وزارة التعليم العالي والبحث العلمي
جـــهاز الاشـــراف والتقـــويم العلـــمي
دائرة ضمان الجودة والاعتماد الأكاديمي

استمارة وصف البرنامج الأكاديمي للكليات والمعاهد

الجامعة : المثنى
الكلية/ المعهد: كلية العلوم
القسم العلمي : الفيزياء
اسم البرنامج الأكاديمي : بكالوريوس
اسم الشهادة النهائية: بكالوريوس في علوم الفيزياء
النظام الدراسي:فصلي(كورسات)
تاريخ ملء الملف : 2023-2024

التوقيع :
اسم رئيس القسم : أ.م.د. موفق فاضل جدوع
التاريخ : 2024/6/ 12

التوقيع :
اسم المعاون العلمي: أ.م. مهثم عباس مكي
التاريخ : 2024/6/ 24

جامعة المثنى / كلية العلوم
مكتب العميد

مصادقة السيد العميد

دقق الملف من قبل
شعبة ضمان الجودة والاداء الجامعي
م.صالح عبيد لزام
التاريخ 24/6/2024
التوقيع

Ministry of Higher Education and Scientific Research
Scientific Supervision and Scientific Evaluation Apparatus
Directorate of Quality Assurance and Academic Accreditation
Accreditation Department

Academic Program and Course Description Guide

2024

Introduction:

The educational program is a well-planned set of courses that include procedures and experiences arranged in the form of an academic syllabus. Its main goal is to improve and build graduates' skills so they are ready for the job market. The program is reviewed and evaluated every year through internal or external audit procedures and programs like the External Examiner Program.

The academic program description is a short summary of the main features of the program and its courses. It shows what skills students are working to develop based on the program's goals. This description is very important because it is the main part of getting the program accredited, and it is written by the teaching staff together under the supervision of scientific committees in the scientific departments.

This guide, in its second version, includes a description of the academic program after updating the subjects and paragraphs of the previous guide in light of the updates and developments of the educational system in Iraq, which included the description of the academic program in its traditional form (annual, quarterly), as well as the adoption of the academic program description circulated according to the letter of the Department of Studies T 3/2906 on 3/5/2023 regarding the programs that adopt the Bologna Process as the basis for their work.

In this regard, we can only emphasize the importance of writing an academic programs and course description to ensure the proper functioning of the educational process.

Concepts and terminology:

Academic Program Description: The academic program description provides a brief summary of its vision, mission and objectives, including an accurate description of the targeted learning outcomes according to specific learning strategies.

Course Description: Provides a brief summary of the most important characteristics of the course and the learning outcomes expected of the students to achieve, proving whether they have made the most of the available learning opportunities. It is derived from the program description.

Program Vision: An ambitious picture for the future of the academic program to be sophisticated, inspiring, stimulating, realistic and applicable.

Program Mission: Briefly outlines the objectives and activities necessary to achieve them and defines the program's development paths and directions.

Program Objectives: They are statements that describe what the academic program intends to achieve within a specific period of time and are measurable and observable.

Curriculum Structure: All courses / subjects included in the academic program according to the approved learning system (quarterly, annual, Bologna Process) whether it is a requirement (ministry, university, college and scientific department) with the number of credit hours.

Learning Outcomes: A compatible set of knowledge, skills and values acquired by students after the successful completion of the academic program and must determine the learning outcomes of each course in a way that achieves the objectives of the program.

Teaching and learning strategies: They are the strategies used by the faculty members to develop students' teaching and learning, and they are plans that are followed to reach the learning goals. They describe all classroom and extra-curricular activities to achieve the learning outcomes of the program.

Academic Program Description Form

University Name: **Al Muthanna**
Faculty/Institute: **Science**
Scientific Department: **Physics**
Academic or Professional Program Name: **Bachelor's**
Final Certificate Name: **Bachelor's in Physics**
Academic System: **courses**
Description Preparation Date:
File Completion Date:

Signature:
Head of Department Name:
Asst. Prof. Dr. Muwafaq Fadhil Jaddoa
Date: **25-6-2024**

Signature:
Scientific Associate Name:
Asst. Prof. Maythem
Date:**26-6-2024**

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

1. Program Vision

Leadership in physics sciences and its applications at the local and international levels, effective participation with community institutions and seeking to upgrade the department to ensure its suitability to international standards in the field of physics and its applications to meet the needs of the labor market, and excellence in preparing qualified national competencies scientifically and research, which makes it distinguished at the level of physics departments in local, regional and international universities.

2. Program Mission

Creativity and excellence in higher education and scientific research in the disciplines of physics, qualifying specialized cadres scientifically and professionally in the field of physics, securing the appropriate educational and academic environment to provide them with the necessary expertise and skills to provide society with specialized competencies in physics and in the field of education and scientific research, as well as developing their scientific capabilities and using them in life phenomena, analyzing them and finding appropriate scientific solutions to them by providing distinguished educational programs that comply with quality standards and meet the requirements of the labor market.

3. Program Objectives

1. The Department of Physics pays great attention to topics that serve the scientific march of the country with all its needs from the various fields of knowledge in the fields of theoretical and practical physics and medical physics.
2. Qualifying specialized scientific and professional competencies to contribute to conducting distinguished scientific and applied research.
3. Providing studies and research related to physics that meet the needs and requirements of institutions and bodies spread throughout the country, and upgrading the level of graduates by achieving comprehensive quality standards through the preparation of advanced and

renewable educational programs that qualify graduates to keep pace with the requirements of the knowledge society and the labor market.

4. The department also meets the need of students to continue their postgraduate studies and provide optimal work in the fields of science and practical application by paying attention to the scientific ability of the teaching staff, developing their scientific, technical and administrative abilities, and upgrading scientific research to contribute to conducting distinguished scientific and applied research.

5. Establishing research centers and exchanging scientific experiences and competencies with research centers in prestigious Arab and international universities.

4. Program Accreditation

Does the program have program accreditation? And from which agency? NO.

5. Other external influences

6. Program Structure

Program Structure	Number of Courses	Credit hours	Percentage	Reviews*
Institution Requirements	-	-	-	-
College Requirements	4	24	-	-
Department Requirements	34	180		Basic
Summer Training	2	4		basic
Other				

Second Year / First Semester			
Subject		**Credit hours**	Code

	Total credit	practical	Theoretical	
Electronics I	3	2	2	Phys 217
Modern physics	3	2	2	Phys 218
Analytical Mechanic I	2	-	2	Phys 219
Advanced Calculus	2	-	2	Math 205
Thermodynamics	3	2	2	Phys 216
English language II	2	-	2	UREQ 106
Computer science II	1	2		UREQ 207
Total	16	8	12	

Second Year / Second Semester				
Subject	Total credit	**Credit hours**		Code
		practical	Theoretical	
Electronics II	3	2	2	Phys 222
Analytical Mechanic II	2	-	2	Phys 224
Material science	2	-	2	Phys 221
Modern physics II	3	2	2	Phys 223
Differential Equations	2	-	2	Math 206
Statistical Mechanics	3	2	2	Phys 335
Computer IV	1	2		CR 207
Total	16	6	12	

Third Year / First Semester				
Subject	Total credit	Credit hours		Code
		practical	Theoretical	
Quantum Mechanics I	3	-	3	Phys 326
Laser physics I	2	-	2	Phys 327
Geometric Optics	3	-	3	Phys 328
Mathematical Physics I	2	-	2	Phys 329
Astronomy Physics	2	-	2	Phys 330
Waves physics	2	-	2	Phys331
Elective subject I	2	-	2	
Matlab	3	2	2	CR 308
Practical Physics V	2	4	-	Phys 332
Total	21	6	18	

Third Year / Second Semester				
Subject	Total credit	Credit hours		Code
		practical	Theoretical	
Quantum Mechanic II	3	-	3	Phys 333
Laser physics II	2	-	2	Phys 334
Physical Optics	3	-	3	Phys 337
Mathematical Physics II	2	-	2	Phys 336
Numerical Analysis	3	2	2	Math 307
Elective subject II	2	-	2	
English language III	2	-	2	UREQ 107
Practical Physics VI	2	4	-	Phys 338
Total	19	6	16	

Fourth Year / First Semester				
Subject	Total credit	Credit hours		Code
		practical	Theoretical	
Nuclear physics I	3	-	3	Phys 439
Solid state physics I	3	-	3	Phys 440
Electromagnetism I	3	-	3	Phys 441
Elective subject I	2	-	2	
Elective subject II	2	-	2	
English language IV	2	-	2	UREQ 108
Practical Physics	2	4	-	Phys 442
Total	17	4	15	

Fourth Year / Second Semester				
Subject	Total credit	Credit hours		Code
		practical	Theoretical	
Nuclear physics II	3	-	3	Phys 444
Solid state physics II	3	-	3	Phys 445
Electromagnetism II	3	-	3	Phys 446
Elective subject III	2	-	2	
Elective subject IV	2	-	2	
Practical Physics	2	4		Phys 447
Research project	2	2	-	Phys 443
Total	17	6	13	

Course Description Form

1. Course Name:

Analog Electronics

2. Course Code:

3. Semester / Year:

First semester / 2023-2024 / 2nd stage

4. Description Preparation Date:

8-5-2024

5. Available Attendance Forms:

Attendance in class

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

Th. 2 / Pr. 2

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

Name: Prof. Dr. Hassan Maktuf Jabber
Email: hassankirkukly@mu.edu.iq

8. Course Objectives

Course Objectives	Enable the student to know the basics of analogue electronics Knowing the student how to create a diode and a transistor Analyze electronic circuits mathematically Apply electronic circuits in the laboratory

9. Teaching and Learning Strategies

The program adopts a variety of teaching and learning strategies, including:

- **Active Participation and Interaction:** Encouraging students to participate in lectures, ask questions, and engage in discussions.
- **Active Listening:** Emphasizing attentive listening during explanations and demonstrations.
- **Hands-on Laboratory Sessions:** Providing practical laboratory sessions to apply theoretical knowledge.
- **Case Studies and Practical Workshops:** Incorporating real-world scenarios to enhance problem-solving skills.
- **Communication Skills Training:** Focusing on effective scientific communication, both written and oral.
- **Integration of General and Transferable Skills:** Developing critical thinking, problem-solving, and research skills.
- **Ethical Considerations:** Teaching responsible use of genetic engineering and discussing ethical dilemmas.
- **Staying Updated with Research:** Encouraging students to keep up with the latest advancements in the field.
- **Collaboration and Teamwork:** Promoting group projects and assignments to simulate real-world scientific collaborations.

10. Evaluation methods

- Evaluation methods are implemented at various stages of the program, including:
- Continuous Assessment: Regular quizzes, assignments, and participation.
- Laboratory Reports: Evaluation of practical work and experimental results.
- Examinations: Mid-term and final exams to assess comprehensive understanding.
- Projects and Presentations: Assessing the ability to apply knowledge and communicate findings.
- Peer and Self-Assessment: Encouraging reflective learning and peer feedback.
- Mid exam
- Final exam

				Second		Second		Year/Level			Program Skills Outline
								Course Code			
					Digital Electronics		Analog Electronics	Course Name			
					optional		optional	Basic or optional			
					+		+	A1	Knowledge	Required program Learning outcomes	
					+		+	A2			
					+		+	A3			
								A4			
					+		+	B1	Skills		
					+		+	B2			
								B3			
								B4			
					+		+	C1	Ethics		
					+		+	C2			
								C3			
								C4			

Course Description Form

1. Course Name: Analog Electronics
2. Course Code:
3. Semester / Year: First /2024
4. Description Preparation Date: 26−5−2024
5. Available Attendance Forms:
6. Number of Credit Hours (Total) / Number of Units (Total)
2\3hr
7. Course administrator's name (mention all, if more than one name)
Name: Prof. Dr. Hassan Maktuff Jaber Al-Ta'ii Email: hassankirkukly@mu.edu.iq

8. Course Objectives	
Course Objectives	Basic principles of electronics and devices, starting from discussing the semiconductor materials and prototype semiconductor based electronic devices towards various electronic devices and applications, • Afterwards, the communication system and digital electronics technologies are discussed and analysed.
	Through this course, the students**:** - - Acquire a basic knowledge in solid state electronics including diodes, MOSFET, BJT, and operational amplifier. - Develop the ability to analyze and design analog electronic circuits using discrete components.- - Observe the amplitude and frequency responses of common amplification circuits - Design, construct, and take measurement of various analog circuits to compare experimental results in the laboratory with theoretical analysis

9. Course Structure					
Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**
1	**2**	Semiconducting Materials)	The Structure of Semi-conductor Materials, The Energy-Band Levels, Classification of Materials (Conductors, Semiconductors, Insulators) Conduction in Semiconductor , Intrinsic and Extrinsic Semiconductors	Lecture and Discussion	Quiz
2	**2**	Semiconducting Materials)	Extrinsic Semiconductors, N-Type, Semi-conductors,P-Type Semiconductors, Analysis of Drift and Diffusion Currents	Lecture and Discussion	
3	**2**	(Diodes and Applications)	Fabrication of a Semiconductor P-N Junction Diode, Diodes, Diode Applied Bias Current-Voltage (I-V) response in F.B. and R.B.Static and Dynamic Resistance, DC load line for a diode, Temperature Effects on P-N Junction, Junction capacitances	Practical Workshop	
4	**2**	(Diodes and Applications)	Diode equivalent circuits, Ideal Diode Models, Zener diodes, Applications of Diode, Series Diode, Configurations with DC Inputs, Parallel Diode, Configurations with DC Inputs, (Rectifier), Half-wave rectifier, Full-wave rectifier, Filter circuits	Lecture and Discussion	Mid-term Exam
5	**2**	(Diodes and Applications)	Filter circuits, Capacitor- input filter, Regulated power supply, CLIPPERS (Diode limiting), CLAMPERS, Voltage Multipliers	Lecture and Discussion	
6	**2**	Types of Diodes	Zener Diodes, Varactor diodes (variable-capa-citance diodes), Optical Diodes, Light Emitting Diode (LED), The Photodiode/ Solar Cells	Lecture and Discussion	Quiz
7	**2**	Types of Diodes	Other types of Diodes, Current Regulator Diode , The Schottky Diode (hot-carrier diode), The PIN Diode, The step-recovery diode (SRD), The Tunnel Diode, Laser Diode	Practical Workshop	Assignment
8	**2**	Transistors, Biasing Circuits and Applicati	Bipolar Junction Transistor (BJT), Construction of BJT and Operation, BJT Characteristics and Parameters, Transistor Amplifying Action, Transistor Switching	Lecture and Discussion	
9	**2**	Transistors, Biasing Circuits and Applications	Transistor Configurations, Common Emitter Configuration (CEC), Common Base Configuration (CBC), Common Collector Configuration (CCC), Base Bias Collector to Base Bias, Voltage Divider Bias	Lecture and Discussion	Quiz

