Academic Program Description Form

2026-2025

Faculty / Institute: College of Science

Scientific Department: Physics Department

Academic or Professional Program Name: B.Sc. in Science

Final Certificate Name: B.Sc. in Physics Department

Academic System: Semester (Courses)

Description Preparation Data: October – 2025 File Completion Data: 25-1 -2026

Signature:

Head of Department Name:

Dr. Alaa J. Mohammed

Data: 25\1\2026

Signature:

Scientific Association Name:

Dr. Salah Abdul Khuder Hassan

Data: 25\1\2026

The File is Checked by:

Department of Quality Assurance and University Performance

M.Sc. Saleh A. Lazam

Data: 25\1\2026

Approval of the Dean

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

2025/2026

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.

1. Program Vision

The Department of Physics Sciences seeks to be a distinguished center for education and scientific research in the field of physics, a leader in preparing qualified scientific competencies, and an active contributor to the development of knowledge and technology and the service of society.

2. Program Mission

The role of the Department of Physics is to provide outstanding university education based on creativity and scientific research, aimed at developing students' abilities in the fields of theoretical and applied physics, and preparing qualified personnel capable of contributing to scientific and technological progress, while promoting research and community partnerships in a way that serves sustainable development.

3. Program Objectives

First: In the field of education and learning

1. Preparing graduates with a strong scientific foundation in various branches of physics.
2. Developing curricula and academic programs that align with quality standards and labor market needs.
3. Enhancing students' critical thinking, analytical, and problem-solving skills.
4. Integrating modern technologies and active learning methods into the educational process.

Second: In the field of scientific research

5. Supporting and encouraging scientific research in the fields of modern and applied physics.
6. Motivating faculty members and students to publish in prestigious journals.
7. Establishing specialized research groups that address real-world scientific and industrial problems.
8. Expanding research collaborations with universities and scientific centers both domestically and internationally.

Third: In the field of community service

9. Contributing to raising scientific awareness in the community through seminars and scientific workshops.

10. Providing scientific consultations and services in the fields of energy, environment, and materials.
11. Engaging students in activities that serve the community and foster a sense of belonging and responsibility. Fourth: In the area of institutional development and quality
12. Implementing academic quality assurance standards in all departmental activities.
13. Developing infrastructure and laboratories to keep pace with scientific and technological advancements.
14. Investing in the professional development of faculty members, technical staff, and administrative personnel.
15. Working to establish graduate programs in advanced physics specializations.

4. Program Accreditation

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

No

5. Other external influences

Is there a sponsor for the program? Ministry of Higher Education and Scientific Research / Al-Muthanna University / College of Science.

Program Structure				
Program Structure	Number of Courses	Credit hours	Percentage	Reviews*
Al-Muthanna University Requirements	8	12	12%	
College of Science Requirements	11	27	15-20%	
Department Requirements physics	28	77	80-85%	
Summer Training	Stage 3			
Other /	Scientific trips field visits		graduation project	student discussion groups

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

7.Program Description

الساعات المعتمدة		Course Code	رمز المقرر أو المساق	Year/Level
practical	Theoretical			
3	-	I Quantum Mechanics	Phys 326	Third
2	-	I Laser Physics	Phys 327	Third
3	-	Geometric Optics	Phys 328	Third
2	-	I Mathematical Physics	Phys 329	Third
3	-	Astrophysics	Phys 330	Third
2	-	Sound Physics	Phys331	Third
2	2	I Elective	Phys 339	Third
-	4	V Practical Physics	Phys 332	Third
3	-	(I, Optics I) Laser	Phys 333	Third
2	-	II Quantum Mechanics	Phys 334	Third
2	-	II Laser Physics	Phys 335	Third
2	-	Statistical Mechanics	Phys 336	Third
3	-	II Mathematical Physics	Phys 337	Fourth
2	2	Physical Optics	Math 307	Fourth
2	-	Numerical Analysis	Phys 432	Fourth
-	4	II Elective	Phys 338	Fourth
3	-	VI Practical Physics	Phys 439	Fourth
3	-	(II, Optics II) Laser	Phys 440	Fourth
3	-	I Nuclear Physics	Phys 441	Fourth
2	-	I Solid State Physics	Phys 450	Fourth
2	-	I Electromagnetism	Phys 451	Fourth
-	4	I Elective	Phys 442	Fourth
-	2	II Elective	Phys 443	Fourth

3	-	VII Practical Physics	Phys 439	Fourth

8. Expected learning outcomes of the program

Knowledge

Cognitive Objectives

The student gains practical experience in the fields of pure and applied sciences.

2. The student gains knowledge in the fields of education, health, industry, and other areas of society.

3. The student gains scientific experience in the field of scientific research.

4. The student develops the ability to comprehend and work with modern and advanced technologies and contribute to their development.

5. The student gains experience in working with other sciences to serve humanity and the environment.

Skills

Program Skill Objectives

1. The student will acquire skills to work in the field of education.

2. The student will acquire skills to work in the fields of industry, health, the environment, and power generation plants.

3. The student will acquire skills to work in the field of scientific research.

Ethics

1. The student acquires mathematical skills that qualify them to solve important problems in physics.

2. The student gains experience in addressing most scientific problems in the field of applied physics.

3. The student acquires skills in developing their mental abilities to solve problems they encounter in applied physics.

9. Teaching and Learning Strategies

The department employs a comprehensive educational strategy that aims to develop students' theoretical and practical skills, fostering critical thinking and scientific research abilities. This strategy includes theoretical lectures (direct instruction), scientific seminars, laboratory work, and training courses. Specifically, the department utilizes a blend of interactive and applied methods, including: delivering theoretical lectures supported by practical sessions that focus on problem-solving and connecting concepts to real-world applications; employing interactive lectures and brainstorming sessions to encourage student participation and develop creative thinking; conducting regular practical exercises in laboratories to train students in the use of scientific tools and techniques; organizing scientific seminars to showcase student projects and research and encourage scientific dialogue; utilizing active learning through group work, case studies, and real-world problem-solving; encouraging students to prepare research projects and field assignments that bridge theory and practice; and developing presentation and scientific communication skills through classroom and extracurricular activities.

10.Evaluation methods

- **Through weekly and term exams, in addition to academic reports.**
- **The department employs a variety of assessment methods to ensure a comprehensive measurement of students' academic and practical abilities. These methods include:**
- **Daily Participation and Interaction: Students' engagement with lectures and their participation in discussions and classroom activities are assessed.**
- **Surprise Quizzes: These are used to measure immediate comprehension of the material and encourage continuous learning.**
- **Monthly Exams: These are held regularly to measure academic progress and identify strengths and weaknesses.**
- **Reports and Seminars: Students are required to prepare academic reports or give presentations (seminars) to assess their research, presentation, and analytical skills.**
- **Homework Assignments: These are used to reinforce understanding outside of class and encourage students to engage in self-study and independent application of concepts.**
- **Final and Midterm Exams: These measure the overall level of achievement and are an essential part of the final course evaluation.**

10.Faculty

Faculty members

Faculty preparation		Special requirements/s (kills (if any		Specialization		Academic rank
Lecturer	Appointed Angel			Private	General	
	#			Magnetism	physics	Hadi Qasim Muhammad Al-Shaloush
	#			Radiation	physics	Hassan Maktoof Jabr Al-Tai
	#			Biophysics	physics	Ali Salman Ali Al-Tamimi
	#			Approximation Theory	physics	Musa Makki Kharijan Al-Kridi
	#			Geophysics	physics	Nawras Nahidh Amin Al-Abyad
	#			Lasers	physics	Muwaffaq Fadhil Jadou Al-Dhaidan
	#			Astronomy	physics	Ali Abdul-Sattar Jaber Al-Adhari
	#			Lasers	physics	Rasha Ali Hussein Al-Fakiki
	#			Optics	physics	Naha Majid Hamid Krouf
	#			Renewable Energies	physics	Hassan Tarikhm Badah Al-Hammadi
	#			Lasers	physics	Alaa Jassim Muhammad Sawat
	#			Optics	physics	Dhil Aqeel Kadhim Al-Mousawi
	#			Materials Physics	physics	Shaimaa Karim Hassan Al-Badiri
	#			Medical Physics	physics	Ahmed Fadhil Hassouni Al-Murshidi
	#			Thin Films	physics	Aqeel Shaker Tahiour Al-Mousawi
	#			Molecular Physics	physics	Ahmed Ni'ma Muhammad Al-Jayashi
	#			International Law	physics	Samar Abdullah Huwaidi Al-Khafaji
	#			Nanoelectronics	physics	Salah Abdul-Khader Hassan Al-Murshidi
	#			Nuclear Physics	physics	Ali Nadhim Sabbar Al-Younis
				Semiconductors		Bashar Hawi Aziz Abu Ja'baz
				Digital Image Processing		Uday Salman Mahdi Al-Salami
				Theoretical Physics		Majid Kamel Ghathith Al-Jayashi
				Geophysics		Ashwaq Iyad Kadhim Al-Aqouli
				Medical		Saleh Ubaid Lazam Al-Badri
				Magnetism		Duaa Kat'a Ghali Al-Kifa

Professional Development

Mentoring new faculty members

Workshops and Training Courses: Courses are organized in modern teaching methods, classroom management, and the use of educational technologies. The department head's policy for guiding new faculty members includes:
1- Participation in Scientific Seminars: New faculty members are encouraged to attend conferences and seminars to broaden their knowledge and build an academic network. A total of 28 workshops and seminars were held for new faculty members in various physics specializations.
2- Providing Feedback: New faculty members provide constructive feedback periodically to improve academic performance, which is discussed in the department council.

3- Encouraging Scientific Research and Publication: New faculty members are supported in preparing and publishing their research and participating in research teams within the department or college. Two research papers have been published by them in international databases.

4- Participation in Committees: New faculty members are given the opportunity to participate in departmental committees to enhance their understanding of administrative and academic systems.

Professional development of faculty members

Personal development is planned through access to up-to-date scientific resources and participation in training courses both within and outside the country in the student's field of specialization. The department places particular emphasis on the continuous professional development of faculty members, aiming to enhance their teaching and research competencies and keep them abreast of academic advancements. This includes:

• Organizing five advanced workshops and training courses in teaching methodologies, student assessment, and the use of modern educational technology.

• Encouraging scientific research and academic publication by supporting participation in conferences, scientific journals, and joint research projects. The average research output was two or more publications per faculty member.

• Participating in quality assurance and academic accreditation programs to raise awareness of educational standards and improve institutional performance. All faculty members participated in self-evaluation committees, conformity assessment reports, and improvement plans.

• Academic exchange and collaboration with other universities, both domestically and internationally, to share experiences and broaden knowledge.

• Contributing to the development of curricula and courses to keep pace with scientific advancements and labor market needs, as per the minutes of the monthly curriculum committees. Eleven updates to the study plan were approved by the college council. • Self-assessment and ongoing feedback to identify strengths and opportunities for improvement in

academic performance.

• Encouraging the use of innovative teaching methods such as active learning and project-based learning.

2. Acceptance Criterion

The general principles adopted by the Central Admission System:

Student nominations for admission to colleges and institutes are conducted electronically under the Central Admission System according to the following principles:

1. Students are admitted based on the choices indicated in the application form submitted through the electronic portal of the Department of Studies, Planning, and Follow-up, and on the basis of competitive ranking based on their overall score.

2. Students must:

a. Graduates of the Biological and Applied Science branches: Fill out (50) choices on the electronic form, with a minimum of (10) institutes.

b. Graduates of the Humanities branch: Fill out a minimum of (25) choices and a maximum of (50) choices on the electronic form, with a minimum of (10) institutes.

3. Submitting an admission form does not guarantee final admission based on the student's choices. Admission depends on their competitive ranking with other students according to the established criteria. 4. Applications to the College of Law are restricted to residents of the province. Students are not permitted to apply to the aforementioned college at universities located outside the province.

