A Handb for Teachers and Students,

Course Description Form

1. Course Name: High Energy Physics- Ph. D

2. Course Code:

3. Semester / Year: First / 2025-2026

4. Description Preparation Date: January 2026

5. Available Attendance Forms: Attendance in class

6. Number of Credit Hours (Total) / Number of Units (Total): 35 hours /2 units

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

Name: Prof. Dr. Saad Naji Abood
Email: Saad.Abood@nahrainuniv.edu.iq

8. Course Objectives

Course Objectives	The objectives of teaching the subject of elementary particles to fourth-year students in the Physics Department include: 1. **Understanding Theoretical Foundations**: Introducing students to concepts of elementary particles, such as quarks and leptons, and the fundamentals of physical models. 2. **Developing Analytical Skills**: Enhancing the ability to analyze data and experiments related to elementary particles. 3. **Practical Applications**: Connecting theoretical concepts to practical applications in fields such as nuclear physics and particle physics. 4. **Critical Thinking**: Encouraging students to engage in critical thinking and explore complex questions about the structure of matter and the universe. 5. **Scientific Research**: Motivating students to participate in research and scientific projects related to elementary particles. 6. **Interaction with Technology**: Exposing students to the latest technologies and devices used in the study of elementary particles, such as particle colliders. These objectives aim to prepare students well for their academic and professional fu in the field of physics.

9. Teaching and Learning Strategies

Strategy	**The teaching and learning strategy for the subject of elementary particles includes several key aspects:** 1. **Active Learning**: Encouraging students to participate actively through

discussions, workshops, and interactive activities.

2. **Project-Based Learning**: Assigning students research projects related to elementary particles, which enhances their deep understanding of the subject.

3. **Technology in Education**: Utilizing computer simulations and educational applications to enhance visual understanding of complex concepts.

4. **Collaborative Learning**: Forming small work groups to promote collaboration among students and knowledge sharing.

5. Continuous Assessment: Implementing diverse assessment methods, such as quizzes, presentations, and self-assessments, to ensure understanding of concepts.

6. Interaction with Experts: Inviting guest lecturers or organizing visits to research centers or particle physics laboratories to enhance the educational experience.

7. Providing Diverse Resources: Offering a variety of educational resources, such as books, articles, and videos, to deepen understanding.

These strategies aim to enhance the learning experience and make it more interactive and suitabl students' needs in the field of elementary particles.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Particle and anti particles	Theoretical	Written exams and homework
2	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Four Forces and Examples	Theoretical	Written exams and homework
3	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Classification of Elementary Particles	Theoretical	Written exams and homework
4	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Properties of Elementary Particles	Theoretical	Written exams and homework
5	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Properties of Elementary Particles	Theoretical	Written exams and homework

6	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Conservation Laws of Elementary Particles	Theoretical	Written exams and homework
7	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Conservation Laws of Elementary Particles	Theoretical	Written exams and homework
8	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Strange Particles	Theoretical	Written exams and homework
9	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Quarks	Theoretical	Written exams and homework
10	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Quarks	Theoretical	Written exams and homework
11	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Quark Models	Theoretical	Written exams and homework
12	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Quark Models	Theoretical	Written exams and homework
13	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Quantum field for describing mutually interacting particles	Theoretical	Written exams and homework
14	**2**	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Quantum Chromodynamics	Theoretical	Written exams and homework

15	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Cosmic Rays	Theoretical	Written exams and homework
16	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Cosmic Rays	Theoretical	Written exams and homework
17	2	Gain the knowledge and skills necessary to understand the subject and apply it effectively in different contexts.	Cosmic Rays	Theoretical	Written exams and homework

11. Course Evaluation

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

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Introduction to Elementary Particles by David Griffiths
Main references (sources)	Particle Physics: A Very short Introduction by: Frank Close
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	

Course Description Form

1. Course Name:
English
2. Course Code:
3. Semester / Year:
2025−2026
4. Description Preparation Date:
2026
5. Available Attendance Forms:
Attendance
6. Number of Credit Hours (Total) / Number of Units (Total)
30 Hours
7. Course administrator's name (mention all, if more than one name)
Name: Dr. Asmaa Hadi Mohammed Email: asmaa.hadi@nahrainuniv.edu.iq
8. Course Objectives