10	**2**	Field effect Transistors - FET	Junction Field Effect transistor (JFET), Types of FET, Biasing of the JFET, Characteristics of JFETs, JFET Operating Characteristics, FET as a Voltage-Controlled Resistor		Assignment
11	**2**	Field effect Transistors - FET)	N-Channel JFET Operation, MOSFETs, JFET (n-channel) Biasing Circuits, The Potential (Voltage) Divider Bias		Mid-term Exam
12	**2**	Transistor Amplifiers, Operational Amplifiers and Applications	BJT Amplifier, Multistage Amplifiers, Gain in Decibels, Band Width of an Amplifier, Single stage CE Amplifier, Capacitor Coupled two stage CE Amplifier	Lecture and Discussion	Quiz
13	**2**	Transistor Amplifiers, Operational Amplifiers and Applicati	Feedback Amplifier, Operational Amplifiers (Op-Amp), Op-Amp Input Modes and Parameters, Negative Feedback, Noninverting Amplifier.		
14	**2**	Transistor Amplifiers, Operational Amplifiers and Applicati	Comparators,Nonzero-Level Detection, Comparator Applications, Summing Amplifier, Integrators, The Op-Amp Differentiator	Lecture and Discussion	Assignment
15	**2**	**Revision**			Final Exam

10. 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

11. Learning and Teaching Resources	
Required textbooks (curricular books, if any	❖ A Textbook of Electrical Technology, B.L. Theraja, A.K. Theraja, 1st, 1999
Main references (sources)	
Recommended books and references (scientific journals, reports…)	1- Schaums outline series theory and problems of electric circuits, 2nd, Josef A. Edminister, 1983. 2-Electronics Physics - Subhi Al Rawii - Mosul University 1974
Electronic References, Websites	❖ PubMed ❖ Science direct ❖ Analog Electronics website

1. Program Vision

To develop problem solving skills and understanding of atomic mechanisms through the application of techniques.

2. Program Mission

1. Recognize the basic components of atom.
2. List the various terms associated with quantum numbers.
3. Summarize what is meant by a basic atomic transitions.
4. Discuss the reaction and involvement of electrons in its orbitals.
5. Study spin angular momentum by stern-garlic experiment.
6. The effects of different strength of electric and magnetic fields on electrons.
7. Knowing the basic terminology of quantum mechanics.

3. Program Objectives

To understand development of atomic structure of materials.
. This course deals with the basic concept of quantum mechanics of atom. Dealing with different atomic spectra.

4. Program Accreditation

Accreditation Requirements and Standards: Adhere to accreditation requirements and standards set by relevant accrediting bodies to ensure the program maintains high educational and professional standards.

5. Other external influences

6. Program Structure

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

Department Requirements	**1**	**3**		
Summer Training				
Other				

* This can include notes on whether the course is basic or optional.

7. Program Description

Year/Level	Course Code	Course Name	Credit Hours	
Two	**Phys 2306**	**Modern I**	**theoretical**	**practical**

8. Expected learning outcomes of the program

Knowledge	
Learning Outcomes 1	• Master fundamental theories of modern physics. • Understand the applications of quantum mechanics and relativity physics. • Stay informed on contemporary research and advancements in the field.

Skills	
Learning Outcomes 2	• Develop expertise in experimental techniques and advanced instrumentation. • Enhance computational skills for modeling, simulating, and analyzing physic systems.
Learning Outcomes 3	• Improve problem-solving and critical thinking through independent research. • Strengthen scientific communication, both written and oral.

Ethics	
Learning Outcomes 4	• Commit to professional integrity and ethical conduct in sciences.
Learning Outcomes 5	• To use and transition scientific knowledge responsibly to the generation of the future.

9. Teaching and Learning Strategies

- The main strategy that will be adopted in delivering this module
- is to encourage students' participation in the exercises, while at the same time refining
- and expanding their critical thinking skills. This will be achieved through classes,
- interactive tutorials and by considering type of simple ideas and equations involving
- some sampling activities that are interesting to the students.

10. Evaluation methods

- Lectures.
- Discussion within the academic university by reading e-books that can be developed.
- Directing students to some websites to benefit from them in understanding the material.
- Small discussion circles to treat sports racing.
- Training students on how to prepare scientific research.
- Using simulation programs to explain atomic transitions.

Professional Development

Mentoring new faculty members

- Orientation programs to familiarize them with departmental policies and teaching methodologies.
- Regular meetings with experienced faculty mentors to discuss teaching strategies and research integration.

Professional development of faculty members

The academic and professional development plan includes:

- Workshops on innovative teaching and learning strategies.
- Seminars on the latest research advancements in modern physics.
- Opportunities for faculty to attend conferences and participate in collaborative research projects.
- Regular assessments and feedback sessions to enhance teaching effectiveness.

11. Acceptance Criterion

The program follows the central admission regulations set by the university, which include academic qualifications, entrance exams, and interviews.

12. The most important sources of information about the program

- Concepts of Modern Physics
  By Arthur Beiser

13. Program Development Plan

The development plan for the Clinical Analysis program involves continuous curriculum review and updates based on the following key elements:

- **Feedback from Students, Faculty, and Industry Partners**: Regularly collect and incorporate feedback from students, faculty, and industry partners to ensure the curriculum remains relevant and meets the needs of all stakeholders.
- **Emerging Trends and Technological Advancements**: Stay abreast of the latest trends and technological advancements in clinical analysis and laboratory medicine to integrate new knowledge and techniques into the curriculum.
- **Accreditation Requirements and Standards**: Adhere to accreditation requirements and standards set by relevant accrediting bodies to ensure the program maintains high educational and professional standards.
- **Periodic Assessments**: Conduct regular assessments and evaluations of the program to ensure it meets its educational and professional objectives, making adjustments as necessary to improve outcomes and maintain excellence.
-

Program Skills Outline															
				Required program Learning outcomes											
Year/Level	Course Code	Course Name	Basic or optional	Knowledge				Skills				Ethics			
				A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4
Two	2306	Modern I	Basic	+	+	+		+	+			+	+		+

- **Please tick the boxes corresponding to the individual program learning outcomes under evaluation.**

Course Description Form

1. Course Name:
Modern I
2. Course Code:
Phys 2306
3. Semester / Year:
Frist / Two
4. Description Preparation Date:
26-6-2024
5. Available Attendance Forms:
Classroom
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: Dr. Hassan Tarikhum Badah Email: hassan.tarikhum@mu.edu.iq

8. Course Objectives	
Course Objectives	To understand development of atomic structure of materials. Basics of solid state physics and nuclear physics. This course deals with the basic concept of quantum mechanics of atom. Dealing with different atomic spectra.

9. Teaching and Learning Strategies	
Strategy	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering types of simple experiments involving some interesting sampling activities for the students.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Atomic Models Thomson's Atomic Model,.	Atomic Models	Lecture and Discussion	Assignment
2	3	Rutherford Atomic Model, Alpha partial scattering,	Atomic Models	Lecture and Discussion	Quiz
3	3	Rutherford Scattering Formula,	Atomic Models	Lecture and Discussion	Report
4	3	Distance of closest Approach,	Atomic Models	Lecture and Discussion	Mid-term Exam
5	3	Electron Orbits,	Atomic Models	Lecture and Discussion	Report
6	3	Atomic Spectra,	Atomic Models	Lecture and Discussion	Quiz
7	3	Spectral Series,	Atomic Models	Lecture and Discussion	Assignment
8	3	Boher Atomic Model, Electron waves in the atom,	Atomic Models	Lecture and Discussion	Report
9	3	Energy Levels and Spectra,	Atomic Models	Lecture and Discussion	Quiz
10	3	Special Relativity, Postulates of Special Relativity	Special Relativity	Lecture and Discussion	Assignment
11	3	Time dilation	Special Relativity	Lecture and Discussion	Mid-term Exam
12	3	Doppler Effect	Special Relativity	Lecture and Discussion	Quiz
13	3	Length Contraction	Special Relativity	Lecture and Discussion	Report
14	3	Twin Paradox	Special Relativity	Lecture and Discussion	Assignment
15	3	Mass And Energy	Special Relativity	Lecture and Discussion	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)	
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	

1. Program Vision

To develop problem solving skills and understanding of modern physics through the application of techniques.

2. Program Mission

1. Recognize the basic components of Particle Properties of Waves and Wave Properties of Particles.
2. Knowing the basic terminology of quantum mechanics.

3. Program Objectives

To understand development of modern physics. This course deals with the basic concept of Particle, Wave Properties, and quantum mechanics.

4. Program Accreditation

Accreditation Requirements and Standards: Adhere to accreditation requirements and standards set by relevant accrediting bodies to ensure the program maintains high educational and professional standards.

5. Other external influences

6. Program Structure

Program Structure	Number of Courses	Credit hours	Percentage	Reviews*
Institution Requirements				
College Requirements				
Department Requirements	1	3		
Summer Training				
Other				

* This can include notes on whether the course is basic or optional.

7. Program Description				
Year/Level	**Course Code**	**Course Name**	**Credit Hours**	
Two	**Phys 2306**	**Modern II**	**theoretical**	**practical**

8. Expected learning outcomes of the program	
Knowledge	
Learning Outcomes 1	• Master fundamental theories of modern physics. • Understand the applications of quantum mechanics and relativity physics. • Stay informed on contemporary research and advancements in the field.

Skills	
Learning Outcomes 2	• Develop expertise in experimental techniques and advanced instrumentation. • Enhance computational skills for modeling, simulating, and analyzing physic systems.
Learning Outcomes 3	• Improve problem-solving and critical thinking through independent research. • Strengthen scientific communication, both written and oral.

Ethics	
Learning Outcomes 4	• Commit to professional integrity and ethical conduct in sciences.
Learning Outcomes 5	• To use and transition scientific knowledge responsibly to the generation of the future.

9. Teaching and Learning Strategies

- The main strategy that will be adopted in delivering this module
- is to encourage students' participation in the exercises, while at the same time refining
- and expanding their critical thinking skills. This will be achieved through classes,
- interactive tutorials and by considering type of simple ideas and equations involving
- some sampling activities that are interesting to the students.

10. Evaluation methods

- Lectures.
- Discussion within the academic university by reading e-books that can be developed.
- Directing students to some websites to benefit from them in understanding the material.
- Small discussion circles to treat sports racing.
- Training students on how to prepare scientific research.
- Using simulation programs to explain atomic transitions.

Academic Rank	Specialization	Special Requirements/Skills (if applicable)	Number of the teaching staff	
	General	Special	Staff	Lecturer
Assistant Professor Dr.	Physics			

Professional Development

Mentoring new faculty members

- Orientation programs to familiarize them with departmental policies and teaching methodologies.
- Regular meetings with experienced faculty mentors to discuss teaching strategies and research integration.

Professional development of faculty members

The academic and professional development plan includes:

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- Opportunities for faculty to attend conferences and participate in collaborative research projects.
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11. Acceptance Criterion

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12. The most important sources of information about the program

- Concepts of Modern Physics
  By Arthur Beiser

13. Program Development Plan

The development plan for the Clinical Analysis program involves continuous curriculum review and updates based on the following key elements:

- **Feedback from Students, Faculty, and Industry Partners**: Regularly collect and incorporate feedback from students, faculty, and industry partners to ensure the curriculum remains relevant and meets the needs of all stakeholders.
- **Emerging Trends and Technological Advancements**: Stay abreast of the latest trends and technological advancements in clinical analysis and laboratory medicine to integrate new knowledge and techniques into the curriculum.
- **Accreditation Requirements and Standards**: Adhere to accreditation requirements and standards set by relevant accrediting bodies to ensure the program maintains high educational and professional standards.
- **Periodic Assessments**: Conduct regular assessments and evaluations of the program to ensure it meets its educational and professional objectives, making adjustments as necessary to improve outcomes and maintain excellence.
-

Program Skills Outline															
				Required program Learning outcomes											
Year/Level	Course Code	Course Name	Basic or optional	Knowledge				Skills				Ethics			
				A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4
Two	2306	Modern II	Basic	+	+	+		+	+			+	+		+

- **Please tick the boxes corresponding to the individual program learning outcomes under evaluation.**

Course Description Form

1. Course Name:
Modern II
2. Course Code:
Phys 2306
3. Semester / Year:
Second / Two
4. Description Preparation Date:
26-6-2024
5. Available Attendance Forms:
Classroom
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: Dr. Hassan Tarikhum Badah Email: hassan.tarikhum@mu.edu.iq

8. Course Objectives	
Course Objectives	To understand development of atomic structure of materials. Basics of solid state physics and nuclear physics. This course deals with the basic concept of quantum mechanics of atom. Dealing with different atomic spectra.