5. Applications to the Colleges of Engineering are submitted electronically, according to the department.

6. Applications to the Colleges of Medicine in universities in the provinces of Maysan, Muthanna, and Wasit are limited to residents of the same province, with a minimum quota of 50%.

7. For admission ranking purposes:

a. Eight percent (8%) of the foreign language score is added to the student's overall score.

b. An additional point is added to the average for first-round graduates (excluding students eligible for retakes).

8. The principle of competitive ranking is only applied when competing for the last available seats in the approved admission plan.

3. The most important sources of information about the program

1- Student Admission Guide issued by the Ministry of Higher Education and Scientific Research.
2- • Student Guide issued by the College of Science, Al-Muthanna University (Quality Assurance Division).
3- • Student Guide issued by the Department of Physics and Educational Guidance Sessions.

4. Program Development Plan

1- The plan aims to enhance the quality of education and learning and update programs to align with scientific advancements and labor market demands through:

2- • Regularly reviewing and updating curricula to ensure their conformity with modern academic standards.

3- • Aligning learning outcomes with labor market requirements and focusing on practical applications, based on recommendations from the annual Employers' Conference.

4- • Enhancing practical and applied training both within and outside the college, in collaboration with labor market institutions.

5- • Introducing modern courses related to sustainable development, such as renewable energy physics, which support scientific research and critical thinking and analytical skills.

6- • Utilizing modern educational technologies, implementing e-learning and interactive courses, and achieving a 20% completion rate for digital courses.

7- • Selecting ideas and projects to address societal problems through graduation projects and scientific activities.

8- • Developing the research and scientific capabilities of faculty

members through specialized training workshops.

9-

10- • Considering the opinions of graduates and employers to improve the program.

11- • Introducing new specializations that keep pace with scientific developments and serve the needs of society, including a specialization in laser physics and optics. • Graduate (and PhD) programs will be established to enhance scientific research and develop highly qualified personnel.

12- • Twinning with corresponding departments locally and internationally will be implemented to exchange expertise and develop programs through academic partnerships with the Universities of Basrah, Sumer, Al-Kafeel, and Al-Ain..

مخطط مهارات البرنامج														
مخرجات التعلم المطلوبة من البرنامج														
القيم		المهارات				المعرفة					Course Code	Course Name	Year/Level	
ق2	ق1	م4	م3	م2	م1	ع5	ع4	ع3	ع2	ع1				
#			#		#			#		#	(Basic)	I. Mechanics and Properties of Matter	First	
#	#	#	#	#		#	#		#		(Basic)	I. Electricity and Magnetism	First	
#			#		#			#		#	(Basic)	I. Calculus	First	
#	#	#	#	#		#	#		#		(Basic)	Earth Science	First	
#	#	#	#	#		#	#		#		(Basic)	Arabic Language	First	
#			#		#			#		#	(Basic)	Human Rights	First	
#			#		#			#		#	(Basic)	I. Computer Science	First	
#	#	#	#	#		#	#		#		(Basic)	Laboratory Safety and Security	First	
#			#		#			#		#	(Basic)	I. Practical Physics (Mechanics, Electricity)	First	
#	#	#	#	#		#	#		#		(Basic)	II. Mechanics and Properties of Matter	First	
#			#		#			#		#	(Basic)	II. Electricity and Magnetism	First	
#	#	#	#	#		#	#		#		(Basic)	II. Calculus	First	
#			#		#			#		#	(Basic)	General Chemistry	First	
#	#	#	#	#		#	#		#		(Basic)	II. Computer Science	First	
#	#		#	#		#	#		#		(Basic)	English Language	First	
#			#		#			#		#	(Basic)	Thermodynamics	Second	
#			#		#			#		#	(Basic)	I Electron	Second	
#	#	#	#	#		#	#		#		(Basic)	Atomic Physics	Second	
#			#		#			#		#	(Basic)	I Analytical Mechanics	Second	
#	#	#	#	#		#	#		#		(Basic)	Advanced Calculus	Second	

#			#		#			#		#	**(Basic)**	III Computing	**Second**	
#	#	#	#	#		#	#		#		**(Basic)**	III Practical Physics (Thermal, Electron, Atomic)	**Second**	
#	#	#	#	#		#	#		#		**(Basic)**	Thermodynamics	**Second**	
#			#		#			#		#	**(Basic)**	I Electron	**Second**	
#	#	#	#	#		#	#		#		**(Basic)**	Materials Science	**Second**	
#			#		#			#		#	**(Basic)**	II Electron	**Second**	
#	#	#	#	#		#	#		#		**(Basic)**	Modern Physics	**Second**	
#	#	#	#	#		#	#		#		**(Basic)**	I Quantum Mechanics	**Third**	
#			#		#			#		#	**(Basic)**	I Laser Physics	**Third**	
#			#		#			#		#	**(Basic)**	Geometric Optics	**Third**	
#	#	#	#	#		#	#		#		**(Basic)**	I Mathematical Physics	**Third**	
#			#		#			#		#	**(Basic)**	Astrophysics	**Third**	
#			#		#			#		#	**(Optional)**	Sound Physics	**Third**	
#	#	#	#	#		#	#		#		**(Basic)**	I Elective	**Third**	
#			#		#			#		#	**(Basic)**	V Practical Physics	**Third**	
#	#	#	#	#		#	#		#		**(Basic)**	(I, Optics I) Laser	**Third**	
#			#		#			#		#	**(Basic)**	II Quantum Mechanics	**Third**	
#	#	#	#	#		#	#		#		**(Basic)**	II Laser Physics	**Third**	
#			#		#			#		#	**(Optional)**	Statistical Mechanics	**Third**	
#	#	#	#	#		#	#		#		**(Basic)**	II Mathematical Physics	**Third**	
#	#	#	#	#		#	#		#		**(Basic)**	Physical Optics	**Third**	
#			#		#			#		#	**(Basic)**	Numerical Analysis	**Third**	
#			#		#			#		#	**(Basic)**	I Nuclear Physics	**Fourth**	
#	#	#	#	#		#	#		#		**(Basic)**	I Solid State Physics	**Fourth**	
#			#		#			#		#	**(Optional)**	I Electromagnetism	**Fourth**	

#	#	#	#	#		#	#		#		**(Basic)**	I Elective	**Fourth**	
#			#		#			#		#	**(Basic)**	II Elective	**Fourth**	
			#		#			#		#	**(Basic)**	VII Practical Physics	**Fourth**	
	#	#	#	#		#	#		#		**(Optional)**	I Solid State, I Nuclear	**Fourth**	
			#		#			#		#	**(Basic)**	Graduation Project	**Fourth**	

- **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 :
Phy 433
3. Semester / Year
First semester 2025/2026
4. Description Preparation Date:
16/10/2025
5. Available Attendance Forms:
Attendance in classrooms
6.Number of Credit Hours (Total) / Number of Units (Total)
2 hours/ units
4. Course administrator's name (mention all, if more than one name)
The name: Prof. Dr. Ali Salman Ali Email: ali.salman@mu.edu.iq
8.Course Objectives
• **Defined some of particles for lattices such as lattices, crystal structure, drawing of planes, Miller indices , fundamental types of lattices Wave diffraction and the reciprocal lattice, Bragg law ……etcs** •
9. Teaching and Learning Strategies
Integrate **theoretical foundations of Solid State physics** with **hands-on practical experience** and **Real-world applications**.

10. Course Structure					
Evaluation method	Learning method	Unit or subject name	Required Learning Outcomes	Hours	Week
Questions and discussion	Lecture	**Crystal structure, An ideal crystal structure, basis and the crystal structure, periodic arrays of atoms.**	Students will learn the developing of crystal structure	2	1
Questions and discussion	Lecture	**Primitive and non-primitive lattice cell. Wigner seitz cell, lattice translation vectors**	Students will learn the lattice cell	2	2
Questions and discussion	Lecture	**2D and 3D bravais lattices**	Students will learn the bravais lattices	2	3
Solved problems	Lecture	**Miller indices, drawing of planes, Examples**	Students will learn the miller indices	2	4
Questions and discussion	Lecture	**Simple crystal structures, Sodium chloride structure**	Students will learn the structure of sodium chloride	2	5
Questions and discussion	Lecture	**cesium chloride, hexagonal-close packed cubic zinc sulfide.**	Students will learn the some structures	2	6
Questions and discussion	Lecture	**Filling fraction, theoretical density, the distance and angle between two planes**	Students will learn the filling fraction	2	7
Questions and discussion	Lecture	**Wave diffraction and the reciprocal lattice, Bragg law**	Students will learn the bragg law	2	8
Questions and discussion	Lecture	**Diffraction condition, Laue equations**	Students will learn the laue equations	2	9
Questions and discussion	Lecture	**Bonds in solid, Van der Waals Bonding, Ionic Bonding**	Students will learn the some Bonds	2	10
Questions and discussion	Lecture	**Covalent Bonding, Metallic Bonding, Hydrogen bond**	Students will learn the other Bonds	2	11
		Crystal vibration, with monoatomic vibration,	Students will learn the	2	12

		First Brillion zone	vibration of crystals		
Questions and discussion	Lecture	**Group Velocity, long Wavelength limit**	Students will learn the group velocity	2	13
Questions and discussion	Lecture	**Derivation of Force Constants, Two atoms per primitive basis**	Students will learn the atoms per primitive	2	14
Questions and discussion	Lecture	**Quantization of Elastic waves, Fonon Momentum**	Students will learn the elastic waves	2	15

11. Course Evaluation

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

12. Learning and Teaching Resources

Required textbooks	Introduction in Solid State Physics (Kettil)
Main references (sources)	Solid state Physics (Omar)
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

1. Course Name:
Nuclear Physics II
2. Course Code:
Phy407
3. Semester / Year:
Second /Fourth
4. Description Preparation Date:
19-10-2025
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 (estimatio n lifetime of sample)	Practical Workshop	Assignment
8	3	Define nuclear reactions and distinguish between fusion and fission processes. Calculate reaction energies and understand conservation laws in nuclear reactions.	Nuclear reactions Q-value of reaction	Laboratory Session	Lab Report
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	Cross-sectional area Macroscopic cross-section	Laboratory Session	Lab Report

		their role in nuclear reactions and shielding.			
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)

Course Description Form

5. Course Name
Mathematical Physics IV
6. Course Code :
Math 306
7. Semester / Year
First semester 2025/2026
4. Description Preparation Date:
18 October 2025
5. Available Attendance Forms:
Attendance in classrooms
6.Number of Credit Hours (Total) / Number of Units (Total)
Four hours/ four units
8. Course administrator's name (mention all, if more than one name)
The name: Ashwaq Eyad Kadhim Email: ashwaq.alaakol@gmail.com ashwkaeid@mu.edu.iq
8.Course Objectives
This course aims to provide students with the fundamental concepts, analytical skills, and problem-solving techniques required to understand and apply ordinary differential equations in science and engineering. The main objectives are to: 1. Introduce the basic principles and terminology of ordinary differential equations. 2. Enable students to classify differential equations according to order, degree, and linearity. 3. Develop students' ability to solve first-order and higher-order differential equations using analytical methods. 4. Provide a clear understanding of homogeneous, non-homogeneous, linear, and non-linear equations. 5. Illustrate practical applications of differential equations in physical, mechanical, and electrical systems.