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

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

	4- Training students to use modern teaching methods and methods, including blended learning using technology. 5- Assigning students to conduct research related to all areas of the English language. 6- Enabling students to use their personal skills.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
Week 1 **Week 2** **Week 3** **Week 4** **Week 5** **Week 6** **Week 7** **Week 8** **Week 9** **Week 10** **Week 11** **Week 12** **Week 13** **Week 14** **Week 15**	30	**Students can learn how to understand and translate articles written in English into their native language.** **Students will understand how to avoid citing papers that have been cited.** **Allow students to conduct research and write research reports in English.** **Learn about the English language and its role in transferring and understanding different types of science and technology.**	**-Introduction** **-Feats of engineering.** **-Water, water everywhere** **-The Terracotta army.** **-The Olympic games.** **-Exam** **-Work.** **-Communication technology.** **-Writing: Keeping healthy.** **-Writing: source of energy.** **-Writing: examples of fair trade** **-Writing: population trends.** **-Research: Crediting sources** **-Language for writing for speaking: interpreting and translating.** **-Final exam**	**Giving students a detailed lecture on the origins and grammar of the English language.** **Listen to, understand, and translate the articles and conversations in the course correctly.** **Using dialogue and active participation to consolidate concepts and deepen understanding.** **Giving students homework that includes an exercise in avoiding textual hijacking.** **Students compose scien articles in English by t writing them in Arabic then translating them i English**	Exams Quizzes Assignments Homework

11. Course Evaluation

daily preparation: 10, daily oral:10, monthly:30, or written exams:40, reports:10

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	Headway- Academic Skills Reading, Writing, and Study Skills level 3

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

Course Description Form

1. Course Name: **Advanced Solid State Physics II/ Ph.D.**

2. Course Code:

3. Semester / Year: Second / 2025-2026

4. Description Preparation Date: 24/12/2025

5. Available Attendance Forms: present

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

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

Name: Ahmed Abdulrahman Ahmed Al-Tabbakh
Email: tabbakh2013@gmail.com

8. Course Objectives

Course Objectives	• A broad overview of Physical properties of solid-state materials and nanostructures ranging from conventional metals, insulators, semiconductors, and superconductors. • Understand the advanced concepts in solid-state physics • Linking a theoretical concept with a practical and experimental observations.

9. Teaching and Learning Strategies

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1-2	6	Academic	General properties: Solid state theories of metals. Drude theory. Sommerfeld theory. Failure of free electron model.	Lectures	Discussion
3-4	6	Academic	Crystal structure: Lattices. Primitive unit cell. Crystal structures. Reciprocal Lattice and Brillouin Zone. Determination of crystal structures by X-ray diffraction.	Lectures	discussion
5	3				Exam
6-7	6	Academic	Electron levels in periodic potential. Tight binding method. Semiclassical theory of conduction in metals. Fermic surface. Band structure of metals.	Lectures	Discussion
8	3	Academic	Beyond relaxation-time approximation. Beyond independent electron approximation.	Lectures	discussion
9	3	Academic	Surface Effects.	Lectures	Discussion
10-11	6	Academic	Failure of static lattice model	Lectures	Discussion
12					Exam

13-14		Academic	Theory of harmonic crystal. Phonos in metals.	lectures	Discussion
15		Academic	Dielectric properties of insulators. Semiconductors. Superconductivity.	lectures	Discussion

11. Course Evaluation	
Distributing the score out of 100 according to the tasks assigned to the student, such as daily preparation, daily oral, monthly, or written exams, reports ... etc 30% mid exam+ discussion+ solving homework 70% final exam	
12. Learning and Teaching Resources	
Required textbooks (curricular books, if any)	
Primary references (sources)	
Recommended books and references (scientific journals, reports...)	Advanced Solid State Physics By Neil Ashcroft and N. David Mermin Solid State Physics: Structures and Properties of Materials By M. A. Wahab
Electronic References, Websites	All books and global sites on the internet