9. Teaching and Learning Strategies	
Strategy	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering types of simple experiments involving some interesting sampling activities for the students.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Particle Properties of Waves	Particle Properties of Waves	Lecture and Discussion	Assignment
2	3	Blackbody Radiation	Particle Properties of Waves	Lecture and Discussion	Quiz
3	3	Photoelectric Effect	Particle Properties of Waves	Lecture and Discussion	Report
4	3	X-Ray Diffraction	Particle Properties of Waves	Lecture and Discussion	Mid-term Exam
5	3	Compton Effect	Particle Properties of Waves	Lecture and Discussion	Report
6	3	Pair Production	Particle Properties of Waves	Lecture and Discussion	Quiz
7	3	Wave Properties of Particles	Wave Properties of Particles	Lecture and Discussion	Assignment
8	3	De Broglie Waves	Wave Properties of Particles	Lecture and Discussion	Report
9	3	Describing a Wave	Wave Properties of Particles	Lecture and Discussion	Quiz
10	3	Phase and Group Velocities	Wave Properties of Particles	Lecture and Discussion	Assignment
11	3	Particle Diffraction	Wave Properties of Particles	Lecture and Discussion	Mid-term Exam
12	3	Uncertainty Principle	Wave Properties of Particles	Lecture and Discussion	Quiz
13	3	The Wave Equation	Wave Properties of Particles	Lecture and Discussion	Report
14	3	Schrödinger's Equation: Time-Dependent Form	Wave Properties of Particles	Lecture and Discussion	Assignment
15	3	Schrödinger's Equation: Time-Independent Form	Wave Properties of Particles	Lecture and Discussion	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)	
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	

14. Program Vision

Our vision is to provide a distinguished scientific environment to reach the highest standards to contribute to community service, thus enhancing the role of the Physics Department in the academic aspect and scientific research, and the application of knowledge to investigate the nature of vibrational motion in the form of waves and wave phenomena by analyzing simple harmonic motion.

15. Program Mission

Our mission is to provide a comprehensive education, equipping students with the knowledge and skills necessary to excel in academic, research. students will be able to determine how a wave moves through space, what the various forms of waves are, and how those waves can be generated..

16. Program Objectives

Program Objectives for a Sound and Wave Motion Program:

1. Fundamental Understanding: to study and understand basic wave concepts.

2. Research and Innovation: Foster the ability to conduct independent research, innovate experimental techniques, and contribute to advancements in the discussion of simple harmonic, damped, forced, and coupled oscillators.

3. Technical Proficiency: Equip students with advanced technical skills in the use of specialized instruments, computational tools, and methodologies essential for sound and wave motion research.

4. Professional Development: Prepare students for successful careers in academia, industry, and government by enhancing their communication, collaboration, and leadership skills through comprehensive training and professional development opportunities.

By achieving these objectives, the program aims to produce highly skilled physicists who are capable of advancing the field and addressing the complex challenges of the modern world.

17. Program Accreditation

18. Other external influences

19. Program Structure				
Program Structure	**Number of Courses**	**Credit hours**	**Percentage**	**Reviews***
Institution Requirements	X			
College Requirements	X			
Department Requirements	2	2		
Summer Training	X			
Other				

* This can include notes on whether the course is basic or optional.

20. Program Description				
Year/Level	**Course Code**	**Course Name**	**Credit Hours**	
second			**theoretical**	**practical**

21. Expected learning outcomes of the program	
Knowledge	
Learning Outcomes 1	1. Recognize the wave properties. 2. Understanding the simple harmonic motion and its applications. 3. Understanding the damped oscillation and its difference with forced oscillation.

22. Teaching and Learning Strategies

- The program adopts a variety of teaching and learning strategies, including:
- Active Participation and Interaction: Encouraging students to participate in lectures, ask questions, and engage in discussions.
- Active Listening: Emphasizing attentive listening during explanations and demonstrations.
- Case Studies and Practical Workshops: Incorporating real-world scenarios to enhance problem-solving skills.
- Communication Skills Training: Focusing on effective scientific communication, both written and oral.
- Integration of General and Transferable Skills: Developing critical thinking, problem-solving, and research skills.
- Staying Updated with Research: Encouraging students to keep up with the latest advancements in the field.
- Collaboration and Teamwork: Promoting group projects and assignments to simulate real-world scientific collaborations.

	4. To understand the sound and shock waves.

Skills	
Learning Outcomes 2	• Develop expertise in experimental techniques and advanced instrumentation. • Enhance computational skills for modeling, simulating, and analyzing physics systems.
Learning Outcomes 3	• Improve problem-solving and critical thinking through independent research. • Strengthen scientific communication, both written and oral.

Ethics	
Learning Outcomes 4	• Establishing teaching principles to limit the misuse of their responsibilities in the scientific and educational field • Commit to professional integrity and ethical conduct in research.
Learning Outcomes 5	• Explaining the importance of science in human life and the great role that physics plays in serving people's lives

23. Evaluation methods

- Evaluation methods are implemented at various stages of the program, including:
- Continuous Assessment: Regular quizzes, assignments, and participation.
- Examinations: Mid-term and final exams to assess comprehensive understanding.
- Projects and Presentations: Assessing the ability to apply knowledge and communicate findings.
- Peer and Self-Assessment: Encouraging reflective learning and peer feedback.
- Mid exam
- Final exam

Professional Development

Mentoring new faculty members

 Orientation programs to familiarize them with departmental policies and teaching methodologies.
 Regular meetings with experienced faculty mentors to discuss teaching strategies and research integration.

Professional development of faculty members

The academic and professional development plan includes:

- Workshops on innovative teaching and learning strategies.
- Seminars on the latest research advancements.
- Opportunities for faculty to attend conferences and participate in collaborative research projects.
- Regular assessments and feedback sessions to enhance teaching effectiveness.

24. Acceptance Criterion

The program follows the central admission regulations set by the university, which include academic qualifications, entrance exams, and interviews.

25. The most important sources of information about the program

- Waves and Oscillations, Walter Fox Smith, Oxford University Press 2010
- Waves and Oscillations, R.N. Chaudhuri, New Age International (P) Ltd., Publishers 2010

26. Program Development Plan

The development plan for the program involves continuous curriculum review and updates based on the following key elements:

●Feedback from Students, and Faculty: Regularly collect and incorporate feedback from students, faculty, and to ensure the curriculum remains relevant and meets the needs of all stakeholders.

●Emerging Trends and Technological Advancements: Stay abreast of the latest trends and technological advancements.

●Accreditation Requirements and Standards: Adhere to accreditation requirements and standards set by relevant accrediting bodies to ensure the program maintains high educational and professional standards.

- Periodic Assessments: Conduct regular assessments and evaluations of the program to ensure it meets its educational and professional objectives, making adjustments as necessary to improve outcomes and maintain excellence.

Program Skills Outline															
				Required program Learning outcomes											
Year/Level	Course Code	Course Name	Basic or optional	Knowledge				Skills				Ethics			
				A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4
Four		Sound and wave motion	Basic	+	+	+		+	+			+	+		+

- **Please tick the boxes corresponding to the individual program learning outcomes under evaluation.**

Course Description Form

13. Course Name:
Sound and Wave Motion
14. Course Code:
Phys 24014
15. Semester / Year:
second/2024
16. Description Preparation Date:
26−6−2024
17.Available Attendance Forms:
Classroom
18.Number of Credit Hours (Total) / Number of Units (Total)
4
19. Course administrator's name (mention all, if more than one name)
Name: Dr. Shaimaa K.Hussian Email: shymaahussen@mu.edu.iq

20. Course Objectives	
Course Objectives	1. To study and understanding basic waves concepts. 2. Discussion of simple harmonic, damped, forced and coupled oscillators . 3. Behavior of transverse waves on a string, longitudinal waves in a gas and a solid, voltage and current waves on a transmission line. 4. Explain the difference between sound and hearing and Describe sound as a wave.

21. Teaching and Learning Strategies	
Strategy	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering types of simple experiments involving some interesting sampling activities for the students.

22. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	Simple Harmonic Motion, Periodic Motion, The Time Period, The Frequency, The Displacement, Restoring Force or Return Force	Principles in wave physics	Lecture and Discussion	Lab Report
2	2	SimpleHarmonic Motion (SHM), Velocity, Acceleration and Energy of a Simple Harmonic Oscillator	Essential characteristics of the waves	Lecture and Discussion	Quiz
3	2	The Simple Pendulum, solved problems		Practical Workshop	Lab Report
4	2	Degrees of Freedom, Superposition Principle		Lecture and Discussion	Mid-term Exam
5	2	Linearity and Superposition, Source Transformations, Thévenin and Norton Equivalents		Lecture and Discussion	Lab Report
6	2	Superposition Principle for Linear		Lecture and Discussion	Quiz

		Inhomogeneous Equation, Superposition of Simple Harmonic Motions along a Straight Line			
7	2	Superposition of Two Simple Harmonic Motions at Right Angles to Each Other, Solved Problems.		Practical Workshop	Assignment
8	2	Damped Harmonic Motion		Lecture and Discussion	Lab Report
9	2	Damped LC Oscillations (LCR Circuit), Solved Problems		Lecture and Discussion	Quiz
10	2	Forced Vibrations, Resonance		Lecture and Case Study	Assignment
11	2	Quality Factor Q, Helmholtz Resonator, Solved Problems		Practical Workshop	Mid-term Exam
12	2	The wave equation, travelling sinusoidal waves, sound waves		Lecture and Discussion	Quiz
13	2	models describing sound, Speed of Sound in Various Media		Lecture and Discussion	Lab Report
14	2	Interference of Sound Waves, beats, Doppler effect		Lecture and Discussion	Assignment
15	2	Shock Waves and Sonic Booms		Lecture and Case Study	Final Exam

23. 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

24. Learning and Teaching Resources

Required textbooks (curricular books, if any	Waves and Oscillations, Walter Fox Smith, Oxford University Press 2010

Main references (sources)	Waves and Oscillations, R.N. Chaudhuri, New Age International (P) Ltd., Publishers 2010
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	

Course Description Form

1 .Course Name**: Heat and Thermodynamic**

2 .Course Code:

3 Semester / Year: Second year/ 1 semesters

2023 – 2024

4 Description Preparation Date:

1/6/2024

5 Available Attendance Forms:

Presence

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

Two theoretical hours, Two practical hours, and (3 Units)

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

Name: Prof.Dr. Hady Qasim
Email: hadey.mohamad@mu.edu.iq

27. Program Vision

Our vision is to establish a leading program in geometric optics that cultivates a deep understanding of optics principles and its innovations. We aim to foster a learning environment that promotes scientific curiosity, critical thinking, and the application of laboratory knowledge.

28. Program Mission

Our mission is to provide a comprehensive education in geometric optics, equipping students with the knowledge and skills necessary to excel in academic and research. We strive to advance the field through cutting-edge research, ethical practices, and the development of innovative solutions to global optical challenges.

29. Program Objectives

The objectives of the optical analysis program are designed to highlight the importance and purpose of the practical study:

1- Familiarize the student with scientific equipment and train him to use them safely.
2- Training the student to maintain safety in the laboratory and college: the safety of his body and clothing, the safety of his colleagues, and the safety of the laboratory, including its furniture and equipment.
3- Giving the student social and scientific attitudes such as: cooperation, working within a group, respecting the opinion of others, scientific objectivity, being careful in making judgements, resorting to scientific experience, and appreciating the efforts of scientists.
4- Giving the student the skill of obtaining data, classifying it, tabulating it, representing it with graphs, and drawing conclusions.
5- The student is trained in the scientific method, given the opportunity to explore and investigate, and enjoy the success he achieves when he reaches the result himself.
6- Integration of theoretical knowledge with the student's practical experience.
7- Positive interaction with the environment in proposing alternatives, designing alternative experiences, and applying what is for the benefit of the student in his practical life.

30. **Program Accreditation**
Yes- Ministry of Higher Education and Scientific Research (Iraq)

31. **Other external influences**
Ministry of Higher Education and Scientific Research (Iraq)

32. **Program Structure**				
Program Structure	**Number of Courses**	**Credit hours**	**Percentage**	**Reviews***
Institution Requirements				
College Requirements				
Department Requirements	**X**	**3**		
Summer Training				
The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.				

* This can include notes whether the course is basic or optional.

33. **Program Description**				
Year/Level	**Course Code**	**Course Name**	**Credit Hours**	
3rd		**First**	**theoretical**	**practical**
			3	**2**

34. Expected learning outcomes of the program	
Knowledge	
Learning Outcomes 1	1-Recognize how light behave as a particle and as a wave. 2-List the various theories of light nature in last centuries. 3-Summarize what is meant by waves in physics. 4-Discuss the properties and superposition of waves as electromagnetic waves. 5-Describe the reflection of light. 6-Explain reflection experiment. 7-Describe the refraction of light. 8-Explain refractive index experiment. 9-Explain the dispersion and its problems.

Skills	
Learning Outcomes 2	1-To develop problem solving skills and understanding of geometrical optics. 2-To understand light nature, wave's superposition, light reflection, refraction and dispersion. 3-This course deals with the basic concept of geometrical nature and propagation of light. 4-This is the basic subject for all lenses and mirrors experiments. 5-To understand Types of light refraction and its applications. 6- To understand dispersion of light and their types.