6. Strengthen mathematical reasoning and critical thinking skills for modeling and solving real-world problems.

9. Teaching and Learning Strategies

1. Lectures 2.Tutorial sessions 3.Group discussions 4.Assignments and quizzes 5.Class demonstrations 6.Use of visual aids 7.Self-study and reading

10. Course Structure

Evaluation method	Learning method	Unit or subject name	Required Learning Outcomes	Hours	Week
Quiz + Lecture questions	Lecture + Discussion	The Basic principles of ordinary differential equations	Understanding the concept and classification of ODEs	4	Frist
Assignment + Lecture	Lecture + Group work	Definition, order and degree of ODEs; linear & nonlinear	Identify and classify differential equations)	4	Second
Quiz	Lecture + Tutorial	General and special solutions of ODEs	Solve basic ordinary differential equations	4	Third
Report + Lecture	Lecture + Problem solving	First order ODE and methods of solution	Apply standard forms and methods to solve ODEs	4	Fourth
Quiz	Lecture + Practice	Separable first order ODE	Solve separable differential equations analytically	4	Fifth
Assignment	Lecture + Tutorial	Homogeneous differential equation with examples	Analyze and solve homogeneous equations	4	Sixth
Quiz	Lecture + Example solving	Exact differential equations with	Verify and solve exact ODEs	4	Seventh

		examples			
Assignment	Lecture + Discussion	Linear and non-linear differential equations	Distinguish between linear and nonlinear differential equations	4	Eighth
Quiz + Tutorial	Lecture + Practice	Equations reducible to linear form (Bernoulli Equation)	Apply transformations to linearize equations	4	Ninth
Assignment	Lecture + Discussion	Linear differential equations of second order with constant coefficients	Solve second-order linear ODEs with constant coefficients	4	Tenth
Quiz	Lecture + Tutorial	Linear independence and Wronskian determinant	Determine linear dependence and independence using Wronskian	4	Eleventh
Assignment	Lecture + Example solving	Homogeneous equations with constant coefficients	Solve homogeneous equations with constant coefficients	4	Twelfth
Quiz	Lecture + Discussion	Complex roots and their applications	Understand and solve ODEs with complex roots	4	Thirteenth
Assignment	Lecture + Tutorial	The nonhomogeneous problems	Solve nonhomogeneous differential equations	4	Fourteenth
Quiz	Lecture + Problem solving	Particular integral of any function f(x)	Find particular integrals of given functions	4	Fifteenth
Assignment + Report	Lecture + Applied examples	Applications: mechanical vibrations, forced vibrations, and electrical networks	Apply ODEs to physical and engineering systems	4	Sixteenth

11. Course Evaluation

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

12. Learning and Teaching Resources	
Required textbooks	• طرق حل المعادلات التفاضلية/ خالد احمد السامرائي و يحي عبد سعيد
Main references (sources)	• Introduction to Differential Equations Jeffrey R. Chasnov / 2009
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

9. Course Name
Mathematical Physics III
10. Course Code :
11. Semester / Year
First semester 2025/2026
4. Description Preparation Date:
18 October 2025
5. Available Attendance Forms:
Attendance in classrooms
6.Number of Credit Hours (Total) / Number of Units (Total)
Four hours/ four units
12. Course administrator's name (mention all, if more than one name)
The name: Ashwaq Eyad Kadhim Email: ashwaq.alaakol@gmail.com ashwkaeid@mu.edu.iq
8.Course Objectives
By the end of this course, students will be able to: 1. Communicate effectively in everyday and academic English contexts. 2. Use major grammatical structures accurately in spoken and written English. 3. Expand vocabulary related to common real-world topics (travel, media, work, life). 4. Improve listening comprehension and speaking fluency through interactive tasks. 5. Develop reading and writing skills using authentic and creative materials. 6. Demonstrate confidence in public speaking, discussions, and written communication.

9. Teaching and Learning Strategies

- **Communicative Approach:** Emphasis on using English in real-life contexts through speaking, listening, and discussion.
- **Task-Based Learning:** Activities such as role-plays, projects, and problem-solving tasks.
- **Collaborative Learning:** Group and pair work to encourage interaction and peer learning.
- **Integrated Skills Practice:** Each unit blends grammar, vocabulary, reading, writing, speaking, and listening.
- **Reflective Learning:** Students self-assess progress and set language goals weekly.
- **Technology Integration:** Use of audio-visual materials and online exercises for listening and pronunciation.

10. Course Structure

Evaluation method	Learning method	Unit or subject name	Required Learning Outcomes	Hours	Week
Short quiz, oral discussion	Lectures, pair speaking, reading comprehension, listening practice	Use various tense forms (simple, continuous, perfect, passive); understand compound words; read and discuss *Saroo's story*.	Unit 1 – *Home and Away!*	4	Frist
Written exercise, participation	Communicative tasks, grammar drills, group discussion	Use present perfect and continuous forms; express emphasis; discuss travel experiences; read *Our Plastic Planet*.	Unit 2 – *Been there, got the T-shirt!*	4	Second
Role-play assessment, quiz	Role-play, news analysis, listening practice	Use narrative tenses; give and receive news; discuss media and news stories.	Unit 3 – *News and Views*	4	Third

Vocabulary quiz, oral Q&A	Pair work, debate, vocabulary exercises	Form questions and negatives; use prefixes and antonyms; discuss conspiracy theories.	Unit 4 – *The Naked Truth*	4	Fourth
Short test, speaking evaluation	Grammar practice, motivational discussions	Use future forms (will, going to, shall); learn *take/put* expressions; read *Inspirational Teenagers*.	Unit 5 – *Looking Ahead*	4	Fifth
Pronunciation check, quiz	Listening and pronunciation practice, vocabulary games	Use quantity expressions; identify stress in words; discuss famous brands.	Unit 6 – *Hitting the Big Time*	4	Sixth
Oral activity, written test	Pair dialogue, grammar focus	Use modals and related verbs; practice declarative questions; read *The Generation Who Refuse to Grow Up*.	Unit 7 – *Getting Along*	4	Seventh
Written exercise, peer feedback	Reading comprehension, sentence building	Form relative clauses; use participles; discuss interesting people and events.	Unit 8 – *How Remarkable!*	4	Eighth
Written test, participation	Storytelling, listening tasks	Express habits and use adjectives with intensifiers; discuss past lifestyles.	Unit 9 – *The Way We Were*	4	Ninth
Quiz, speaking activity	Group speaking, grammar tasks	Use modal auxiliary verbs in the past; expressions with modals; discuss feelings.	Unit 10 – *Over My Dead Body!*	4	Tenth
Grammar quiz, oral exam	Conversation practice, sentence transformation	Use conditionals and hypothetical expressions; explore word pairs.	Unit 11 – *It's All Hypothetical!*	4	Eleventh

Vocabulary test, short writing	Reading, vocabulary activities	Use articles and determiners; express time-related idioms; read *The Isle of Muck*.	Unit 12 – *Time Flies*	4	Twelfth
Listening test, oral presentation	Audio exercises, dialogues	Practice listening comprehension, speaking fluency, expressing opinions.	Skills Development: Listening & Speaking	4	Thirteenth
Writing task, peer review	Guided reading, writing workshops	Read extended texts; write formal/informal letters and reports.	Skills Development: Reading & Writing	4	Fourteenth
Mock test, teacher feedback	Group project, review games	Review grammar, vocabulary, and pronunciation; project preparation.	Review & Integration	4	Fifteenth
Final written & oral exam	Presentation, interview practice	Apply all skills learned in final project/presentation.	Final Assessment & Presentations	4	Sixteenth

11. Course Evaluation

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

12. Learning and Teaching Resources

Required textbooks	• Headway Upper-Intermediate Student's Book
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

13. Course Name:
Laser Physics I
14. Course Code :
Phy 434
15. Semester / Year
First semester 2025/2026
4. Description Preparation Date:
14/10/2025
5. Available Attendance Forms:
Attendance in classrooms
6.Number of Credit Hours (Total) / Number of Units (Total)
3 hours/ units
16. Course administrator's name (mention all, if more than one name)
The name: Asst. Prof. Dr. Muwafaq Fadhil Jaddoa Email: Muwafaq_fj@mu.edu.iq
8.Course Objectives
• Light-Matter Interaction: Understanding the quantum mechanical processes of absorption, spontaneous emission, and, stimulated emission

- Laser Theory: population inversion (the necessary non-equilibrium condition), gain media (the active material), pumping mechanisms (how energy is supplied), and the role of Einstein coefficients.
- Solving Practical Problems: Developing the ability to formulate and solve quantitative problems related to laser operation

9. Teaching and Learning Strategies

Integrate **theoretical foundations of laser physics** with **hands-on practical experience** and **real-world applications**.

10. Course Structure

Evaluation method	Learning method	Unit or subject name	Required Learning Outcomes	Hours	Week
Questions and discussion	Lecture	Historical review and basic concepts	Students will learn the developing of first laser device	3	1
Questions and discussion	Lecture	Bohr's model of atoms	Students will learn the structure of the atom	3	2
Questions and discussion	Lecture	Spontaneous and stimulated emission	Students will learn the process when light Interact with matter	3	3
Solved problems	Lecture	Laser idea, Energy states (levels)	Students will learn the transitions between atomic levels	3	4
		Examination 1		1.5	5
Questions and discussion	Lecture	Two, Three and four laser scheme	Students will learn the schematic of pumping levels	3	6
Questions and discussion	Lecture	Properties of laser beam	Students will learn the main properties of laser beam	3	7
Questions and discussion	Lecture	Black body theory	Students will learn the black body theory	3	8
Questions and discussion	Lecture	Einstein's thermodynamic theory	Students will learn the Einstein's coefficients	3	9
Questions and discussion	Lecture	Steven -Boltzmann theory	Students will learn the thermal equilibrium and Boltzmann distribution	3	10
Questions and discussion	Lecture	Threshold gain coefficient	Students will learn the gain conditions of laser	3	11
		Examination 2		1.5	12
Questions and discussion	Lecture	Pumping processes , Laser resonators	Students will learn the pumping technics and resonators	3	13

Questions and discussion	Lecture	Laser modes	Students will learn the laser modes properties	3	14
Questions and discussion	Lecture	Types of laser modes	Students will learn the types of laser modes	3	15

11. Course Evaluation

Laboratory	seminars	Quizzes	Homework	practical	Mid-semester exam	Total	Final exam
5	5	10	5	15	10	50	50

12. Learning and Teaching Resources

Required textbooks	Lasers, Theory and Applications M.N. Avadhnnulu
Main references (sources)	Lasers: Fundamentals and Applications K. Thyagarajan · Ajoy Ghatak
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

17. Course Name:
Quantum Mechanics I
18. Course Code :
Phy 401
19. Semester / Year
First semester 2025/2026
4. Description Preparation Date:
16/10/2025
5. Available Attendance Forms:
Attendance in classrooms
6.Number of Credit Hours (Total) / Number of Units (Total)
4 hours/ units
20. Course administrator's name (mention all, if more than one name)
The name: Prof. Dr. Hadey K. Mohamad Email: hadey.mohamad@mu.edu.iq
8.Course Objectives
• **To develop problem solving skills and understanding of Quantum theory through the application of techniques.** • **To understand the wave function, linear operator and Schrödinger equation from given applications.** • **This course deals with the basic concepts of the Quantum theory.** • **To understand the simple harmonic oscillator problem.** • **To perform Reflection and Transmission Coefficients.**

9. Teaching and Learning Strategies

- **Recognize how the linear operator works on the wave function.**
- **Recognize how the wave function becomes an Eigen or not one, so one may evaluate the Eigen value and Eigen function, respectively.**
- **Summarize what is meant by an admissible wave function, and Hermitian operator.**
- **Solve the time-independent Schrödinger wave equation in one-dimensional case.**
- **Solve the time-independent Schrödinger wave equation in two-dimensional case.**
- **Solve the time-independent Schrödinger wave equation in three-dimensional case.**
- **Study the important applications in solving the time-independent Schrödinger wave equation in one-dimensional case.**
- **solve the time-independent Schrödinger wave equation for the simple harmonic oscillator problem.**
- **Obtain the wave functions of the simple harmonic oscillator for all energy levels.**

10. Course Structure

Evaluation method	Learning method	Unit or subject name	Required Learning Outcomes	Hours	Week
Questions and discussion	Lecture	**Wave-Particle Property: Duality Property**	Students will learn the duality property	4	1
Questions and discussion	Lecture	**Wave function and Probability Density**	Students will learn the probability density	4	2
Questions and discussion	Lecture	**Ortho-Normality of Functions**	Students will learn the ortho-normality condition	4	3
Solved problems	Lecture	**Operators and Eigenvalues Equation, Commutative Operators**	Students will learn the operators and commutation relations	4	4
		Examination 1		1.5	5
Questions and discussion	Lecture	**Hermitian Operators**	Students will learn the Hermitian operators	4	6
Questions and discussion	Lecture	**Schrödinger Wave Equation**	Students will learn the Schrödinger wave equation	4	7
Questions and discussion	Lecture	**Free Particle**	Students will learn the free particle	4	8
Questions and discussion	Lecture	**Particle in a Box(Infinite Potential Box)**	Students will learn the particle in a box	4	9

Questions and discussion	Lecture	**Step potential(Transmission and Reflection Coefficients)**	Students will learn the transmission and reflection coefficients	4	10
Questions and discussion	Lecture	**Linear Harmonic Oscillator, Schrödinger Equation Solution of Harmonic Oscillator**	Students will learn the linear harmonic oscillator	4	11
		Examination 2		1.5	12
Questions and discussion	Lecture	**Calculation of Wave Functions for Harmonic Oscillator**	Students will learn the calculation of wave functions for S.H.O.	4	13
Questions and discussion	Lecture	**Isotropic Harmonic Oscillator**	Students will learn the calculation of energy levels for S.H.O.	4	14
Questions and discussion	Lecture	**Bloch Theorem**	Students will learn the Bloch Theorem	4	15

11. Course Evaluation

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

12. Learning and Teaching Resources

Required textbooks	Textbook of Quantum Mechanics, 2nd Edition, 2010, autho by A.K.Saxena
Main references (sources)	ميكانيك الكم أساسيات 1. د.سالم الشماع د.أمجد عبد الرزاق كرجيه 1988 2. Davydov, 2nd Ed., Quantum Mechanics 1976
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

21. Course Name:
Geometrical Optics
22. Course Code:
Phy 333
23. Semester / Year
First semester 2025/2026
4. Description Preparation Date:
18 October 2025
5. Available Attendance Forms:
Attendance in classrooms
6.Number of Credit Hours (Total) / Number of Units (Total)
3 hours/ units
24. Course administrator's name (mention all, if more than one name)
The name: Asst. Prof. Dr. Thill Akeel Kadhum Almusawi Email: thillakeel@mu.edu.iq
8.Course Objectives
• To develop problem solving skills and understanding of wave optics. • To understand light nature, waves superposition, light interference, diffraction and polarization. • This course deals with the basic concept of wave nature and propagation of light.

9. Teaching and Learning Strategies

Integrate theoretical foundations of geometrical optics physics with hands-on practi experience and real-world applications.

10. Course Structure

Evaluation method	Learning method	Unit or subject name	Required Learning Outcomes	Hours	Week
Questions and discussion	Lecture	Waves, Travelling waves, Mathematics of waves		3	1
Questions and discussion	Lecture	Waves Amplitude, wavelength, frequency, wave equation, superposition of waves		3	2
Questions and discussion	Lecture	Interference of light, Wave front, Types of wave front, Huygens Principle, constructive interference, destructive interference, Condition for interference of light		3	3
Solved problems	Lecture	classification of interference, Young's double slit interference, Geometrical Solution		3	4
	Lecture	Analytical Solution, the intensity distribution of the light, Fresnel's Biprism		1.5	5
Questions and discussion	Lecture	The Michelson, Interferometer, Applications		3	6
Questions and discussion	Lecture	The Fizeau Interferometer, Fabry-Perot Interferometer, Applications.		3	7
Questions and discussion	Lecture	Interference in Thin Films: Division of Amplitude, Production of Colours in Thin Films, Interference from an Air Wedge.		3	8
Questions and discussion	Lecture	Newton's Rings, A Variable Air Wedge, Calculation of Path Difference, Conditions for Constructive and Destructive Interferences, Circular Fringes.		3	9
Questions and discussion	Lecture	Central Dark Spot in Newton's Rings, Localized Fringes, Theory of Newton's Rings: Radius of the Bright and Dark Rings, Determination of the Wavelength of Light a Plano-Convex Lens		3	10
Questions and	Lecture	Determination of the Refractive		3	11

discussion		Index of Transparent Liquid, Why the Diameter of the Newton's Rings Decreases if Liquid Medium is Taken in the Optical System.			
	Lecture	Diffraction theory, Fresnel diffraction, Fraunhoffer diffraction, Difference between Interference and Diffraction.		1.5	12
Questions and discussion	Lecture	Diffraction from a Single Slit.		3	13
Questions and discussion	Lecture	Introduction, Types of Polarization, Polarizers and polarizing beam splitters, Birefringence or Double refraction, Partially polarized light, Nicol Prism.		3	14
Questions and discussion	Lecture	Polarization of Light by Reflection, Polarization Based Scattering, Wave plates, Compensators, Fiber Loop Retarder.		3	15

11. Course Evaluation

Distribution of the grade out of 40 according to the tasks assigned to the student, such as daily preparation, daily, monthly, written exams, reports, etc.

12. Learning and Teaching Resources

Required textbooks	**1- Fundamentals of Optics, Francis Arthur Jenkins and Harvy E. White, McGraw-Hill Education**
Main references (sources)	**1-Optics** by Eugene Hecht **(4th edition)** **2-Introduction to Optics** by Frank L. Pedrotti **(2nd edition, 1993)** **3-Optics** **by F. A. Jenkins and H. E. White**
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

25. Course Name
Modern physics I
26. Course Code :
Phys 306
27. Semester / Year
First/ 2025−2026
4. Description Preparation Date:
1−10−2025
5. Available Attendance Forms:
Attendance in classrooms
6.Number of Credit Hours (Total) / Number of Units (Total)
4 hours/ 5 units
28. Course administrator's name (mention all, if more than one name)
The name: Hassan Tarikhum B. Email: Hassan.tarikhum@mu.edu.iq
8.Course Objectives
• To develop problem-solving skills and understanding of atomic mechanisms through t application of techniques. • To understand the development of the atomic structure of materials. Basics of solid-sta physics and nuclear physics. • This course deals with the basic concept of quantum mechanics of the atom. • Dealing with different atomic spectra.
9. Teaching and Learning Strategies

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

10. Course Structure

Evaluation method	Learning method	Unit or subject name	Required Learning Outcomes	Hours	Week
		Introduction, Atomic Models Thomson's Atomic Model,		2	1
		Rutherford Atomic Model,		2	2
		Rutherford Scattering Formula,		2	4
		Distance of closest Approach,		2	5
		Classical model of electron,		2	6
		Boher Atomic Model,		2	7
		Atomic Spectra,		2	8
		Energy Levels and Spectra,		2	9
		The Wave Equation		2	10
		Expectation Values,		2	11
		Operators,		2	12
		Quantum Numbers,		2	13
		Zeeman Effect,		2	14
		Schrödinger's Equation: Time-Independent Form		2	15
		Preparatory week before the final Exam		2	16

11. Course Evaluation

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

12. Learning and Teaching Resources

Required textbooks	Concepts of Modern Physics Arthur Beiser
Main references (sources)	
Recommended books and references (scientific journals, reports...)	**Introduction to atomic and nuclear physics: 5 eddition. Hennery semat.!973 By Champ mann and Hall.**
Electronic References, Websites	

Course Description Form

29. Course Name:
Mathematics III
30. Course Code:
COS 2314
31. Semester / Year:
Second Year / First Semester (2025-2026)
4. Description Preparation Date:
2025/10/15
5. Available Attendance Forms:
Attendance in classrooms
6.Number of Credit Hours (Total) / Number of Units (Total)
150 / 6 ECTS
7. Course administrator's name (mention all, if more than one name)
The name: Asst. Prof. Dr. Ahmed Fadhil Almurshedi Email: fhahmed2@mu.edu.iq
8.Course Objectives
1. Introducing second year students to advance calculus. 2. Understand two or more terms from a verbal, numerical, visual, and algebraic perspective. 3. This course covers the basic concepts of double and triple integrals, and how they are used to calculate integrals, storage areas, and sums. 4. Understand the types of sequences and series, and how to solve problems.
9. Teaching and Learning Strategies
The main strategy for delivering this unit is to encourage students to engage in exercises and, by the end of the semester, sharpen and expand their critical thinking skills. This will be achieved through classroom instruction, interactive lessons, and the study of simple experiments that include sample activities of interest to students.
10. Course Structure

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

			Outcomes		
Quiz, Exam, Report	Lecture, Discussion, Solving Problem	**Introduction and Review**	Understanding	4	1
Quiz, Exam, Report	Lecture, Discussion, Solving Problem	Functions of Several Variables, Domains and Ranges, Functions of Two Variables, Functions of Three Variables, level Curve, Exercises	Understanding	4	2
Quiz, Exam, Report	Lecture, Discussion, Solving Problem	Limits and Continuity of several variables	Understanding	4	3
Quiz, Exam, Report	Lecture, Discussion, Solving Problem	Partial Derivatives of a Function of Two Variables, Second-Order Partial Derivatives, The Mixed Derivative Theorem, Partial Derivatives of Still Higher Order	Understanding	4	4
Quiz, Exam, Report	Lecture, Discussion, Solving Problem	Exercises, The Chain Rule	Understanding	4	5
Quiz, Exam, Report	Lecture, Discussion, Solving Problem	Differentiable and Direction Derivatives	Understanding	4	6
Quiz, Exam, Report	Lecture, Discussion, Solving Problem	Lagrange Multipliers Constrained Maxima and Minima	Understanding	4	7
Quiz, Exam, Report	Lecture, Discussion, Solving Problem	Double Integrals over Rectangles	Understanding	4	8
Quiz, Exam, Report	Lecture, Discussion, Solving Problem	Double Integrals on nonrectangular regions, Nonrectangular Regions, Finding Limits of Integration	Understanding	4	9
Quiz, Exam, Report	Lecture, Discussion, Solving Problem	Properties of Double Integrals, Area by Double Integration, Exercises.	Understanding	4	10
Quiz, Exam, Report	Lecture, Discussion, Solving Problem	Double Integrals in Polar Coordinates	Understanding	4	11
Quiz, Exam, Report	Lecture, Discussion, Solving Problem	Triple Integrals, Finding Limits of Integration in the Order dz dy dx	Understanding	4	12
Quiz, Exam,	Lecture,	Triple Integrals in Spherical	Understanding	4	13

Report	Discussion, Solving Problem	coordinates			
Quiz, Exam, Report	Lecture, Discussion, Solving Problem	Masses and First Moments, Moments of Inertia.	Understanding	4	14
Quiz, Exam, Report	Lecture, Discussion, Solving Problem	Sequences, Calculating Limits of Sequences	Understanding	4	15

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

12. Learning and Teaching Resources	
Required textbooks	CALCULAS, George B. Thomas, Pearson Education, Inc, 2014
Main references (sources)	CALCULAS, James Stewart, Cengage Learning, 2012
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