Ethics	
Learning Outcomes 4	
Learning Outcomes 5	

35. Teaching and Learning Strategies

The program adopts a variety of teaching and learning strategies, including:

- **Active Participation and Interaction:** Encouraging students to participate in lectures, ask questions, and engage in discussions.
- **Active Listening:** Emphasizing attentive listening during explanations and demonstrations.
- **Hands-on Laboratory Sessions:** Providing practical laboratory sessions to apply theoretical knowledge.
- **Case Studies and Practical Workshops:** Incorporating real-world scenarios to enhance problem-solving skills.
- **Communication Skills Training:** Focusing on effective scientific communication, both written and oral.
- **Integration of General and Transferable Skills:** Developing critical thinking, problem-solving, and research skills.
- **Staying Updated with Research:** Encouraging students to keep up with the latest advancements in the field.
- **Collaboration and Teamwork:** Promoting group projects and assignments to simulate real-world scientific collaborations.

36. Evaluation methods

1-Evaluation methods are implemented at various stages of the program, including:
2-Continuous Assessment: Regular quizzes, assignments, and participation.
3-Laboratory Reports: Evaluation of practical work and experimental results.
4-Examinations: Mid-term and final exams to assess comprehensive understanding.
5-Projects and Presentations: Assessing the ability to apply knowledge and communicate findings.
6-Peer and Self-Assessment: Encouraging reflective learning and peer feedback.
7-Mid exam
8-Final exam

Academic Rank	Specialization	Special Requirements/Skills (if applicable)	Number of the teaching staff	
	General	Special	Staff	Lecturer
Lecturer Dr.	physics	optics		

Professional Development
Mentoring new faculty members
1-Orientation programs to familiarize them with departmental policies and teaching methodologies. 2-Regular meetings with experienced faculty mentors to discuss teaching strategies and research integration.
Professional development of faculty members
The academic and professional development plan includes: 1-Workshops on innovative teaching and learning strategies. 2-Seminars on the latest research advancements in microbial genetics. 3-Opportunities for faculty to attend conferences and participate in collaborative research projects. 4-Regular assessments and feedback sessions to enhance teaching effectiveness.

37.**Acceptance Criterion**
The program follows the central admission regulations set by the university, which include academic qualifications, entrance exams, and interviews.

38.**The most important sources of information about the program**
1) Fundamentals of Optics, Francis Arthur Jenkins and Harvy E. White, McGraw-Hill Education.

2) Introduction to optics (3rd edition), by: F. L. Pedrotti, Leno M. Pedrotti and Leno S. Pedrotti.

3) Principles of optics, (7th edition), by: Max Born and Emil Wolf.

39.Program Development Plan

The development plan involves continuous curriculum review and updates based on the following key elements:

1- Feedback from Students and faculty: Regularly collect and incorporate feedback from students, faculty, and industry partners to ensure the curriculum remains relevant and meets the needs of all stakeholders.

2- Emerging Trends and Technological Advancements: Stay abreast of the latest trends and technological advancements in physical optics to integrate new knowledge and techniques into the curriculum.

3- Accreditation Requirements and Standards: Adhere to accreditation requirements and standards set by relevant accrediting bodies to ensure the program maintains high educational and professional standards.

4- Periodic Assessments: Conduct regular assessments and evaluations of the program to ensure it meets its educational and professional objectives, making adjustments as necessar to improve outcomes and maintain excellence.

Program Skills Outline															
				Required program Learning outcomes											
Year/Level	Course Code	Course Name	Basic or optional	Knowledge				Skills				Ethics			
				A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4
3rd		Geometric optics	Basic	+	+	+		+	+			+	+		

- **Please tick the boxes corresponding to the individual program learning outcomes under evaluation.**

Course Description Form

25.Course Name:
Geometric optics
26.Course Code:
Phys 337
27.Semester / Year:
First /2024
28.Description Preparation Date:
27-6-2024
29.Available Attendance Forms:
Weekly/official working hours
30.Number of Credit Hours (Total) / Number of Units (Total)
3 hr./ 3 unit
31.Course administrator's name (mention all, if more than one name)
Name: Lecturer Dr.Thill Akeel Kadhum Almusawi Email: thillakeel@mu.edu.iq

32. Course Objectives	
Course Objectives	

33.Teaching and Learning Strategies	
Strategy	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.

34. Course Structure					
Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**
1	2	Nature of light	Nature of light, Electromagnetic spectrum.	Lecture and Discussion	Quiz
2	2	Nature of light	Maxwell's equations, Fermat principle, Optical path length.	Laboratory Session	Lab Report
3	2	Reflection	Interaction of light with matter, Reflection of light, Fermat principle (Law of reflection), Types of reflection, Laws of reflection.	Practical Workshop	Lab Report
4	2	Reflection	Reflection of light by spherical mirrors, Terminology of spherical mirrors, Types of spherical mirrors, Image formation by concave mirror, Image formation by convex mirror	Lecture and Discussion	Mid-term Exam
5	2	Reflection	Derivation of mirror equation, Image Magnification	Laboratory Session	Lab Report
6	2	Reflection	Total internal reflection of light, application of total internal reflection of light, Optical fibers.	Lecture and Discussion	Quiz
7	2	Refraction	Refraction, Fermat principle (Law of refraction),	Practical Workshop	Assignment
8	2	Refraction	The lenses, types of lenses, Image	Laboratory Session	Lab Report

			formation by concave lens, Image formation by convex lens.		
9	2	Refraction	Lens makers' formula, power of lens.	Lecture and Discussion	Quiz
10	2	Refraction	Thin lens and compound lens.	Lecture and Case Study	Assignment
11	2	Refraction	Refractive index, type of refractive index, equation of refractive index.	Practical Workshop	Mid-term Exam
12	2	Refraction	Application of refraction, Totally reflecting prism, Sparkling of Diamond, Mirage and rainbow.	Lecture and Discussion	Quiz
13	2	Optical instruments	Optical instruments, the human eye, Camera, and Telescope.	Laboratory Session	Lab Report
14	2	Optical instruments	Visual defects, Myopia, Hyperopia, Astigmatism, Presbyopia.	Lecture and Discussion	Assignment
15	2	Optical instruments	Visual defects, Myopia, Hyperopia, Astigmatism, Presbyopia.	Lecture and Case Study	Final Exam

35.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

36.Learning and Teaching Resources	
Required textbooks (curricular books, if any)	1) Introcution to optics (3rd edition), by: F. L. Pedrotti, Leno M. Pedrotti and Leno S. Pedrotti. 2) Principles of optics, (7th edition), by: Max Born and Emil Wolf.
Main references (sources)	
Recommended books and references (scientific journals, reports...)	1) Fundamentals of optics, (4th edition), by: Francis A. Jenkins and Harvey E. White.
Electronic References, Websites	

40. Program Vision

Our vision is to establish a leading program in physical optics that cultivates a deep understanding of optics principles and its innovations. We aim to foster a learning environment that promotes scientific curiosity, critical thinking, and the application of laboratory knowledge.

41. Program Mission

Our mission is to provide a comprehensive education in physical optics, equipping students with the knowledge and skills necessary to excel in academic and research. We strive to advance the field through cutting-edge research, ethical practices, and the development of innovative solutions to global optical challenges.

42. Program Objectives

The objectives of the optical analysis program are designed to highlight the importance and purpose of the practical study:

1- Familiarize the student with scientific equipment and train him to use them safely.
2- Training the student to maintain safety in the laboratory and college: the safety of his body and clothing, the safety of his colleagues, and the safety of the laboratory, including its furniture and equipment.
3- Giving the student social and scientific attitudes such as: cooperation, working within a group, respecting the opinion of others, scientific objectivity, being careful in making judgements, resorting to scientific experience, and appreciating the efforts of scientists.
4- Giving the student the skill of obtaining data, classifying it, tabulating it, representing it with graphs, and drawing conclusions.
5- The student is trained in the scientific method, given the opportunity to explore and investigate, and enjoy the success he achieves when he reaches the result himself.
6- Integration of theoretical knowledge with the student's practical experience.
7- Positive interaction with the environment in proposing alternatives, designing alternative experiences, and applying what is for the benefit of the student in his practical life.

43. **Program Accreditation**
Yes- Ministry of Higher Education and Scientific Research (Iraq)

44. **Other external influences**
Ministry of Higher Education and Scientific Research (Iraq)

45. **Program Structure**

Program Structure	Number of Courses	Credit hours	Percentage	Reviews*
Institution Requirements				
College Requirements				
Department Requirements	X	3		
Summer Training				

The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.

* This can include notes whether the course is basic or optional.

46. Program Description

Year/Level	Course Code	Course Name	Credit Hours	
3rd		Second	theoretical	practical
			3	2

47. Expected learning outcomes of the program	
Knowledge	
Learning Outcomes 1	1-Recognize how light behave as a particle and as a wave. 2-List the various theories of light nature in last centuries. 3-Summarize what is meant by waves in physics. 4-Discuss the properties and superposition of waves as electromagnetic waves. 5-Describe the interference of light. 6-Explain Young's double slit experiment. 7-Identify the conditions of bright and dark fringes. 8-Discuss thin film interference and its types. 9-Explain the diffraction and its problems. 10-Explain the polarization of light and lts types and the problems and applications of polarization.

Skills	
Learning Outcomes 2	1-To develop problem solving skills and understanding of wave optics. 2-To understand light nature, wave's superposition, light interference, diffraction and polarization. 3-This course deals with the basic concept of wave nature and propagation of light. 4-This is the basic subject for all interference experiments. 5-To understand Types of light diffraction and its applications. 6- To understand polarization of light and the polarizers and their types.

Ethics	
Learning Outcomes 4	
Learning Outcomes 5	

48. Teaching and Learning Strategies

The program adopts a variety of teaching and learning strategies, including:

- **Active Participation and Interaction:** Encouraging students to participate in lectures, ask questions, and engage in discussions.
- **Active Listening:** Emphasizing attentive listening during explanations and demonstrations.
- **Hands-on Laboratory Sessions:** Providing practical laboratory sessions to apply theoretical knowledge.
- **Case Studies and Practical Workshops:** Incorporating real-world scenarios to enhance problem-solving skills.
- **Communication Skills Training:** Focusing on effective scientific communication, both written and oral.
- **Integration of General and Transferable Skills:** Developing critical thinking, problem-solving, and research skills.
- **Staying Updated with Research:** Encouraging students to keep up with the latest advancements in the field.
- **Collaboration and Teamwork:** Promoting group projects and assignments to simulate real-world scientific collaborations.

49. Evaluation methods

1-Evaluation methods are implemented at various stages of the program, including:
2-Continuous Assessment: Regular quizzes, assignments, and participation.
3-Laboratory Reports: Evaluation of practical work and experimental results.
4-Examinations: Mid-term and final exams to assess comprehensive understanding.
5-Projects and Presentations: Assessing the ability to apply knowledge and communicate findings.
6-Peer and Self-Assessment: Encouraging reflective learning and peer feedback.
7-Mid exam
8-Final exam

Academic Rank	Specialization	Special Requirements/Skills (if applicable)	Number of the teaching staff	
	General	Special	Staff	Lecturer
Lecturer Dr.	physics	optics		

Professional Development
Mentoring new faculty members
1-Orientation programs to familiarize them with departmental policies and teaching methodologies. 2-Regular meetings with experienced faculty mentors to discuss teaching strategies and research integration.
Professional development of faculty members
The academic and professional development plan includes: 1-Workshops on innovative teaching and learning strategies. 2-Seminars on the latest research advancements in microbial genetics. 3-Opportunities for faculty to attend conferences and participate in collaborative research projects. 4-Regular assessments and feedback sessions to enhance teaching effectiveness.

50.**Acceptance Criterion**
The program follows the central admission regulations set by the university, which include academic qualifications, entrance exams, and interviews.

51.**The most important sources of information about the program**
1) Fundamentals of Optics, Francis Arthur Jenkins and Harvy E. White, McGraw-Hill Education. 2) Introduction to optics (3rd edition), by: F. L. Pedrotti, Leno M. Pedrotti and Leno S. Pedrotti. 3) Principles of optics, (7th edition), by: Max Born and Emil Wolf.

52.Program Development Plan
The development plan involves continuous curriculum review and updates based on the following key elements: 1- Feedback from Students and faculty: Regularly collect and incorporate feedback from students, faculty, and industry partners to ensure the curriculum remains relevant and meets the needs of all stakeholders. 2- Emerging Trends and Technological Advancements: Stay abreast of the latest trends and technological advancements in physical optics to integrate new knowledge and techniques into the curriculum. 3- Accreditation Requirements and Standards: Adhere to accreditation requirements and standards set by relevant accrediting bodies to ensure the program maintains high educational and professional standards. 4- Periodic Assessments: Conduct regular assessments and evaluations of the program to ensure it meets its educational and professional objectives, making adjustments as necessar to improve outcomes and maintain excellence.

Program Skills Outline															
				Required program Learning outcomes											
Year/Level	Course Code	Course Name	Basic or optional	Knowledge				Skills				Ethics			
				A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4
3rd		physical optics	Basic	+	+	+		+	+			+	+		

- **Please tick the boxes corresponding to the individual program learning outcomes under evaluation.**

Course Description Form

37.Course Name:
Geometric optics
38.Course Code:
Phys 337
39.Semester / Year:
First /2024
40.Description Preparation Date:
27-6-2024
41.Available Attendance Forms:
Weekly/official working hours
42.Number of Credit Hours (Total) / Number of Units (Total)
3 hr./ 3 unit
43.Course administrator's name (mention all, if more than one name)
Name: Lecturer Dr.Thill Akeel Kadhum Almusawi Email: thillakeel@mu.edu.iq

44. Course Objectives	
Course Objectives	

45.Teaching and Learning Strategies	
Strategy	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.

46. Course Structure					
Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**
1	3	Interference	Superposition of waves, addition of waves	Lecture and Discussion	Quiz
2	3	Interference	Huygens's principles, division of wave front	Laboratory Session	Lab Report
3	3	Interference	Interference, Newton's rings	Practical Workshop	Lab Report
4	3	Interference	Constructive interference, destructive interference.	Lecture and Discussion	Mid-term Exam
5	3	Interference	Young's double slits exp., Fresnel's exp.	Laboratory Session	Lab Report
6	3	Interference	Thin film interference	Lecture and Discussion	Quiz
7	3	Interference	Michelson's interferometer, Fabry-Perot interferometer	Practical Workshop	Assignment
8	3	Diffraction	Diffraction	Laboratory Session	Lab Report
9	3	Diffraction	Diffraction by single slit	Lecture and Discussion	Quiz
10	3	Diffraction	Fraunhofer and Fresnel diffraction	Lecture and Case Study	Assignment
11	3	Diffraction	Diffraction Grating	Practical Workshop	Mid-term Exam
12	3	Diffraction	The double slits diffraction	Lecture and Discussion	Quiz
13	3	Polarization	Introduction to the Polarization	Laboratory Session	Lab Report

14	3	Polarization	Polarization by reflection and Brewster's angle	Lecture and Discussion	Assignment
15	3	Polarization	Law of Malus, Fresnel's diffraction	Lecture and Case Study	Final Exam

47.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

48.Learning and Teaching Resources	
Required textbooks (curricular books any)	1) Introcution to optics (3rd edition), by: F. L. Pedrotti, Leno M. Pedrotti and Leno S. Pedrotti. 2) Principles of optics, (7th edition) , by: Max Born and Emil Wolf.
Main references (sources)	
Recommended books and references (scientific journals, reports...)	1) Fundamentals of optics, (4th edition), by: Francis A. Jenkins and Harvey E. White.
Electronic References, Websites	

Course Description Form

1. Course Name

Quantum mechanics1

2. Course Code

Department of Physical Sciences – third stage

3. Semester / Year

First Semester(2023-2024)

4. Description Preparation Date: 22-6-2024

5. Available Attendance Forms

Actual Attendance

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

(2 Theory)

7. Course administrator's name

Name: Prof.Dr. Hadi Qasim Mohamed
Email: hadey.mohamad@mu.edu.iq

8. Course Objectives

9. Teaching and Learning Strategies	
Strategy	**-Group discussions and assignments** **-Creating an atmosphere of competition among students and treating individual differences using appropriate educational methods.** **-Research groups - nested discussion circles.** **- Teaching methods include the use of educational technology.** **- Encouraging students to self-learn.**

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	(2 Th+1 Tu)	Elementary characteristics of quantum mechanics and the importance of quantum mechanics in physics	Theoretical		Daily preparation, daily and oral exams on the board and assignments
2	(2 Th+1 Tu)	Vector function and its interpretation	Theoretical		Daily preparation, daily and oral exams on the board and assignments
3	(2 Th+1 Tu)	Derivation of Schödinger equation	Theoretical		Daily preparation, daily and oral exams on the board and assignments
4	(2 Th+1 Tu)	Schödinger vector equation - effects	Theoretical		Daily preparation, daily and oral exams on the board and assignments
5	(2 Th+1 Tu)	Schödinger vector equation - effects	Theoretical		Daily preparation, daily and oral exams on the board and assignments
6	(2 Th+1 Tu)	Derivation of the vector equation for the hydrogen atom	Theoretical		Daily preparation, daily and oral exams on the board and assignments
7	(2 Th+1 Tu)	Deduce the Laplacian effects that affect a	Theoretical		Daily preparation, daily and oral exams on the

1. Course Name
Quantum mechanics2
2. Course Code
Department of Physical Sciences – third stage

3. Semester / Year
Second Semester(2023-2024)
4. Description Preparation Date:
5. Available Attendance Forms
Actual Attendance
6. Number of Credit Hours (Total) / Number of Units (Total)
(2 Theory+1 Tutorial)
7. Course administrator's name (mention all, if more than one name)
Name: Prof.Dr. Hadi Dwaich ALattabi **Email: alattabih@uowasit.edu.iq**
8. Course Objectives

Course Objectives	**1.The goals of studying quantum mechanics in physics express the real behavior in the study of physical systems in the microscopic state, such as**

9. Teaching and Learning Strategies

Strategy	**-Group discussions and assignments** **-Creating an atmosphere of competition among students and treating individual differences using appropriate educational methods.** **-Research groups - nested discussion circles.** **- Teaching methods include the use of educational technology.** **- Encouraging students to self-learn.**

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	(2 **Th+1 Tu)**	**Results in quantum mechanics that correspond to fundamental results in classical mechanics**	**Theoretical**		**Daily preparation, daily and oral exams on the board and assignments**
2	(2 **Th+1 Tu)**	Solution of the time-dependent Schödinger equation	**Theoretical**		**Daily preparation, daily and oral exams on the board and assignments**
3	(2 **Th+1 Tu)**	**Complement of the time-dependent Schödinger equation**	**Theoretical**		**Daily preparation, daily and oral exams on the board and assignments**
4	(2 **Th+1 Tu)**	**Characteristics of energy levels and vector functions**	**Theoretical**		**Daily preparation, daily and oral exams on the board and assignments**
5	(2 **Th+1 Tu)**	**Dissolution**	**Theoretical**		**Daily preparation, daily and oral exams on the board and assignments**
6	(2 **Th+1 Tu)**	**Results implied by the time-independent**	**Theoretical**		**Daily preparation, daily and oral exams on the board and assignments**
7	(2 Th+1 Tu)	**Results implied by the time-independent Schödinger equation**	**Theoretical**		**Daily preparation, daily and oral exams on the board and assignments**
8	(2 **Th+1 Tu)**	Mid-term Exam	**written exams**		
9	(2 **Th+1 Tu)**	**Mathematical expression and features of the Kroenker function**	**Theoretical**		**Daily preparation, daily and oral exams on the board and assignments**
10	(2 **Th+1 Tu)**	**Representing a vector function with an expansion**	**Theoretical**		**Daily preparation, daily and oral exams on the board and assignments**
11	(2 **Th+1 Tu)**	**Effects properties**	**Theoretical**		**Daily preparation, daily and oral exams on the board and assignments**
12	(2 **Th+1 Tu)**	**Substituting effect**	**Theoretical**		**Daily preparation, daily and oral exams on the board and assignments**
13	(2 **Th+1 Tu)**	**The expected value per unit of time depends on the effect of studying the change in the value replaced**	**Theoretical**		**Daily preparation, daily and oral exams on the board and assignments**

14	(2 **Th+1 Tu)**	**Low probability**	**Theoretical**	**Daily preparation, daily and oral exams on the board and assignments**
15	(3 h)	**Probability stream and quantized states**	**Theoretical**	**reports**
16	(3 h)	**Symmetry in quantum mechanics**	**Theoretical**	**Daily preparation, daily and oral exams on the board 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 **Course**	**Daily preparation, daily and oral exams**	**Daily assignments**	**reports**	**Seminars**	**Mid-term Exam**	**Final -Exam**
2nd	**15**	**15**	**5**	**5**	**10**	**50**

53. Program Vision

To advance nuclear physics through innovative research, cutting-edge technology, and global collaboration, enhancing our understanding of atomic nuclei and leveraging nuclear science for societal benefit.

54. Program Mission

The mission of our Nuclear Physics Program is to advance the understanding of atomic nuclei and their fundamental interactions. We aim to foster groundbreaking research, develop innovative technologies, and train the next generation of scientists. Through cutting-edge experiments, theoretical advancements, and interdisciplinary collaboration, we seek to uncover the mysteries of nuclear matter, contribute to national security, and drive progress in energy, medicine, and industry. Our commitment is to excellence in education, research, and community engagement, ensuring our work has a lasting impact on science and society.

55. Program Objectives

Program Objectives for a Nuclear Physics Program:

1. Fundamental Understanding: Develop a deep understanding of the fundamental principles of nuclear physics, including the structure, behavior, and interactions of atomic nuclei.

2. Research and Innovation: Foster the ability to conduct independent research, innovate experimental techniques, and contribute to advancements in nuclear physics through original scientific investigations.

3. Technical Proficiency: Equip students with advanced technical skills in the use of specialized instruments, computational tools, and methodologies essential for modern nuclear physics research.

4. Professional Development: Prepare students for successful careers in academia, industry, and government by enhancing their communication, collaboration, and leadership skills through comprehensive training and professional development opportunities.

By achieving these objectives, the program aims to produce highly skilled nuclear physicists who are capable of advancing the field and addressing the complex challenges of the modern world.

56. Program Accreditation

57. Other external influences

58. Program Structure				
Program Structure	**Number of Courses**	**Credit hours**	**Percentage**	**Reviews***
Institution Requirements	**X**			
College Requirements	**X**			
Department Requirements	**1**	**3**	**5%**	
Summer Training	**X**			
Other	**Lab**			

* This can include notes on whether the course is basic or optional.

59. Program Description				
Year/Level	**Course Code**	**Course Name**	**Credit Hours**	
Four	**Phy407**		**Theoretical**	**practical**

60. Expected learning outcomes of the program	
Knowledge	
Learning Outcomes 1	• Master fundamental theories of nuclear physics, including nuclear structure and reactions. • Understand the applications of quantum mechanics and relativity in nuclear physics. • Stay informed on contemporary research and advancements in the field.

61. Teaching and Learning Strategies

- Lectures and Seminars: Deliver comprehensive lectures and interactive seminars to provide foundational knowledge and facilitate in-depth discussions on advanced topics in nuclear physics.
- Laboratory Work: Incorporate hands-on laboratory sessions where students can apply theoretical knowledge, develop experimental skills, and gain experience with advanced instrumentation.
- Research Projects: Encourage independent and collaborative research projects that allow students to explore specific areas of interest, develop critical thinking, and contribute to scientific advancements.
- Problem-Based Learning: Utilize problem-based learning approaches to enhance problem-solving skills, foster critical thinking, and apply theoretical concepts to real-world scenarios.
- Guest Lectures and Industry Collaboration: Invite experts from academia, industry, and research institutions to share their knowledge, provide insights into current developments, and expose students to diverse perspectives and career opportunities.

Skills	
Learning Outcomes 2	• Develop expertise in experimental techniques and advanced instrumentation. • Enhance computational skills for modeling, simulating, and analyzing nuclear systems.
Learning Outcomes 3	• Improve problem-solving and critical thinking through independent research. • Strengthen scientific communication, both written and oral.

Ethics	
Learning Outcomes 4	• Understand ethical considerations in nuclear research, focusing on safety, security, and environmental impact. • Commit to professional integrity and ethical conduct in research.
Learning Outcomes 5	• Recognize the societal implications of nuclear physics and aim to use scientific knowledge responsibly.

62. Evaluation methods

Evaluation in the nuclear physics program utilizes a combination of rigorous assessment tools to measure student progress and achievement. Methods include:

- Examinations: Regular assessments covering theoretical knowledge and problem-solving skills in nuclear physics principles.
- Laboratory Reports: Analysis of experimental data, methodologies, and interpretations to gauge practical skills in nuclear physics research.
- Research Projects: Independent or group-based research projects evaluating students' ability to formulate hypotheses, conduct experiments, and analyze results.
- Presentations: Oral presentations and written reports on research findings, assessing communication and dissemination skills.

Academic Rank	Specialization	Special Requirements/Skills (if applicable)	Number of the teaching staff	
	General	Special	Staff	Lecturer
Assistant Professor Dr.	Physics			

Professional Development

Mentoring new faculty members

 Orientation programs to familiarize them with departmental policies and teaching methodologies.
 Regular meetings with experienced faculty mentors to discuss teaching strategies and research integration.

Professional development of faculty members

The academic and professional development plan includes:

- Workshops on innovative teaching and learning strategies.
- Seminars on the latest research advancements in microbial genetics.
- Opportunities for faculty to attend conferences and participate in collaborative research projects.
- Regular assessments and feedback sessions to enhance teaching effectiveness.

63. Acceptance Criterion

The program follows the central admission regulations set by the university, which include academic qualifications, entrance exams, and interviews.

64. The most important sources of information about the program

- Principles in nuclear physics, By Mayerhoof.1984.
- Nuclear physics, by Anka, 1988, John Wiley and Sons.
- Fundamentals of Nuclear Physics (cambridge.org)

65. Program Development Plan

The development plan for the Clinical Analysis program involves continuous curriculum review and updates based on the following key elements:

- **Feedback from Students, Faculty, and Industry Partners**: Regularly collect and incorporate feedback from students, faculty, and industry partners to ensure the curriculum remains relevant and meets the needs of all stakeholders.
- **Emerging Trends and Technological Advancements**: Stay abreast of the latest trends and technological advancements in clinical analysis and laboratory medicine to integrate new knowledge and techniques into the curriculum.
- **Accreditation Requirements and Standards**: Adhere to accreditation requirements and standards set by relevant accrediting bodies to ensure the program maintains high educational and professional standards.
- **Periodic Assessments**: Conduct regular assessments and evaluations of the program to ensure it meets its educational and professional objectives, making adjustments as necessary to improve outcomes and maintain excellence.
-

Program Skills Outline															
				Required program Learning outcomes											
Year/Level	Course Code	Course Name	Basic or optional	Knowledge				Skills				Ethics			
				A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4
Four		Nuclear Phys	Basic	+	+	+		+	+			+	+		+

- **Please tick the boxes corresponding to the individual program learning outcomes under evaluation.**

Course Description Form

49. Course Name:
Nuclear Physics I
50. Course Code:
Phy407
51. Semester / Year:
First /Fourth
52. Description Preparation Date:
26-6-2024
53.Available Attendance Forms:
Classroom
54.Number of Credit Hours (Total) / Number of Units (Total)
3/17
55. Course administrator's name (mention all, if more than one name)
Name: Dr. Ali N Sabbar Email: alinadhm@mu.edu.iq

56. Course Objectives	
Course Objectives	Defining the nucleus and its composed, nuclear models, nuclear force, reactions and reactor types and nuclear pollution

57. Teaching and Learning Strategies	
Strategy	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering types of simple experiments involving some interesting sampling activities for the students.

58. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Demonstrate a thorough understanding of the fundamental principles and concepts underlying nuclear physics theories and applications.	Principles in nuclear physics	Lecture and Discussion	Lab Report
2	3	Explain the structure, composition, and properties of atomic nuclei, including their size, mass, and charge distribution.	Essential characteristics of the nucleus	Laboratory Session	Quiz
3	3	Describe how various types of radiation (alpha, beta, gamma) interact with matter at the atomic and molecular levels, including ionization and excitation processes.	Interaction of radiation with matter	Practical Workshop	Lab Report
4	3	Analyze the behavior of electrons when interacting with matter, focusing on scattering processes, energy loss mechanisms, and the production of secondary radiation.	Interaction of electron with matter	Lecture and Discussion	Mid-term Exam
5	3	Evaluate neutron interactions with different materials, including scattering, absorption, and moderation processes,	Interaction of neutron with matter	Laboratory Session	Lab Report

		and their implications for nuclear reactions and shielding.			
6	3	Discuss the penetration, attenuation, and absorption of gamma rays in various materials, and the mechanisms of photoelectric effect, Compton scattering, and pair production.	Interaction of gamma rays with matter	Lecture and Discussion	Quiz
7	3	Describe the factors influencing nuclear stability, such as binding energy, nuclear shell model, and the role of isotopes and isotones in determining nuclear stability.	Nuclear structure and stability	Practical Workshop	Assignment
8	3	Compare and contrast different nuclear models (liquid drop model, shell model, collective model) to explain nuclear properties and predict nuclear behavior.	Nuclear models	Laboratory Session	Lab Report
9	3	Explain the nature and characteristics of nuclear forces (strong and weak nuclear forces), their role in nuclear stability, binding energy, and nuclear reactions.	Nuclear forces	Lecture and Discussion	Quiz
10	3	Evaluate methods and implications of nuclear activation, including induced radioactivity and its applications in medicine, industry, and research.	Nuclear activation	Lecture and Case Study	Assignment
11	3	Analyze the principles of nuclear reactor operation, including reactor types, fuel cycles, safety mechanisms, and environmental impact.	Nuclear reactors	Practical Workshop	Mid-term Exam
12	3	Assess the sources, effects, and mitigation strategies of radiation pollution on the environment and biological systems.	Radiation pollution and its biological effects	Lecture and Discussion	Quiz
13	3	Explain the concept of radioactivity, radioactive decay processes, decay laws, and the use of radioactive isotopes in various applications.	Radioactivity	Laboratory Session	Lab Report

14	3	Define radiation units	Radiation Units, Exposure	Lecture and Discussion	Assignment
15	3	Calculate and interpret radiation units such as exposure (roentgen), absorbed dose (rad, gray), and equivalent dose (rem, sievert), and their significance in radiation protection and dosimetry.	Absorbed Dose, Equivalent dose	Lecture and Case Study	Final Exam

59. 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

60. Learning and Teaching Resources

Required textbooks (curricular books, if any	**Principles in nuclear physics, By Mayerhoof.1984.**
Main references (sources)	**Nuclear physics, by Anka, 1988, John Wiley and Sons.**
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	Fundamentals of Nuclear Physics (cambridge.org)

Course Description Form

1. Course Name:
Nuclear Physics II
2. Course Code:
Phy407
3. Semester / Year:
Second /Fourth
4. Description Preparation Date:
26-6-2024
5. Available Attendance Forms:
Classroom
6. Number of Credit Hours (Total) / Number of Units (Total)
3/17
7. Course administrator's name (mention all, if more than one name)
Name: Dr. Ali N Sabbar Email: alinadhm@mu.edu.iq

8. Course Objectives	
Course Objectives	Defining the nucleus and its composed, nuclear models, nuclear force, reactions and reactor types and nuclear pollution

9. Teaching and Learning Strategies	
Strategy	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering types of simple experiments involving some interesting sampling activities for the students.

10. Course Structure					
Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**
1	3	Understand the concept of radioactive decay and its significance in nuclear physics. Identify different types of radioactive decay processes, including alpha, beta, and gamma decay. Calculate decay constants and half-lives of radioactive isotopes.	Radioactive decay Nuclear decay modes	Lecture and Discussion	Lab Report
2	3	Explain the mechanism of alpha decay and its characteristics. Calculate decay energies and understand the emission of alpha particles from nuclei.	Alpha decay	Laboratory Session	Quiz
3	3	Describe beta decay processes, distinguishing between beta-minus and beta-plus decay. Discuss the role of neutrinos in beta decay and apply the neutrino hypothesis.	Beta decay Neutrino hypothesis	Practical Workshop	Lab Report
4	3	Explain electron capture as a nuclear decay process. Compare electron capture with positron emission and beta-minus decay.	Electron capture	Lecture and Discussion	Mid-term Exam
5	3	Interpret and construct decay schemes for radioactive nuclei.	Decay scheme	Laboratory Session	Lab Report
6	3	Understand gamma decay processes, emission of gamma rays, and associated energy transitions.	Gamma decay	Lecture and Discussion	Quiz
7	3	Apply radiometric dating methods to estimate the age or lifetime of radioactive samples.	Radiometric dating (estimation lifetime of sample)	Practical Workshop	Assignment
8	3	Define nuclear reactions and distinguish between fusion and fission processes. Calculate reaction energies and understand	Nuclear reactions Q-value of reaction	Laboratory Session	Lab Report

		conservation laws in nuclear reactions.			
9	3	Differentiate between exergonic (exothermic) and endergonic (endothermic) nuclear reactions.	Exothermic and endothermic reactions (Exergonic and Endergonic reactions)	Lecture and Discussion	Quiz
10	3	Describe nuclear fission and fusion processes, including their applications and energy release mechanisms.	Fission & Fusion	Lecture and Case Study	Assignment
11	3	Explain the principles and operation of nuclear reactors.	Nuclear reactors	Practical Workshop	Mid-term Exam
12	3	Understand neutron activation analysis and its role in material characterization.	Nuclear activation	Lecture and Discussion	Quiz
13	3	Define cross-sectional area in the context of nuclear interactions. Calculate cross-sections and interpret their role in nuclear reactions and shielding.	Cross-sectional area Macroscopic cross-section	Laboratory Session	Lab Report
14	3	Identify and describe elementary particles relevant to nuclear physics, such as protons, neutrons, electrons, neutrinos, and mesons.	Elementary particles	Lecture and Discussion	Assignment
15	3	Study neutron properties, interactions, and behavior in nuclear environments.	Neutron physics	Lecture and Case Study	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	**Principles in nuclear physics, By Mayerhoof.1984.**
Main references (sources)	**Nuclear physics, by Anka, 1988, John Wiley and Sons.**

Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	Fundamentals of Nuclear Physics (cambridge.org)

66. Program Vision

To Have social, scientific and ethical values in the stages of collecting, interpreting, announcing and applying the data in the field of physics. Can research interdisciplinary fields. Use techniques and modern instruments for applications in Physics. Keep up with latest developments and new applications in physics.

67. Program Mission

The mission of this Program is to advance theoretical and applied knowledge about physics. use theoretical and applied knowledge of science and mathematics. Examine the concepts and ideas in Physics through scientific methods, express and analyze the problem, formulate a solution based on research, and interpret and evaluate the results. Take responsibility to solve unpredictable and complex problems encountered in applications as an individual and as a member of a team. Plan and manage activities in teamwork. Identify and assess learning needs and evaluate the knowledge and skills acquired with an inquisitive approach.

68. Program Objectives

Program Objectives for Electromagnetism I Program:

1. Fundamental Understanding: Program and use numerical methods to illustrate or solve relevant problems involving electromagnetic fields. Access and read critically relevant scientific literature, making original connections to other publications and the course.

2. Research and Innovation: Foster the ability to conduct independent research, innovate experimental techniques, and contribute to advancements in electromagnetic fields through original scientific investigations.

3. Technical Proficiency: Equip students with advanced technical skills in the use of specialized instruments, computational tools, and methodologies essential for electromagnetic fields research. In addition, to effectively communicate scientific concepts and results in written as well as oral form.

4. Professional Development: Prepare students for successful careers in academia, industry, and government by enhancing their communication, collaboration, and leadership skills through comprehensive training and professional development opportunities.

By achieving these objectives, the program aims to give students a solid foundation in electromagnetism. After undertaking this course, students should be confident in their ability to present electromagnetism to high school students. Students will be able to solve problems involving charges, circuits and electromagnetic waves. They will be introduced to Maxwell's equations in the integral form and be able to use these to solve problems involving moving and static charges. Students will be able to plan experiments and carry them out.

69. Program Accreditation

70. Other external influences

71. Program Structure

Program Structure	Number of Courses	Credit hours	Percentage	Reviews*
Institution Requirements	X			
College Requirements	X			
Department Requirements	2	3		
Summer Training	X			
Other	X			

* This can include notes on whether the course is basic or optional.

72. Program Description

Year/Level	Course Code	Course Name	Credit Hours	
Four			theoretical	practical
			3	/

73. Expected learning outcomes of the program

Knowledge	
Learning Outcomes 1	• Describe and understand the basic concepts underpinning electricity and magnetism such as potential and field. • Understand the relationship between electric and magnetic fields. • Calculate the electrostatic and magnetic fields produced by static and moving charges in a variety of simple configurations.

Skills	
Learning Outcomes 2	• See how the theory describing electricity and magnetism relates to areas in physics such as gravitation, fluids, thermal physics and quantum mechanics. • Identify and apply appropriate theoretical techniques to solve a range of different problems in electromagnetism. • Apply those theoretical techniques to solve problems in any context underpinned by coupled linear differential equations.
Learning Outcomes 3	• Design, set up, and carry out experiments; analyze data recognizing and accounting for errors; and compare with theoretical predictions

Ethics	
Learning Outcomes 4	• Understand ethical considerations in the electromagnetism research field, focusing on safety, and security impact. • Commit to professional integrity and ethical conduct in research.

Learning Outcomes 5	• Recognize the societal implications of electromagnetism and aim to use scientific knowledge responsibly.

74. Teaching and learning strategies

The Strategy	❖Weekly lectures included providing students with the basics and topics related to the pre-skills education outcomes to solve practical problems through presentation, lecture, or conducting experiments. ❖Solve a group of practical and applied examples by faculty members. ❖Through discussion, students participate in solving some practical problems. ❖Asking the student to visit the library and the international information network (the Internet) to obtain additional knowledge of the academic subjects. ❖Presenting a seminar to the student in front of his fellow students to enhance his self-confidence.

75. Course structure

Week	Hours	Name of the unit or topic	Required learning outcomes	Learning method	Evaluation method
1	3	**Electromagnetics Overview** *What is electromagnetics? Why study electromagnetics? Course topics*	An introductory introduction to electromagnetic fields and their importance in electrical engineering	Lectures, Tutorials	Daily, oral, monthly, written examinations and reports
2	3	**Vector Algebra:** *Scalars and Vectors; Unit Vector; Vector Addition and Subtraction; Position and Distance Vectors; Vector Multiplication; Components of a Vector*	Vector review	Lectures, Tutorials	Daily, oral, monthly, written examinations and reports
3	3	**Coordinate Systems and Transformation:** *Cartesian Coordinates (x, y, z); Circular Cylindrical Coordinates (ρ, φ, z); Spherical Coordinates (r, ∅, φ); Constant-Coordinate Surfaces, the transformation between coordinate system.*	Learn about coordinate systems, transformation, and vector calculations	Lectures, Tutorials	Daily, oral, monthly, written examinations and reports
4	3	**Vector Calculus:** *Differential Length, Area, and Volume; Line, Surface, and Volume*	Learn about coordinate systems, transformation, and vector calculations	Lectures, Tutorials	Daily, oral, monthly, written examinations and reports

		Integrals Del Operator; Gradient of a Scalar; Divergence of a Vector and Divergence Theorem.			
5	9	**Coulomb's Law and Electric Field Intensity:** *The experimental law of Coulomb, Electric field intensity; Field of n point charges;*	Study of Coulomb's law and electric field intensity	Lectures, Tutorials	Daily, oral, monthly, written examinations and reports
6	3	*Electric fields due to continuous charge distributions (line charge, surface charge and volume charge distributions),*	Study of Coulomb's law and electric field intensity	Lectures, Tutorials	Daily, oral, monthly, written examinations and reports
7	3	*Steam line and sketches of fields; Electric flux density.*	Study of Coulomb's law and electric field intensity	Lectures, Tutorials	Daily, oral, monthly, written examinations and reports
8	3	**Gauss's Law-Electric Flux Density:** *Gauss's law; Some symmetrical charge distribution*	Study of Chaos' law and its applications	Lectures, Tutorials	Daily, oral, monthly, written examinations and reports
9	3	*Application of Gauss's law; Maxwell's first equation (for electrostatics);*	Study of Chaos' law and its applications	Lectures, Tutorials	Daily, oral, monthly, written examinations and reports
10	3	*The vector operator and the divergence theorem.*	Study of Chaos' law and its applications	Lectures, Tutorials	Daily, oral, monthly, written examinations and reports
11	3	**Electrostatic Fields** *Coulomb's Law and Field Intensity; Electric Flux Density, and Gauss's Law;*	Identify the electric field intensity	Lectures, Tutorials	Daily, oral, monthly, written examinations and reports
12	3	*Applications of Gauss's Law; Energy and Potential.*	Identify the electric field intensity	Lectures, Tutorials	Daily, oral, monthly, written examinations and reports
13	3	**Energy and Potential:** *Energy and potential-energy expended in moving a point charge in an electric field*	Learn how to calculate energy and electrical magnitude Difference	Lectures, Tutorials	Daily, oral, monthly, written examinations and reports
14	3	*The line integrals; Potential difference and potential, The potential field of a point charge; The potential field of a system of charges*	Learn how to calculate energy and electrical magnitude Difference	Lectures, Tutorials	Daily, oral, monthly, written examinations and reports
15	3	*Conservative property; Potential gradient; The dipole energy density in the electrostatic field.*	Learn how to calculate energy and electrical magnitude Difference	Lectures, Tutorials	Daily, oral, monthly, written examinations and reports
76. Course Evaluation					