32. Course Name:
Nano science
33. Course Code:
Phy 445
34. Semester / Year:
Fourth Year / First Semester (2025-2026)
4. Description Preparation Date:
2025/10/15
5. Available Attendance Forms:
Attendance in classrooms
6.Number of Credit Hours (Total) / Number of Units (Total)
2 Hrs per week / 2 Unit
7. Course administrator's name (mention all, if more than one name)
The name: Asst. Prof. Dr. Ahmed Fadhil Almurshedi Email: fhahmed2@mu.edu.iq
8.Course Objectives
Introducing the student to emerging technology of nano science, its importance, uses, methods of preparation, and its special features.
9. Teaching and Learning Strategies
The main strategy for delivering this unit is to encourage students to engage and understand the important technologies and applications of nano science, by the end of the semester, sharpen and expand their critical thinking skills. This will be achieved through classroom instruction, interactive lessons, and the study of simple experiments that include sample activities of interest to students.
10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	Understanding of nano technology	**Introduction to nano science**	Lecture, Discussion	Quiz, Exam, Report
2	2	Understanding of	History of	Lecture,	Quiz, Exam,

		importance of nano	nanotechnology, importance of nanotechnology	Discussion	Report
3	2	Understanding structures of atoms and molecules	Nature of the element, Bohr model of atomic structure, nature of nanomaterials	Lecture, Discussion	Quiz, Exam, Report
4	2	Understanding formation of nano	Nano structures: Quantum dots, fullerenes, nanospheres, nanoparticles Nanotubes, nanofibers, nanowires, nanocomposites	Lecture, Discussion	Quiz, Exam, Report
5	2	Understanding formation of nano engineer	Nano Engineering: One-dimensional nanomaterials, two-dimensional nanomaterials, three-dimensional nanomaterials, structures Nanotechnology	Lecture, Discussion	Quiz, Exam, Report
6	2	Understanding properties of nano	Mechanical properties, melting point, optical properties of nano materials	Lecture, Discussion	Quiz, Exam, Report
7	2	Understanding properties of nano	Magnetic properties, electrical properties of nano materials	Lecture, Discussion	Quiz, Exam, Report
8	2	Understanding nano preparation	Bottom-up method, top-down method, bottom-up and top-down approximation techniques nano fabrication	Lecture, Discussion	Quiz, Exam, Report
9	2	Understanding nano preparation	Pulsed laser deposition method, grinding method	Lecture, Discussion	Quiz, Exam, Report
10	2	Understanding nano preparation	chemical-mechanical preparation method	Lecture, Discussion	Quiz, Exam, Report
11	2	Understanding nano preparation	Pulsed wire discharge method, chemical deposition method, sintering technique	Lecture, Discussion	Quiz, Exam, Report
12	2	Understanding nano preparation	Sol-Gel, Carbon nanotubes, nanotube properties	Lecture, Discussion	Quiz, Exam, Report

13	2	Understanding characterization techniques	TEM, SEM, AFM	Lecture, Discussion	Quiz, Exam, Report
14	2	Understanding nano applications	Applications: Genesis engines, molecular computers, quantum computers	Lecture, Discussion	Quiz, Exam, Report
15	2	Understanding nano applications	Applications: Smart clothing, medical applications, energy production (solar cells), etc.	Lecture, Discussion	Quiz, Exam, Report

11. Course Evaluation	
Distribution of the grade out of 100 according to the tasks assigned to the student, such as daily preparation, daily, monthly, written exams, reports, etc.	
12. Learning and Teaching Resources	
Required textbooks	– مقدمة في تقنية النانو .. تاليف: د. محمد بن صالح الصالحي و د. عبدالله بن صالح الضويان – علم النانو وتقنية النانو تحضيره وتطبيقاته .. تاليف: احمد عامر حسين الشمري
Main references (sources)	-
Recommended books and references (scientific journals, reports...)	– تكنولوجيا النانو من اجل غد افضل .. تاليف: أ.د. محمد شريف الاسكندراني – النانو تكنولوجي وتطبيقاته في المستقبل
Electronic References, Websites	-

Course Description Form

1. Course Name: English language III
2. Course Code:
3. Semester / Year: 1st semester
4. Description Preparation Date: 16-09-2025
5. Available Attendance Forms: onsite (classroom)
6. Number of Credit Hours (Total) / Number of Units (Total) 30
7. Course administrator's name (mention all, if more than one name)
Name: Nawrass N. Ameen Email: nawrass@mu.edu.iq
8. Course Objectives

Course Objective	● Developing Proficiency in Language Skills: ● Objective: To develop students' proficiency in the four language skills: listening, speaking, reading, and writing. ● Aim: To enable students to effectively communicate in English, understand spoken and wri texts, and express their thoughts and ideas accurately. ● Objective: To enhance students' knowledge of grammar, vocabulary, and sentence structure ● Aim: To enable students to use the English language correctly and appropriately in vari contexts, demonstrating a solid understanding of language rules and structures. ● Promoting Critical Thinking and Analysis:

	• Objective: To encourage students to think critically, analyze texts, and express their opinion • Aim: To develop students' ability to evaluate and interpret information in English, engage thoughtful discussions, and express their viewpoints with clarity and coherence.

9. Teaching and Learning Strategies

Strategy	A large amount of interactions with other students. A low-stress environment for language performance. Opportunities to demonstrate language comprehension through physical expression. Physical involvement with language. Success can be independent of language performance. The use of multiple mediums to present information.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1 1	2	Students will learn grammar, vocabulary and learn tenses	Unit 1: A world deference	Presentation (ppt) with participating students throw readings, solve exercises	Quizzes
2	2	Students will learn grammar, vocabulary and learn tenses	Unit 2: The working week	Presentation (ppt) with participating students throw readings, solve exercises	Quizzes
3	2	Students will learn grammar, vocabulary and learn tenses	Unit 3: Good times, bad times	Presentation (ppt) with participating students throw readings, solve exercises	Quizzes
4	2	Students will learn grammar, vocabulary and learn tenses	Unit 4: Getting it right	Presentation (ppt) with participating students throw readings, solve exercises	Quizzes

5	2	Students will learn grammar, vocabulary and learn tenses	Unit 5: Our changing world	Presentation (ppt) with participating students throw readings, solve exercises	Quizzes
6	2	Students will le grammar, vocabulary learn tenses	Unit 6: What matters to m	Presentation (ppt) w participating stude throw readings, so exercises	Quizzes
7	2	Students will le grammar, vocabulary learn tenses	Unit 7: Passions and fissions	Presentation (ppt) w participating stude throw readings, so exercises	Quizzes
8	2	Students will le grammar, vocabulary learn tenses	Unit 8: No fear	Presentation (ppt) w participating stude throw readings, so exercises	Quizzes
9	2	Students will le grammar, vocabulary learn tenses	Unit 8: It depends how you look at it	Presentation (ppt) w participating stude throw readings, so exercises	Quizzes
10	2	Students will le grammar, vocabulary learn tense	Unit 8: All things high tech	Presentation (ppt) w participating stude throw readings, so exercises	Quizzes

11. Course Evaluation

40% (30% exams+ 10% assignments+ attendance)+ **60%** midterm final exam

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	New Headway intermediate student's bo fourth edition
Main references (sources)	New Headway intermediate student's bo fourth edition
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	https://elt.oup.com/student/headway nt/download?cc=global&selLanguage=

Course Description Form

35. Course Name
Electromagnetism I
36. Course Code :
Phy 333
37. Semester / Year
First semester 2025/2026
4. Description Preparation Date: 2025-2026
5. Available Attendance Forms:
Attendance in classrooms
6.Number of Credit Hours (Total) / Number of Units (Total)
3hours/3 units
38. Course administrator's name (mention all, if more than one name)
The name: Asst. Prof. Dr. Rasha A. Hussein Email: rasha.lasereng@mu.edu.iq
8.Course Objectives
• Electromagnetism is the branch of physics concerned with studying interactions between electrically char particles. In this course, students will learn about charge distributions, electric current, and electric flux. T will use Gauss's law to find electric fields and electric potentials around symmetric charge distributions. T will learn how to define and calculate capacitance. The concept of charge is introduced, and the propertie electrical forces are compared with those of other familiar forces, such as gravitation. Coulomb's Law, al with the principle of superposition, allows for the calculation of electrostatic forces from a given cha distribution.

9. Teaching and Learning Strategies

Students will have a set of tutorial problems to solve each week to check that they are able to apply the theory presented to them to solve problems. Promoting student participation in the exercises while also enhancing and extending their critical thinking skills will be the main strategy employed to deliver this module. This will be achieved through lectures, interactive tutorials, and the study of brief experiments using interesting sampling tasks.

10. Course Structure

Evaluation method	Learning method	Unit or subject name	Required Learning Outcomes	Hours	Week
Quizzes, Assignments	Lecture, tutorial	Revision on vector analysis	Interpret vector magnitude and direction physically.	3	
Quizzes, Assignments	Lecture, tutorial	Charge distributions	Identify and describe point, line, surface, and volume charge distributions. Understand charge density consept.	3	
Quizzes, Assignments	Lecture, tutorial	Coulomb's Law	Understand the concept of electric force, distinguish between attraction and repulsion forces	3	
Quizzes, Assignments	Lecture, tutorial	Electric Field Intensity, and Electric Flux Density	Describe and use equations to solve problems about basic concepts underpinning electricity such as potential and field.	3	
Quizzes, Assignments	Lecture, tutorial	Gauss's law	Use Gauss's law to calculate electric fields for simple configurations, use these electric fields to calculate electric potentials.	3	
Quizzes, Assignments	Lecture, tutorial	Electric Flux Density and Gauss's law	Use Gauss's law to calculate electric fields for simple configurations.	3	
Mid-term Exam					
Quizzes, Assignments	Lecture, tutorial	Energy and Potential	use the electric fields to calculate electric potentials	3	
Quizzes, Assignments	Lecture, tutorial	Work and energy in the electric field	Show a good grasp of the meaning of the gradient of scalar and vector fields, and apply it to obtain electric fields from electric potentials	3	

Quizzes, Assignments	Lecture, tutorial	dipole	Calculate the electrostatic potential and field of a dipole	3	
Quizzes, Assignments	Lecture, tutorial	conductors	Understand the nature of conductors, differentiate between conductors and insulators, describe charge distribution in conductors	3	
Quizzes, Assignments	Lecture, tutorial	Electrostatic Field in Dielectric Media	Calculate the energy of a dipole in an electric field, and apply the understanding of dipoles to the behavior of dielectric materials in electric fields	3	
Quizzes, Assignments	Lecture, tutorial	Electric current		3	
Quizzes, Assignments	Lecture, tutorial	Capacitance and capacitors	State the definition of capacitance and use this definition with equations for electric fields and voltages to calculate the capacitance of different arrangements of charge and the charge distribution on different combinations of capacitors.	3	
Quizzes, Assignments	Lecture, tutorial	Maxwell's equations	Understand that the Maxwell equations can be split into two twos for time-independent fields, two for electrostatics, two for magnetostatics	3	

11. Course Evaluation

daily preparation → 5
Quiz → 10
Assignment → 5
monthly exams → 20
final exam →60

12. Learning and Teaching Resources

Required textbooks	
Main references (sources)	ELECTROMAGNETICS, STEVEN W. ELLINGSON, Copyright Year: 2020
Recommended books and references (scientific journals, reports...)	Electromagnetism ; Schaum's series.

Electronic References, Websites	

Course Description Form

39. Course Name
Scientific Research Methods
40. Course Code :
41. Semester / Year
First semester 2025/2026
4. Description Preparation Date:
5. Available Attendance Forms:
Attendance in classrooms
6.Number of Credit Hours (Total) / Number of Units (Total)
3hours/3 units
42. Course administrator's name (mention all, if more than one name)
The name: Asst. Prof. Dr. Rasha A. Hussein Email: rasha.lasereng@mu.edu.iq
8.Course Objectives
Introduce students to the objectives of science and the assumptions of the scientific method. - Familiarize students with research methodology and methods of scientific research. - Introduce students to the nature of research activity, the conditions of scientific research, and the principles of scientific thinking.

9. Teaching and Learning Strategies

- Using personal, linguistic, logical–mathematical, visual, bodily, naturalistic, and social intelligences.

- Using brainstorming techniques and their various applications.

- Using different types of mind maps.

- Using deductive and inductive methods.

10. Course Structure

Evaluation method	Learning method	Unit or subject name	Required Learning Outcomes	Hours	Week
Daily exams and assignments	Lecture, discussion, brainstorming, group work	General Concepts	Introduction to scientific research	3	1.
Daily exams and assignments	Lecture, discussion, brainstorming, group work	Principles of Scientific Research (1)	Definition and objectives of scientific research; importance and impact; characteristics and types of scientific research	3	2.
Daily exams and assignments	Lecture, discussion, brainstorming, group work	Principles of Scientific Research (2)	Concept of academic supervision; research ethics; researcher's traits; key references in research methodology	3	3.
Daily exams and assignments	Lecture, discussion, brainstorming, group work	Research Methodologies	Definition and classification of research methods; importance of selecting an appropriate research method; foundations for choosing a method	3	4.
Daily exams and assignments	Lecture, discussion, brainstorming, group work	Formulating the Research Idea	How to generate research ideas; identifying and selecting the topic; research title; reviewing previous studies and sources	3	5.
Daily exams and assignments	Lecture, discussion, brainstorming, group work	Developing the Research Plan (1)	Selecting a research topic; formulating the title; announcing the topic; demonstrating significance and rationale	3	6.
First Monthly Exam					7.

Daily exams and assignments	Lecture, discussion, brainstorming, group work	Developing the Research Plan (2)	Defining research objectives; formulating hypotheses and research questions; outlining the structure logically and coherently	3	8.
Daily exams and assignments	Lecture, discussion, brainstorming, group work	Developing the Research Plan (2)	Explaining the chosen methodology; selecting research tools; comparing with previous studies; identifying main sources; reviewing research plan samples	3	9.
Daily exams and assignments	Lecture, discussion, brainstorming, group work	Research Tools	Questionnaire, interview, observation, test	3	10.
Daily exams and assignments	Lecture, discussion, brainstorming, group work	Rules of Data Collection	Methods of data collection; stages and accuracy in data gathering; reliance on original sources; using modern technology	3	11.
Daily exams and assignments	Lecture, discussion, brainstorming, group work	Research Writing Rules	Academic rigor in form and content; scientific citation principles; analysis and interpretation of collected material	3	12.
Daily exams and assignments	Lecture, discussion, brainstorming, group work	Rules of Annotation and Documentation	Rules of annotation; functions of footnotes; appropriate citation numbering systems	3	13.
Daily exams and assignments	Lecture, discussion, brainstorming, group work	Sources and References: Organization and Indexing	Definition of sources and references; types of references; citation styles in-text and bibliography; major references in specialized fields	3	14.
Second Monthly Exam				3	15.

11. Course Evaluation
Quizzes 10 Homework Assignments 10 Seminars 10 Research Projects 10

Midterm Exam 10 Final Exam 50
12. Learning and Teaching Resources

Required textbooks	
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

43. Course Name
Electromagnetism II
44.Course Code :
45.Semester / Year
Second semester 2025/2026
4. Description Preparation Date:
5. Available Attendance Forms:
Attendance in classrooms
6.Number of Credit Hours (Total) / Number of Units (Total)
3hours/3 units
46.Course administrator's name (mention all, if more than one name)

The name: Asst. Prof. Dr. Rasha A. Hussein

Email: rasha.lasereng@mu.edu.iq

8.Course Objectives

By the end of this course, students will be able to:

- **Understand the physical origins of magnetic fields**
  – Describe magnetic fields produced by steady currents and permanent magnets.
- **Apply the Biot–Savart Law**
  – Calculate magnetic field distributions for simple current configurations (straight wire, loop, solenoid, toroid).
- **Use Ampère's Law in integral and differential forms**
  – Evaluate magnetic fields in highly symmetric systems.
  – Identify when Ampère's Law is applicable and when the Biot–Savart Law is necessary.
- **Analyze magnetic materials**
  – Distinguish between paramagnetic, diamagnetic, and ferromagnetic behavior.
  – Use **B–H relationships**, magnetic susceptibility, permeability, and magnetization.
- **Solve boundary conditions for magnetic fields**
  – Apply boundary relations for **B** and **H** at interfaces between different magnetic media.
- **Understand energy in magnetostatic fields**
  – Derive and compute magnetic energy density and inductance for basic geometries.
- **State and interpret Maxwell's equations**
  – In both their **differential** and **integral** forms.
- **Understand the role of displacement current**
  – Explain why Maxwell corrected Ampère's Law and how this leads to electromagnetic waves.
- **Apply Maxwell's equations to electrostatic and magnetostatic problems**
  – Use Gauss's Law, Faraday's Law, and Ampère–Maxwell Law to solve field distributions.

9. Teaching and Learning Strategies

Teaching strategies for this course include using visual field diagrams and examples to introduce static magnetic fields, supported by guided practice of the Biot–Savart Law and Ampère's Law for common current geometries. Magnetic flux and Gauss's Law are reinforced through short surface-integral exercises, while curl and Stokes' Theorem are taught using graphical interpretations and small-group problem transformations. Magnetic forces and the Lorentz force are demonstrated with animations and numerical examples, and the microscopic properties of magnetic materials are clarified through domain illustrations and quick conceptual checks. Inductance is taught using circuit analogies and simple coil demonstrations, and Faraday's Law is supported by in-class induction demonstrations. Maxwell's equations are explained through step-by-step derivations and targeted application exercises, followed by applications in matter using interface boundary examples. Wave equations are illustrated with simulations of field propagation, and the Poynting vector is introduced through simple plane-wave power-flow calculations connected to real engineering applications.

10. Course Structure					
Evaluation method	Learning method	Unit or subject name	Required Learning Outcomes	Hours	Week
Quizzes, Assignments	Lecture, tutorial	Static magnetic field and its sources	• Explain the physical origin of magnetic fields produced by steady currents and permanent magnets. • Identify different types of current distributions (line, surface, volume) and their associated magnetic fields. • Apply the concept of magnetic field lines and understand their properties. • Use vector calculus to express the magnetic field in terms of current density.	3	16.
Quizzes, Assignments	Lecture, tutorial	Biot-Savart law	• State the Biot–Savart Law and interpret its physical meaning. • Calculate magnetic fields generated by simple current geometries (straight wire, circular loop, solenoid). • Analyze how geometry and symmetry affect the magnitude and direction of magnetic fields. • Compare the applicability of Biot–Savart Law with Ampère's Law for various configurations.	3	17.
Quizzes, Assignments	Lecture, tutorial	Ampere law	• State Ampère's Law in integral and differential form. • Use Ampère's Law to compute magnetic fields in systems with high symmetry (e.g., solenoid, toroid, infinite wire). • Determine when Ampère's Law is valid and when Biot–Savart must be used instead. • Relate Ampère's Law to the curl of the magnetic field.	3	18.
Quizzes, Assignments	Lecture, tutorial	Magnetic flux density and magnetic flux	• Define magnetic flux density $\mathbf{B}$ and magnetic flux Φ, and describe their physical significance. • Compute magnetic flux through surfaces of various shapes using appropriate integrals. • Apply Gauss's Law for magnetism and understand the concept of zero magnetic monopoles. • Relate $\mathbf{B}$, $\mathbf{H}$, and magnetization $\mathbf{M}$	3	19.

			for different magnetic materials.		
Quizzes, Assignments	Lecture, tutorial	Curl of vector field and stocks theory and applications	• Compute the curl of a vector field and interpret its physical meaning in electromagnetism. • Apply Stokes' Theorem to convert between line integrals and surface integrals. • Use Stokes' Theorem in solving magnetostatic problems involving Ampère's Law. • Analyze the relationship between circulation of the magnetic field and current enclosed.	3	20.
Quizzes, Assignments	Lecture, tutorial	Forces of magnetic field and electric-magnetic field combined	•Calculate magnetic force on a moving charge using the Lorentz force law. •Determine the magnetic force on current-carrying conductors and current loops. • Analyze torque and energy associated with magnetic dipoles in magnetic fields. •Describe the interaction between electric and magnetic fields in static and dynamic situations. •Solve problems involving combined electric and magnetic forces acting simultaneously on charges and currents.	3	21.
Mid-term Exam					22.
Quizzes, Assignments	Lecture, tutorial	Microscopic properties of magnetic materials	• Describe the microscopic origin of magnetism in terms of atomic magnetic moments and electron spin. • Distinguish between diamagnetic, paramagnetic, and ferromagnetic materials based on their microscopic behavior. • Relate magnetization **M**, magnetic susceptibility, and permeability to the internal structure of materials. • Explain domain formation, hysteresis, and magnetic saturation in ferromagnetic materials. • Analyze how microscopic properties influence macroscopic magnetic	3	23.

			behavior.		
Quizzes, Assignments	Lecture, tutorial	Inductance (self and mutual inductance)	• Define inductance and explain its physical meaning in terms of stored magnetic energy. • Calculate **self-inductance** for simple geometries such as solenoids and toroids. • Calculate **mutual inductance** between circuits and understand its dependence on coupling. • Use the energy expression of magnetic fields to evaluate inductance. • Apply inductance concepts in circuits involving changing magnetic fields.	3	24.
Quizzes, Assignments	Lecture, tutorial	Faradays law and magnetic circuit	• State and interpret Faraday's Law in differential and integral form. • Calculate induced emf in moving conductors, loops, and time-varying magnetic fields. • Explain Lenz's Law and predict the direction of induced currents. • Analyze magnetic circuits using magnetic reluctance and magnetomotive force (MMF). • Apply Faraday's Law to transformer operation and inductive devices.	3	25.
Quizzes, Assignments	Lecture, tutorial	Maxwell's equation	•State the four Maxwell equations in integral and differential form. •Explain the physical meaning of each equation in vacuum and in material media. •Understand the concept of displacement current and its role in completing Ampère's Law. •Derive continuity of charge from Maxwell's equations. •Solve basic field problems using Maxwell's equations as the	3	26.

			fundamental framework.		
Quizzes, Assignments	Lecture, tutorial	Applications of Maxwell's equations in matter	• Apply Maxwell's equations to dielectric, conducting, and magnetic media. • Use constitutive relations (**D** = **εE**, **B** = **μH**, **J** = **σE**) to solve field problems. • Determine boundary conditions for **E**, **D**, **B**, and **H** at material interfaces. • Analyze wave propagation in materials based on Maxwell's formulation. • Explain polarization, magnetization, and conduction phenomena in terms of macroscopic field behavior.	3	27.
Quizzes, Assignments	Lecture, tutorial	Wave equation	• Derive the electromagnetic wave equation from Maxwell's equations. • Solve the wave equation for plane waves in free space and in matter. • Determine wave velocity, wavelength, frequency, and impedance of a medium. • Explain reflection, refraction, attenuation, and dispersion of electromagnetic waves. • Analyze power flow and energy transport in electromagnetic waves.	3	28.
Quizzes, Assignments	Lecture, tutorial	Poynting vector	• Define the Poynting vector and explain its role in describing electromagnetic energy flow. • Calculate Poynting vector for various field configurations. • Interpret the Poynting Theorem and apply it to energy conservation in electromagnetic systems. • Analyze power transfer in wave propagation, circuits, and radiation scenarios. • Evaluate instantaneous and average power densities for harmonic fields.	3	29.

Second Exam	30.

11. Course Evaluation
daily preparation → 5 Quiz → 10 Assignment → 5 monthly exams → 20 final exam →60

12. Learning and Teaching Resources	
Required textbooks	
Main references (sources)	ELECTROMAGNETICS, STEVEN W. ELLINGSON, Copyright Year: 2020
Recommended books and references (scientific journals, reports...)	Electromagnetism ; Schaum's series.
Electronic References, Websites	

Course Description Form

1. Course Name:
Medical Physics
2. Course Code:
3. Semester / Year:
Third Year / Second Semester (2025-2026)
4. Description Preparation Date:
2025/11/7
5. Available Attendance Forms:
Attendance in classrooms
6.Number of Credit Hours (Total) / Number of Units (Total)

2 Hrs per week / 2 Unit

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

The name: Asst. Prof. Dr. Ahmed Fadhil Almurshedi Email: fhahmed2@mu.edu.iq

8.Course Objectives

Introducing the student application of physics principles for medical purpose, its importance, uses, methods of diagnosis and treatment in different organs of human body.