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

Quizzes	10% (10)
Assignments	10% (10)
Projects	10% (10)
Report	10% (10)
Annual quest	40% (40)
Final Exam	60% (60)
Total assessment	100% (100 Marks)

77.Learning and teaching resources

Required textbooks (methodology, if any)	Matthew, N. O. "Sadiku Elements of Electromagnetics." (2018).
Main references (sources)	Electromagnetics By Joseph Edminister (Schaum's Outline Series) : Joseph Edminister, Vishnu Priye Mc Graw Hill Education
Recommended supporting books and references (scientific journals, reports....)	All scientific magazines and periodicals related to electromagnetic fields
Electronic references, Internet sites	https://www.coursera.org/browse/physical-science-and-engineering/electrical-engineering

Course Description Form

1. Course Name:
Electromagnetism I
2. Course Code:
3. Semester / Year:
Fourth /2024
4. Description Preparation Date:
27-6-2024
5. Available Attendance Forms:
Physically
6. Number of Credit Hours (Total) / Number of Units (Total)
3 hours
7. Course administrator's name (mention all, if more than one name)
Name: Asst Prof. Dr. Rasha A. Hussein Email: rasha.lasereng@mu.edu.iq

78. Course structure

Week	Hours	Name of the unit or topic	Required learning outcomes	Learning method	Evaluation method
1	3	Static magnetic field and its sources	Induction to magnetic field, Lorentz force law and its applications.	Lectures, Tutorials	Daily, oral, monthly, written examinations and reports
2	3	Biot-Savart law	Biot-Savart Law and its applications.	Lectures, Tutorials	Daily, oral, monthly, written examinations and reports
3	3	Ampere law	Ampere's Law (differential and integral shape). Application of Ampere's law.	Lectures, Tutorials	Daily, oral, monthly, written examinations and reports
4	3	Magnetic flux density and magnetic flux	Magnetic flux density	Lectures, Tutorials	Daily, oral, monthly, written examinations and reports
5	3	Curl of vector field and stocks theory and applications	Divergence and curl of the magnetic field.	Lectures, Tutorials	Daily, oral, monthly, written examinations and reports
6	3	Forces of magnetic field and electric-magnetic field combined	force and Torques on Rigid Circuits	Lectures, Tutorials	Daily, oral, monthly, written examinations and reports
7	3	Microscopic properties of magnetic materials	The origin of magnetism in the matter. Magnetic moment of the atom. Magnetic current density. Surface current density. Magnetic Intensity.	Lectures, Tutorials	Daily, oral, monthly, written examinations and reports
8	3	Mid-term Exam	Exam	Tutorials	Daily, oral, monthly, written examinations and reports

9	3	Inductance	Self Induction Mutual Induction	Lectures, Tutorials	Daily, oral, monthly, written examinations and reports
10	3	Faradays law and magnetic circuit	Magnetic energy of a solid circuit. Magnetic Energy of Coupled Circuits,	Lectures, Tutorials	Daily, oral, monthly, written examinations and reports
11	3	Maxwell's equation	Displacement Current	Lectures, Tutorials	Daily, oral, monthly, written examinations and reports
12	3	Applications of Maxwell's equations in matter	Maxwell's Equation's	Lectures, Tutorials	Daily, oral, monthly, written examinations and reports
13	3	Wave equation	- Wave Equation for Electric and Magnetic Field	Lectures, Tutorials	Daily, oral, monthly, written examinations and reports
14	3	Poynting vector	Poynting vector	Lectures, Tutorials	Daily, oral, monthly, written examinations and reports
15	3	Preparatory week before the Final Exam	Preparatory week before the Final Exam	Tutorials	Daily, oral, monthly, written examinations and reports

79. Course Evaluation

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

Quizzes	10% (10)
Assignments	10% (10)
Projects	10% (10)
Report	10% (10)
Annual quest	40% (40)
Final Exam	60% (60)
Total assessment	100% (100 Marks)

80. Learning and teaching resources

Required textbooks (methodology, if any)	Matthew, N. O. "Sadiku Elements of Electromagnetics." (2018).
Main references (sources)	Electromagnetics By Joseph Edminister (Schaum's Outline Series) : Joseph Edminister, Vishnu Priye Mc Graw Hill Education

Recommended supporting books and references (scientific journals, reports....)	All scientific magazines and periodicals related to electromagnetic fields
Electronic references, Internet sites	https://www.coursera.org/browse/physical-science-and-engineering/electrical-engineering

81. Faculty

Faculty Members

Academic Rank	Specialization	Special Requirements/Skills (if applicable)	Number of the teaching staff	
	General	Special	Staff	Lecturer
Assistant Professor Dr.	Physics			

Professional Development

Mentoring new faculty members

 Orientation programs to familiarize them with departmental policies and teaching methodologies.
 Regular meetings with experienced faculty mentors to discuss teaching strategies and research integration.

Professional development of faculty members

The academic and professional development plan includes:

- Workshops on innovative teaching and learning strategies.
- Seminars on the latest research advancements in microbial genetics.
- Opportunities for faculty to attend conferences and participate in collaborative research projects.
- Regular assessments and feedback sessions to enhance teaching effectiveness.

82. Acceptance Criterion

The program follows the central admission regulations set by the university, which include academic qualifications, entrance exams, and interviews.

83. Program Development Plan
The development plan for the Clinical Analysis program involves continuous curriculum review and updates based on the following key elements: • **Feedback from Students, Faculty, and Industry Partners**: Regularly collect and incorporate feedback from students, faculty, and industry partners to ensure the curriculum remains relevant and meets the needs of all stakeholders. • **Emerging Trends and Technological Advancements**: Stay abreast of the latest trends and technological advancements in clinical analysis and laboratory medicine to integrate new knowledge and techniques into the curriculum. • **Accreditation Requirements and Standards**: Adhere to accreditation requirements and standards set by relevant accrediting bodies to ensure the program maintains high educational and professional standards. • **Periodic Assessments**: Conduct regular assessments and evaluations of the program to ensure it meets its educational and professional objectives, making adjustments as necessary to improve outcomes and maintain excellence. •

Course Description Form

61. Course Name:
Electromagnetism II
62. Course Code:
63. Semester / Year:
Fourth /2024
64. Description Preparation Date:
27−6−2024
65.Available Attendance Forms:
Physically
66.Number of Credit Hours (Total) / Number of Units (Total)
3 hours
67. Course administrator's name (mention all, if more than one name)
Name: Asst Prof. Dr. Rasha A. Hussein Email: rasha.lasereng@mu.edu.iq

1. Program Vision

To understand the field of Solid state physics through a combination of course work, laboratory experiences, research, and practical training. The combination of instructional methods leads students to a balanced understanding of the scientific theories of solid state to make observations, develop insights and create new knowledge about the physical laws and theories that controlling the matter.

2. Program Mission

The Program seeks to provide all physical students with fundamental knowledge of solid state physics, as well as a deeper understanding of a selected focus area within the solid sciences. The curriculum and advising have been designed to prepare student for their professional future, whether they choose to work as field of solid state specializing. The solid state physical program also provides the necessary fundamental knowledge of wide range of phenomena in solid state. In addition, physical courses provide a key laboratory science experience for those students seeking to complete the general education requirements in solid state physic.

3. Program Objectives

Program Objectives for a Nuclear Physics Program:

1. Fundamental Understanding: Develop a deep understanding of the fundamental principles of solid state physics, including the structure, behavior, and the properties of solid state material.

2. Research and Innovation: Foster the ability to conduct independent research, innovate experimental techniques, and contribute to advancements in solid state physics through original scientific investigations.

3. Technical Proficiency: Equip students with advanced technical skills in the use of specialized instruments, computational tools, and methodologies essential for modern solid state physics research.

4. Professional Development: Prepare students for successful careers in academia, industry, and government by enhancing their communication, collaboration, and leadership skills through comprehensive training and professional development opportunities.

By achieving these objectives, the program aims to produce highly skilled physicists who are capable of advancing the field and addressing the complex challenges of the modern world.

4. Program Accreditation

5. Other external influences

6. Program Structure

Program Structure	Number of Courses	Credit hours	Percentage	Reviews*
Institution Requirements	X			
College Requirements	X			
Department Requirements	1	3	5%	
Summer Training	X			
Other	Lab			

* This can include notes on whether the course is basic or optional.

7. Program Description

Year/Level	Course Code	Course Name	Credit Hours	
Four	Phys 440	Solid state I	Theoretica	practical
			3	2

8. Expected learning outcomes of the program

Knowledge	
Learning Outcomes 1	1. Recognize the type of Crystal structure. 2. List the various terms associated with solid state material.

	3. Summarize what is meaning of crystal lattice. 4. Discuss the types of bonds involvement of crystal structure. 5. Describe real space, Fourier space (reciprocal space), and the relation between two space. 6. Define diffraction condition law. 7. Identify the type of Crystal structure and their applications. 8. Discuss the type of wave and in physics and their rule to transfer energy. 9. Discuss the vibration mode of crystal lattice in one, two and three dimension. 10. Explain the dispersion relation which consist of angular frequency and the wave vector formed from the vibration mode and understand the transfer of energy in crystal lattice.

Skills	
Learning Outcomes 2	● Develop expertise in experimental techniques and advanced instrumentation. ● Enhance computational skills for modeling, simulating, and analyzing the solid state system
Learning Outcomes 3	● Improve problem-solving and critical thinking through independent research. ● Strengthen scientific communication, both written and oral.

Ethics	
Learning Outcomes 4	● Understand ethical considerations in solid state research, focusing on safety, security, and environmental impact. ● Commit to professional integrity and ethical conduct in research.
Learning Outcomes 5	● Recognize the societal implications of solid state physics and aim to use scientific knowledge responsibly.

10. Teaching and Learning Strategies

- Lectures and Seminars: Deliver comprehensive lectures and interactive seminars to provide foundational knowledge and facilitate in-depth discussions on advanced topics in solid state physics.
- Laboratory Work: Incorporate hands-on laboratory sessions where students can apply theoretical knowledge, develop experimental skills, and gain experience with advanced instrumentation.
- Research Projects: Encourage independent and collaborative research projects that allow students to explore specific areas of interest, develop critical thinking, and contribute to scientific advancements.
- Problem-Based Learning: Utilize problem-based learning approaches to enhance problem-solving skills, foster critical thinking, and apply theoretical concepts to real-world scenarios.
- Guest Lectures and Industry Collaboration: Invite experts from academia, industry, and research institutions to share their knowledge, provide insights into current developments, and expose students to diverse perspectives and career opportunities.

9. Evaluation methods

Evaluation in the solid state physics program utilizes a combination of rigorous assessment tools to measure student progress and achievement. Methods include:

- Examinations: Regular assessments covering theoretical knowledge and problem-solving skills in solid state physics principles.
- Laboratory Reports: Analysis of experimental data, methodologies, and interpretations to gauge practical skills in solid state research.
- Research Projects: Independent or group-based research projects evaluating students' ability to formulate hypotheses, conduct experiments, and analyze results.
- Presentations: Oral presentations and written reports on research findings, assessing communication and dissemination skills.

11. Faculty

Faculty Members

Academic Rank	Specialization	Special Requirements/Skills (if applicable)	Number of the teaching staff	
	General	Special	Staff	Lecturer
Assistant Professor Dr.	Physics			

Professional Development

Mentoring new faculty members

 Orientation programs to familiarize them with departmental policies and teaching methodologies.
 Regular meetings with experienced faculty mentors to discuss teaching strategies and research integration.

Professional development of faculty members

The academic and professional development plan includes:

- Workshops on innovative teaching and learning strategies.
- Seminars on the latest research advancements in solid state physic.
- Opportunities for faculty to attend conferences and participate in collaborative research projects.
- Regular assessments and feedback sessions to enhance teaching effectiveness.

12. Acceptance Criterion

The program follows the central admission regulations set by the university, which include academic qualifications, entrance exams, and interviews.

13. The most important sources of information about the program

- Introduction to solid state physics, By Charles Kittle.
- فيزياء الحالة الصلبة ز تاليف الكتور مؤيد جبرائيل يوسف
- فيزياء الحالة الصلبة تاليف الدكتور يحيى الجمال

14. Program Development Plan

The development plan for the Clinical Analysis program involves continuous curriculum review and updates based on the following key elements:

- **Feedback from Students, Faculty, and Industry Partners**: Regularly collect and incorporate feedback from students, faculty, and industry partners to ensure the curriculum remains relevant and meets the needs of all stakeholders.
- **Emerging Trends and Technological Advancements**: Stay abreast of the latest trends and technological advancements in solid state and laboratory experiment to integrate new knowledge and techniques into the curriculum.
- **Accreditation Requirements and Standards**: Adhere to accreditation requirements and standards set to ensure the program maintains high educational and professional standards.