9. Teaching and Learning Strategies

The main strategy for delivering this unit is to encourage students to engage and understand the important technologies and applications of physics from human body in the diagnosis and treatment, by the end of the semester, sharpen and expand their critical thinking skills. This will be achieved through classroom instruction, interactive lessons, and the study of simple experiments that include sample activities of interest to students.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	2	Understanding of measurement in medical physics	Terminology & Measurements	Lecture, Discussion	Quiz, Exam, Report
2	2	Understanding of forces effecting on body	Force on and in the body	Lecture, Discussion	Quiz, Exam, Report
3	2	Understanding energy and work concept in the body	Energy, Work and Power of the Body	Lecture, Discussion	Quiz, Exam, Report
4	2	Understanding heat in medicine	Heat and cold in medicine	Lecture, Discussion	Quiz, Exam, Report
5	2	Understanding effect of pressure on the body	Pressure in the body	Lecture, Discussion	Quiz, Exam, Report
6	2	Understanding blood flow in the body	Physics of cardiovascular system	Lecture, Discussion	Quiz, Exam, Report
7	2	Understanding electricity in the body	Electricity in human body	Lecture, Discussion	Quiz, Exam, Report

8	2	Understanding of cell membrane potentials	Bio Potentials	Lecture, Discussion	Quiz, Exam, Report
9	2	Understanding sound in medicine	Sound in medicine	Lecture, Discussion	Quiz, Exam, Report
10	2	Understanding sound and hearing	Physics of hearing and ear	Lecture, Discussion	Quiz, Exam, Report
11	2	Understanding physics of vision	Physics of eye and vision	Lecture, Discussion	Quiz, Exam, Report
12	2	Understanding the effect of electromagnetic radiation on the body	Light and UV in medicine	Lecture, Discussion	Quiz, Exam, Report
13	2	Understanding using of x-yay in the medical imaging	x-ray in medicine	Lecture, Discussion	Quiz, Exam, Report
14	2	Understanding effect of radiation on the body	Radiation in medicine	Lecture, Discussion	Quiz, Exam, Report
15	2	Understanding application of nuclear in medicine	Nuclear medicine	Lecture, Discussion	Quiz, Exam, Report

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

12. Learning and Teaching Resources	
Required textbooks	-
Main references (sources)	Medical physics by Cameron and Skofronick, 2010.
Recommended books and references (scientific journals, reports...)	Elements of Biophysics by Randall, 1998.
Electronic References, Websites	-

Head of dept. **Lecturer**

Asst. Prof. Dr. Alaa Jasim **Asst. Prof. Dr. Ahmed Fadhil Almurshedi**

Course Description Form

47. Course Name:
Magnetism
48. Course Code:
Phys 1215
49. Semester / Year:
First Year / Second Semester (2025-2026)
4. Description Preparation Date:
2025/11/7
5. Available Attendance Forms:
Attendance in classrooms
6.Number of Credit Hours (Total) / Number of Units (Total)
151 / 6 ECTS
7. Course administrator's name (mention all, if more than one name)
The name: Asst. Prof. Dr. Ahmed Fadhil Almurshedi Email: fhahmed2@mu.edu.iq
8.Course Objectives
1. To understand the nature of magnetism and magnet. 2. To differentiate between electric field and magnetic field. 3. To understand the magnetic field and its different examples. 4. To understand the behavior of the motion of charged particle in uniform and nonuniform magnetic field. 5. To develop problem solving skills related to magnetism. 6. Application of Gauss' law for magnetism. 7. Study of Amperes law, lenz law and Maxwell equations. 8. To study the type of transformer and its applications. 9. To understand the inductance, self and mutual inductance.

10. To study the type of transformer and its applications.

9. Teaching and Learning Strategies

The main strategy for delivering this unit is to encourage students to understand the concepts of magnetism, by the end of the semester, sharpen and expand their critical thinking skills. This will be achieved through classroom instruction, interactive lessons, and the study of simple experiments that include sample activities of interest to students.

10. Course Structure

Evaluation method	Learning method	Unit or subject name	Required Learning Outcomes	Hours	Week
Quiz, Exam, Report	Lecture, Discussion, Solving Problem	Introduction to Magnetism, Magnet, Magnetic materials, magnetic field of earth	Understanding	3	1
Quiz, Exam, Report	Lecture, Discussion, Solving Problem	Magnetic field, Magnetic force, Lorentz force	Understanding	3	2
Quiz, Exam, Report	Lecture, Discussion, Solving Problem	Motion of a charged particle in a uniform magnetic field	Understanding	3	3
Quiz, Exam, Report	Lecture, Discussion, Solving Problem	Motion of a charged particle in a nonuniform magnetic field	Understanding	3	4
Quiz, Exam, Report	Lecture, Discussion, Solving Problem	Magnetic force on an electric current	Understanding	3	5
Quiz, Exam, Report	Lecture, Discussion, Solving Problem	Magnetic field produced by a closed current	Understanding	3	6
Quiz, Exam, Report	Lecture, Discussion, Solving Problem	Magnetic field of a rectilinear current (Biot-Savart Law)	Understanding	3	7
Quiz, Exam, Report	Lecture, Discussion, Solving Problem	Magnetic field of a circular current, Magnetic field of moving charge	Understanding	3	8
Quiz, Exam, Report	Lecture, Discussion, Solving Problem	Amperes Law for the magnetic field, Examples on Amperes Law	Understanding	3	9

Quiz, Exam, Report	Lecture, Discussion, Solving Problem	Magnetic Flux, Magnetization, Magnetic susceptibility	Understanding	3	10
Quiz, Exam, Report	Lecture, Discussion, Solving Problem	Faraday's Law, Lenz's Law, Faraday Henry Law	Understanding	3	11
Quiz, Exam, Report	Lecture, Discussion, Solving Problem	Inductance, Self Inductance, Mutual Inductance	Understanding	3	12
Quiz, Exam, Report	Lecture, Discussion, Solving Problem	DC circuit, Transformers	Understanding	3	13
Quiz, Exam, Report	Lecture, Discussion, Solving Problem	AC circuit, A Resistor and Capacitor Connected to an ac Source	Understanding	3	14
Quiz, Exam, Report	Lecture, Discussion, Solving Problem	AC circuit, An Inductor Connected to an ac Source, Series Combination of a Resistor, an Inductor and a Capacitor Connected to an ac Source	Understanding	3	15

11. Course Evaluation	
Distribution of the grade out of 100 according to the tasks assigned to the student, such as daily preparation, daily, monthly, written exams, reports, etc.	
12. Learning and Teaching Resources	
Required textbooks	1. الفيزياء العامة (ميكانيك - كهربائية ومغناطيسية) - أ.م.د. فؤاد شاكر د. علي خلف 2. الكهربائية والمغناطيسية - إبراهيم ناصر واخرون
Main references (sources)	Fundamentals of Physics, Halliday & Resnicle, John Wiley, 2011 9th edition.
Recommended books and references (scientific journals, reports...)	University Physics by Francis and others.
Electronic References, Websites	-

Course Description Form

50. Course Name
Modern physics I
51. Course Code :
Phys 2306
52. Semester / Year
First/ 2025−2026
4. Description Preparation Date:
1−10−2025
5. Available Attendance Forms:
Attendance in classrooms
6.Number of Credit Hours (Total) / Number of Units (Total)
4 hours/ 5 units
53. Course administrator's name (mention all, if more than one name)
The name: Hassan Tarikhum B. Email: Hassan.tarikhum@mu.edu.iq
8.Course Objectives
• To develop problem-solving skills and understanding of atomic mechanisms through t application of techniques. • To understand the development of the atomic structure of materials. Basics of solid-sta physics and nuclear physics. • This course deals with the basic concept of quantum mechanics of the atom. • Dealing with different atomic spectra.
9. Teaching and Learning Strategies

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

10. Course Structure

Evaluation method	Learning method	Unit or subject name	Required Learning Outcomes	Hours	Week
Direct Questions	Giving lectures	**Introduction, Atomic Models Thomson's Atomic Model,**	**Acquiring knowledge**	2	1
Participation	Giving lectures	**Rutherford Atomic Model,**	**Acquiring cognitive skills**	2	2
Exam	Giving lectures	**Rutherford Scattering Formula,**	**Acquiring mathematical skills**	2	4
Participation	Giving lectures	**Distance of closest Approach,**	**Developing intelligence skills**	2	5
Assignments	Giving lectures	**Classical model of electron,**	**Acquiring interpretive skills**	2	6
Exam	Giving lectures	**Boher Atomic Model,**	**Acquiring cognitive skills**	2	7
Direct Questions	Giving lectures	**Atomic Spectra,**	**Acquiring mathematical skills**	2	8
Participation	Giving lectures	**Energy Levels and Spectra,**	**Acquiring interpretive skills**	2	9
Report	Giving lectures	**The Wave Equation**	**Acquiring problem-solving skills**	2	10

Exam	Giving lectures	**Expectation Values,**	**Knowledge skills**	2	11
Participation	Giving lectures	**Operators,**	**Mathematical skills**	2	12
Direct Questions	Giving lectures	**Quantum Numbers,**	**Intelligence skills**	2	13
Report	Giving lectures	**Zeeman Effect,**	**Derivational skills**	2	14
Assignment	Giving lectures	**Schrödinger's Equation: Time-Independent Form**	**Comprehension skills**	2	15
Questions	Giving lectures	**Preparatory week before the final Exam**	**Interpretive skills**	2	16

11. Course Evaluation

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

12. Learning and Teaching Resources

Required textbooks	Concepts of Modern Physics Arthur Beiser
Main references (sources)	
Recommended books and references (scientific journals, reports...)	**Introduction to atomic and nuclear physics: 5 eddition. Hennery semat.!973 By Champ mann and Hall.**
Electronic References, Websites	

Course Description Form

1. Course Name
Electricity
2. Course Code :
Phys 1102
3. Semester / Year
First/ 2025−2026
4. Description Preparation Date:
1−10−2025
5. Available Attendance Forms:
Attendance in classrooms
6.Number of Credit Hours (Total) / Number of Units (Total)
4 hours/ 6 units
4. Course administrator's name (mention all, if more than one name)
The name: Hassan Tarikhum B. Email: Hassan.tarikhum@mu.edu.iq
8.Course Objectives
1. To differentiate between conductors, insulators and semiconductor. 2. To understand the concept of electric charge. 3. To use Coulomb's law to solve problems about electric force electric field and electric potential.

4. To understand the meaning of dipole moments.

5. Use Gauss' law to different types of charge distributions in space.

6. Explain the physical basis of Ohm's law and use Ohm's law in solving problem.

7. To understand types of Kirshoff's current and voltage Laws and using it in the electric circuits.

8. To understand different types of capacitor and its application in the circuits.

9. To know concepts such as Electric Current, Current density, Resistance, Resistivity, Series and parallel combination of resistance.

10. To develop problem solving problem skills related to the electric force, electric field and electric potentials.

9. Teaching and Learning Strategies

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

10. Course Structure

Evaluation method	Learning method	Unit or subject name	Required Learning Outcomes	Hours	Week
Direct Questions	Giving lectures	Electric Charge	**Acquiring knowledge**	2	1
Participation	Giving lectures	Electric force, Coulomb's Low	**Acquiring cognitive skills**	2	2

Exam	Giving lectures	Electric Field of point charges	**Acquiring mathematical skills**	2	4
Participation	Giving lectures	**The Electric Field of a Uniform Ring of Charge and disk**	**Developing intelligence skills**	2	5
Assignments	Giving lectures	**Electric Flux,**	**Acquiring interpretive skills**	2	6
Exam	Giving lectures	**Gauss's Law**	**Acquiring cognitive skills**	2	7
Direct Questions	Giving lectures	**Electrical potential**	**Acquiring mathematical skills**	2	8
Participation	Giving lectures	**Electric Potential of a Uniformly Charged Sphere**	**Acquiring interpretive skills**	2	9
Report	Giving lectures	**Energy stored in charged system**	**Acquiring problem-solving skills**	2	10
Exam	Giving lectures	**Capacitors**	**Knowledge skills**	2	11
Participation	Giving lectures	**Polarization**	**Mathematical skills**	2	12
Direct Questions	Giving lectures	**Dielectric and Isolator Material**	**Intelligence skills**	2	13
Report	Giving lectures	**Ohm's law Electric Current**	**Derivational skills**	2	14
Assignment	Giving lectures	**Resistance**	**Comprehension skills**	2	15
Questions	Giving lectures	**Preparatory week before the final Exam**	**Interpretive skills**	2	16

11. Course Evaluation

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

12. Learning and Teaching Resources

Required textbooks	Fundamentals of Physics, Halliday & Resnicle, John Wiley, 2011 9th edition. - University Physics by Francis and others.
Main references (sources)	
Recommended books and references (scientific journals, reports...)	كهربائية و مغناطيسية **ابراهيم ناصر واخرون**
Electronic References, Websites	https://openstax.org/books/physics/pages/18-3-electric-field

Course Description Form

1. Course Name:
Quantum Mechanics I
2. Course Code :
3. Semester / Year
First semester 2025/2026
4. Description Preparation Date:
16/10/2025
5. Available Attendance Forms:
Attendance in classrooms
6.Number of Credit Hours (Total) / Number of Units (Total)
4 hours/ units
4. Course administrator's name (mention all, if more than one name)
The name: Prof. Dr. Hadey K. Mohamad Email: hadey.mohamad@mu.edu.iq
8.Course Objectives
● **To develop problem solving skills and understanding of Quantum theory through the application of techniques.** ● **This course deals with the basic concepts of the Quantum theory.** ● **To understand the wave function, linear operator and Schrödinger equation from given applications.** ● **To understand the simple harmonic oscillator problem.** ● **To perform Reflection and Transmission Coefficients.**

9. Teaching and Learning Strategies

- **Recognize how the linear operator works on the wave function.**
- **Recognize how the wave function becomes an Eigen or not one, so one may evaluate the Eigen value and Eigen function, respectively.**
- **Summarize what is meant by an admissible wave function, and Hermitian operator.**
- **Solve the time-independent Schrödinger wave equation in one-dimensional case.**
- **Solve the time-independent Schrödinger wave equation in two-dimensional case.**
- **Solve the time-independent Schrödinger wave equation in three-dimensional case.**
- **Study the important applications in solving the time-independent Schrödinger wave equation in one-dimensional case.**
- **solve the time-independent Schrödinger wave equation for the simple harmonic oscillator problem.**
- **Obtain the wave functions of the simple harmonic oscillator for all energy levels.**

10. Course Structure

Evaluation method	Learning method	Unit or subject name	Required Learning Outcomes	Hours	Week
Questions and discussion	Lecture	**Wave-Particle Property: Duality Property**	Students will learn the duality property	4	1
Questions and discussion	Lecture	**Wave function and Probability Density**	Students will learn the probability density	4	2
Questions and discussion	Lecture	**Ortho-Normality of Functions**	Students will learn the ortho-normality condition	4	3
Solved problems	Lecture	**Operators and Eigenvalues Equation, Commutative Operators**	Students will learn the operators and commutation relations	4	4

		Examination 1		1.5	5
Questions and discussion	Lecture	**Hermitian Operators**	Students will learn the Hermitian operators	4	6
Questions and discussion	Lecture	**Schrödinger Wave Equation**	Students will learn the Schrödinger wave equation	4	7
Questions and discussion	Lecture	**Free Particle**	Students will learn the free particle	4	8
Questions and discussion	Lecture	**Particle in a Box(Infinite Potential Box)**	Students will learn the particle in a box	4	9
Questions and discussion	Lecture	**Step potential(Transmission and Reflection Coefficients)**	Students will learn the transmission and reflection coefficients	4	10
Questions and discussion	Lecture	**Linear Harmonic Oscillator, Schrödinger Equation Solution of Harmonic Oscillator**	Students will learn the linear harmonic oscillator	4	11
		Examination 2		1.5	12
Questions and discussion	Lecture	**Calculation of Wave Functions for Harmonic Oscillator**	Students will learn the calculation of wave functions for S.H.O.	4	13
Questions and discussion	Lecture	**Exact solution of Schrödinger equation for simple harmonic oscillator**	Students will learn the calculation of energy levels for S.H.O.	4	14
Questions and discussion	Lecture	**Hermite polynomial and calculation of zero-point energy**	Students will evaluate zero-point energy	4	15

11. Course Evaluation

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

12. Learning and Teaching Resources	
Required textbooks	Textbook of Quantum Mechanics, 2nd Edition, 2010, authored by A.K.Saxena
Main references (sources)	
Recommended books and references (scientific journals, reports...)	أساسيات ميكانيك الكم 1. د.سالم الشماع د.أمجد عبد الرزاق كرجيه 1988 2. Quantum Mechanics Davydov, 2nd Ed., 1976
Electronic References, Websites	

Course Description Form

1. Course Name:
Quantum Mechanics II
2. Course Code :
3. Semester / Year
Second semester 2025/2026
4. Description Preparation Date:
16/10/2025
5. Available Attendance Forms:
Attendance in classrooms
6.Number of Credit Hours (Total) / Number of Units (Total)
4 hours/ units
4. Course administrator's name (mention all, if more than one name)
The name: Prof. Dr. Hadey K. Mohamad Email: hadey.mohamad@mu.edu.iq

8.Course Objectives

- **To understand the Bloch Theorem, and Time-dependent Schrödinger equation from given applications.**
- **This course deals with orbital angular momenta operators in Quantum mechanics.**
- **To develop problem solving skills and understanding of spherically symmetrical systems problem through the application of techniques.**
- **To perform approximation methods in Quantum mechanics.**

9. Teaching and Learning Strategies

- **Summarize what is meant by Bloch theorem, and Time-dependent Schrödinger equation.**
- **Recognize how the angular momenta operators work on the wave functions.**
- **Solve the time-independent Schrödinger wave equation for H. atom.**
- **Calculate the radial wave functions for an electron of H. atom.**
- **Calculate the spherical harmonics for an electron of H. atom.**
- **Study some of approximate methods in Quantum Mechanics**.

10. Course Structure

Evaluation method	Learning method	Unit or subject name	Required Learning Outcomes	Hours	Week
Questions and discussion	Lecture	**Bloch Theorem**	Students will study the Bloch theorem	4	1
Questions and discussion	Lecture	**Time-Dependent Schrödinger Equation**	Students will learn the solution of Schrödinger equation	4	2
Questions and discussion	Lecture	**Ehrenfest Theorem, Applications**	Students will learn the Ehrenfest Theorem	4	3
Solved problems	Lecture	**Angular Momentum**	Students will	4	4

		Operators in terms of Cartesian Coordinates	learn the Angular momenta operators		
		Examination 1		1.5	5
Questions and discussion	Lecture	**Commutation Relations of Angular Momentum Operators,**	Students will learn the commutation relations	4	6
Questions and discussion	Lecture	**Orbital Angular Momentum Operators in terms of Spherical Coordinates**	Students will learn the Angular momenta operators in spherical coordinates	4	7
Questions and discussion	Lecture	**Dirac Representation, Applications,**	Students will learn the Dirac representation	4	8
Questions and discussion	Lecture	**Spherical Symmetry of Systems, Hydrogen Atom**	Students will learn the solved Schrödinger equation of H. atom	4	9
Questions and discussion	Lecture	**Schrödinger Equation Solutions in terms of Spherical Coordinates**	Students will learn the solved Schrödinger equation of H. atom in spherical coordinates	4	10
Questions and discussion	Lecture	**Radial Schrödinger Equation of H. Atom**	Students will learn the radial wave functions of H. atom	4	11
		Examination 2		1.5	12
Questions and discussion	Lecture	**Spherical Harmonics, calculation of total wave functions for H. atom, Applications**	Students will learn the spherical wave functions of H. atom	4	13

Questions and discussion	Lecture	**Approximate Methods, Variational Method**	Students will learn the energies by variational method	4	14
Questions and discussion	Lecture	**Perturbation Method in Solving Schrödinger Wave Equation**	Students will learn the energies by perturbation method	4	15

11. Course Evaluation

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

12. Learning and Teaching Resources

Required textbooks	Textbook of Quantum Mechanics, 2nd Edition, 2010, authored by A.K.Saxena
Main references (sources)	
Recommended books and references (scientific journals, reports...)	أساسيات ميكانيك الكم 1. د.سالم الشماع د.أمجد عبد الرزاق كرجيه 1988 2. Quantum Mechanics Davydov, 2nd Ed., 1976
Electronic References, Websites	

Course Description Form

5. Course Name:
Quantum Mechanics II
6. Course Code :
7. Semester / Year
Second semester 2025/2026
4. Description Preparation Date:
16/10/2025
5. Available Attendance Forms:
Attendance in classrooms
6.Number of Credit Hours (Total) / Number of Units (Total)
4 hours/ units
8. Course administrator's name (mention all, if more than one name)
The name: Prof. Dr. Hadey K. Mohamad Email: hadey.mohamad@mu.edu.iq
8.Course Objectives
● **To understand the Bloch Theorem, and Time-dependent Schrödinger equation from given applications.** ● **This course deals with orbital angular momenta operators in Quantum mechanics.** ● **To develop problem solving skills and understanding of spherically symmetrical systems problem through the application of techniques.** ● **To perform approximation methods in Quantum mechanics.**

9. Teaching and Learning Strategies

- **Summarize what is meant by Bloch theorem, and Time-dependent Schrödinger equation.**
- **Recognize how the angular momenta operators work on the wave functions.**
- **Solve the time-independent Schrödinger wave equation for H. atom.**
- **Calculate the radial wave functions for an electron of H. atom.**
- **Calculate the spherical harmonics for an electron of H. atom.**
- **Study some of approximate methods in Quantum Mechanics**.

10. Course Structure

Evaluation method	Learning method	Unit or subject name	Required Learning Outcomes	Hours	Week
Questions and discussion	Lecture	**Bloch Theorem**	Students will study the Bloch theorem	4	1
Questions and discussion	Lecture	**Time-Dependent Schrödinger Equation**	Students will learn the solution of Schrödinger equation	4	2
Questions and discussion	Lecture	**Ehrenfest Theorem, Applications**	Students will learn the Ehrenfest Theorem	4	3
Solved problems	Lecture	**Angular Momentum Operators in terms of Cartesian Coordinates**	Students will learn the Angular momenta operators	4	4
		Examination 1		1.5	5
Questions and discussion	Lecture	**Commutation Relations of Angular Momentum Operators,**	Students will learn the commutation relations	4	6
Questions and	Lecture	**Orbital Angular Momentum Operators in terms of**	Students will	4	7

discussion		**Spherical Coordinates**	learn the Angular momenta operators in spherical coordinates		
Questions and discussion	Lecture	**Dirac Representation, Applications,**	Students will learn the Dirac representation	4	8
Questions and discussion	Lecture	**Spherical Symmetry of Systems, Hydrogen Atom**	Students will learn the solved Schrödinger equation of H. atom	4	9
Questions and discussion	Lecture	**Schrödinger Equation Solutions in terms of Spherical Coordinates**	Students will learn the solved Schrödinger equation of H. atom in spherical coordinates	4	10
Questions and discussion	Lecture	**Radial Schrödinger Equation of H. Atom**	Students will learn the radial wave functions of H. atom	4	11
		Examination 2		1.5	12
Questions and discussion	Lecture	**Spherical Harmonics, calculation of total wave functions for H. atom, Applications**	Students will learn the spherical wave functions of H. atom	4	13
Questions and discussion	Lecture	**Approximate Methods, Variational Method**	Students will learn the energies by variational method	4	14
Questions and discussion	Lecture	**Perturbation Method in Solving Schrödinger Wave Equation**	Students will learn the energies by perturbation method	4	15

11. Course Evaluation	
Distribution of the grade out of 100 according to the tasks assigned to the student, such as daily preparation, daily, monthly, written exams, reports, etc.	
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Required textbooks	Textbook of Quantum Mechanics, 2nd Edition, 2010, autho by A.K.Saxena
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Electronic References, Websites	