- **Periodic Assessments**: Conduct regular assessments and evaluations of the program to ensure it meets its educational and professional objectives, making adjustments as necessary to improve outcomes and maintain excellence.
-

Program Skills Outline															
				Required program Learning outcomes											
Year/Level	Course Code	Course Name	Basic or optional	Knowledge				Skills				Ethics			
				A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4
Four	Phys 440	Solid state I	Basic	+	+	+		+	+			+	+		+

- **Please tick the boxes corresponding to the individual program learning outcomes under evaluation.**

Course Description Form

1. Course Name:
Solid state Physics I
2. Course Code:
Phys 440
3. Semester / Year:
First /Fourth
4. Description Preparation Date:
26-6-2024
5. Available Attendance Forms:
Classroom
6. Number of Credit Hours (Total) / Number of Units (Total)
3/17
7. Course administrator's name (mention all, if more than one name)
Name: Dr. Salah. A. Hassan Email: salah.almurshidee@mu.edu.iq

8. Course Objectives	
Course Objectives	Teach students the most important basic concepts, principles, laws, and scientific theories of the Solid state Physics, the student has the scientific skills that enable him to perform their professional and business functions, and others.

9. Teaching and Learning Strategies	
Strategy	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering types of simple experiments involving some interesting sampling activities for the students.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	3	Introduction, Crystal, Crystal Structure, Translation Vectors ,	Principles in solid state	Lecture and Discussion	Lab Report

2	3	Types of Unit Cell, Crystal System, Unit Cell, Area and Volume of Unit Cell	Crystal Structure	Lecture and Discussion	Quiz
3	3	Crystal Plane and their Indices, Inter planar distance, Wigner- Seitz	Crystal Structure	Lecture and Discussion	Lab Report
4	3	**The bonding, Types of bond, Crystal lattice energy**	**The bonding**	Lecture and Discussion	Mid-term Exam
5	3	**Determination of Madelung Constant in 1D and 2D, Crystal structures for some Crystals**	**The bonding**	Lecture and Discussion	Lab Report
6	3	**The diffraction, The Bragg diffraction law**	**The diffraction Law**	Lecture and Discussion	Quiz
7	3	**Fourier Analysis**	**The diffraction Law**	Practical Workshop	Assignment
8	3	**Reciprocal Lattice, Reciprocal Lattice Vectors,**	**The diffraction Law**	Lecture and Discussion	Lab Report
9	3	**The Ewald sphere diffraction in Reciprocal Lattice**	**The diffraction Law**	Lecture and Discussion	Quiz
10	3	**Brilloun Zones, Geometrical Structure Factor**	**The diffraction Law**	Lecture and Case Study	Assignment
11	3	**Sound Waves, Atomical Vibration in the lattice,**.	**Vibrational modes**	Practical Workshop	Mid-term Exam
12	3	**Vibrational modes of linear monoatomic lattice**.	**Vibrational modes**	Lecture and Discussion	Quiz
13	3	**Velocities in wave motion of linear monoatomic lattice**.	**Vibrational modes**	Lecture and Discussion	Lab Report
14	3	**Vibrational modes of diatomic linear lattice**,	**Vibrational modes**	Lecture and Discussion	Assignment
15	3	**Velocities in wave motion of diatomic linear lattice**.	**Vibrational modes**	Lecture and Discussion	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	• Introduction to solid state physics, By Charles Kittle.
Main references (sources)	• فيزياء الحالة الصلبة ز تاليف الكتور مؤيد جبرائيل يوسف فيزياء الحالة الصلبة تاليف الدكتور يحيى الجمال
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	

15. Program Vision

To understand the field of Solid state physics through a combination of course work, laboratory experiences, research, and practical training. The combination of instructional methods leads students to a balanced understanding of the scientific theories of solid state to make observations, develop insights and create new knowledge about the physical laws and theories that controlling the matter.

16. Program Mission

The Program seeks to provide all physical students with fundamental knowledge of solid state physics, as well as a deeper understanding of a selected focus area within the solid sciences. The curriculum and advising have been designed to prepare student for their professional future, whether they choose to work as field of solid state specializing. The solid state physical program also provides the necessary fundamental knowledge of wide range of phenomena in solid state. In addition, physical courses provide a key laboratory science experience for those students seeking to complete the general education requirements in solid state physic.

17. Program Objectives

Program Objectives for a Nuclear Physics Program:

1. Fundamental Understanding: Develop a deep understanding of the fundamental principles of solid state physics, including the structure, behavior, and the properties of solid state material.

2. Research and Innovation: Foster the ability to conduct independent research, innovate experimental techniques, and contribute to advancements in solid state physics through original scientific investigations.

3. Technical Proficiency: Equip students with advanced technical skills in the use of specialized instruments, computational tools, and methodologies essential for modern solid state physics research.

4. Professional Development: Prepare students for successful careers in academia, industry, and government by enhancing their communication, collaboration, and leadership skills through comprehensive training and professional development opportunities.

By achieving these objectives, the program aims to produce highly skilled physicists who are capable of advancing the field and addressing the complex challenges of the modern world.

18. Program Accreditation

19. Other external influences

20. Program Structure				
Program Structure	**Number of Courses**	**Credit hours**	**Percentage**	**Reviews***
Institution Requirements	**X**			
College Requirements	**X**			
Department Requirements	**1**	**3**	**5%**	
Summer Training	**X**			
Other	**Lab**			

* This can include notes on whether the course is basic or optional.

21. Program Description				
Year/Level	**Course Code**	**Course Name**	**Credit Hours**	
Four	Phys 445		**Theoretical**	**practical**
			3	**2**

22. Expected learning outcomes of the program	
Knowledge	
Learning Outcomes 1	11. Recognize the type of thermal and electrical properties of

	solids state materials. 12. List the various terms associated with thermal and electrical properties of solids state materials. 13. Summarize the Classical, Einstein and Debye theories to calculate specific heat capacity. 14. Summarize Classical, quantum theory for free electron gas to calculate the electronic properties of material. 15. Summarize Band Theory in solid and their rule calculate the electronic. 16. Discuss the failed and the success of the Classical, Einstein and Debye theories to give a good agreement with the experimental values for specific heat capacity at higher and low temperature. 17. . Discuss the failed of the Classical and quantum theory for free electron gas to give a good agreement with the experimental values. 18. Describe Band Theory in solid and their rule to calculate the electronic properties of material. 19. Identify the type of the semiconductors and their potential application in devises.

Skills	
Learning Outcomes 2	● Develop expertise in experimental techniques and advanced instrumentation. ● Enhance computational skills for modeling, simulating, and analyzing the solid state system
Learning Outcomes 3	● Improve problem-solving and critical thinking through independent research. ● Strengthen scientific communication, both written and oral.

Ethics	
Learning Outcomes 4	● Understand ethical considerations in solid state research, focusing on safety, security, and environmental impact. ● Commit to professional integrity and ethical conduct in research.
Learning Outcomes 5	● Recognize the societal implications of solid state physics and aim to use scientific knowledge responsibly.

24. Teaching and Learning Strategies

- Lectures and Seminars: Deliver comprehensive lectures and interactive seminars to provide foundational knowledge and facilitate in-depth discussions on advanced topics in solid state physics.
- Laboratory Work: Incorporate hands-on laboratory sessions where students can apply theoretical knowledge, develop experimental skills, and gain experience with advanced instrumentation.
- Research Projects: Encourage independent and collaborative research projects that allow students to explore specific areas of interest, develop critical thinking, and contribute to scientific advancements.
- Problem-Based Learning: Utilize problem-based learning approaches to enhance problem-solving skills, foster critical thinking, and apply theoretical concepts to real-world scenarios.
- Guest Lectures and Industry Collaboration: Invite experts from academia, industry, and research institutions to share their knowledge, provide insights into current developments, and expose students to diverse perspectives and career opportunities.

23. Evaluation methods

Evaluation in the solid state physics program utilizes a combination of rigorous assessment tools to measure student progress and achievement. Methods include:

- Examinations: Regular assessments covering theoretical knowledge and problem-solving skills in solid state physics principles.
- Laboratory Reports: Analysis of experimental data, methodologies, and interpretations to gauge practical skills in solid state research.
- Research Projects: Independent or group-based research projects evaluating students' ability to formulate hypotheses, conduct experiments, and analyze results.
- Presentations: Oral presentations and written reports on research findings, assessing communication and dissemination skills.

25. Faculty

Faculty Members

Academic Rank	Specialization	Special Requirements/Skills (if applicable)	Number of the teaching staff	
	General	Special	Staff	Lecturer
Assistant Professor Dr.	Physics			

Professional Development

Mentoring new faculty members

 Orientation programs to familiarize them with departmental policies and teaching methodologies.
 Regular meetings with experienced faculty mentors to discuss teaching strategies and research integration.

Professional development of faculty members

The academic and professional development plan includes:

- Workshops on innovative teaching and learning strategies.
- Seminars on the latest research advancements in solid state physic.
- Opportunities for faculty to attend conferences and participate in collaborative research projects.
- Regular assessments and feedback sessions to enhance teaching effectiveness.

26. Acceptance Criterion

The program follows the central admission regulations set by the university, which include academic qualifications, entrance exams, and interviews.

27. The most important sources of information about the program

- Introduction to solid state physics, By Charles Kittle.
- فيزياء الحالة الصلبة ز تاليف الكتور مؤيد جبرائيل يوسف
- فيزياء الحالة الصلبة تاليف الدكتور يحيى الجمال

28. Program Development Plan

The development plan for the Clinical Analysis program involves continuous curriculum review and updates based on the following key elements:

- **Feedback from Students, Faculty, and Industry Partners**: Regularly collect and incorporate feedback from students, faculty, and industry partners to ensure the curriculum remains relevant and meets the needs of all stakeholders.
- **Emerging Trends and Technological Advancements**: Stay abreast of the latest trends and technological advancements in solid state and laboratory experiment to integrate new knowledge and techniques into the curriculum.
- **Accreditation Requirements and Standards**: Adhere to accreditation requirements and standards set to ensure the program maintains high educational and professional standards.

- **Periodic Assessments**: Conduct regular assessments and evaluations of the program to ensure it meets its educational and professional objectives, making adjustments as necessary to improve outcomes and maintain excellence.
-

Program Skills Outline															
				Required program Learning outcomes											
Year/Level	Course Code	Course Name	Basic or optional	Knowledge				Skills				Ethics			
				A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4
Four	Phys 445	Solid state II	Basic	+	+	+		+	+			+	+		+

- **Please tick the boxes corresponding to the individual program learning outcomes under evaluation.**

Course Description Form

13. Course Name:
Solid state Physics II
14. Course Code:
Phys 445
15. Semester / Year:
Second /Fourth
16. Description Preparation Date:
26-6-2024
17.Available Attendance Forms:
Classroom
18.Number of Credit Hours (Total) / Number of Units (Total)
3/17
19. Course administrator's name (mention all, if more than one name)
Name: Dr. Salah. A. Hassan Email: salah.almurshidee@mu.edu.iq

20. Course Objectives	
Course Objectives	Teach students the most important basic concepts, principles, laws, and scientific theories of the Solid state Physics, the student has the scientific skills that enable him to perform their professional and business functions, and others.

21. Teaching and Learning Strategies	
Strategy	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering types of simple experiments involving some interesting sampling activities for the students.

22. Course Structure

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

1	3	Thermal properties of solid, Classical model of specific heat capacity,	Thermal properties of solid	Lecture and Discussion	Lab Report
2	3	Einstein theory for specific heat, Phonon.	Thermal properties of solid	Lecture and Discussion	Quiz
3	3	The Density of states, Debye theory for specific heat.	Thermal properties of solid	Lecture and Discussion	Lab Report
4	3	Electrical Conductivity, Metal, Energy distribution functions, Maxwell-Boltzmann distribution.	Electrical Properties of metals	Lecture and Discussion	Mid-term Exam
5	3	Bose-Einstein distribution, Fermi-Dirac distribution. Electron Conductivity in Metals.	Electrical Properties of metals	Lecture and Discussion	Lab Report
6	3	Classical Free electron model, Drude Theory for Free Electron Conductivity.	Electrical Properties of metals	Lecture and Discussion	Quiz
7	3	Quantum Theory of free Electron Gas, Ideal Fermi – Dirac Gas.	Electrical Properties of metals	Practical Workshop	Assignment
8	3	Fermi – Dirac function, Electronic levels in one dimension, Electronic levels in three dimension	Electrical Properties of metals	Lecture and Discussion	Lab Report
9	3	Density of states in 3D, Fermi energy level at T=0 K. Electron velocity at Fermi surface , kinetic energy .	Electrical Properties of metals	Lecture and Discussion	Quiz
10	3	Electronic properties at $T \neq 0K$, Sommerfeld Theory for Electrical Conductivity.	Electrical Properties of metals	Lecture and Case Study	Assignment
11	3	Brillouin Zones in Band Theory, Kronig- Penny Model.	Band Theory	Practical Workshop	Mid-term Exam
12	3	General properties of Bloch Theory, Energy band according to Bloch Theory.	Bloch Theory	Lecture and Discussion	Quiz
13	3	Semiconductors, Intrinsic Semiconductors, Concentration of electrons and holes in semiconductor.	Semiconductors	Lecture and Discussion	Lab Report
14	3	Doping of Semiconductors. Concentration of electrons and holes in dopped Semiconductors.	Semiconductors	Lecture and Discussion	Assignment
15	3	Applications of semiconductors in important devises.	Semiconductors	Lecture and Discussion	Final Exam

23. 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

24. Learning and Teaching Resources	
Required textbooks (curricular books, if any)	Introduction to solid state physics by kittle
Main references (sources)	فيزياء الحالة الصلبة للدكتور مؤيد جبرائيل يوسف فيزياء الحالة الصلبة للدكتور يحيى الجمال
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	