Academic Program Description Form

2026-2025

Faculty / Institute: College of Science

Scientific Department: Physics Department

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

Final Certificate Name: M.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

Year/Level	رمز المقرر أو المساق	Course Code	الساعات المعتمدة	
			Theoretical	practical
HIGHER STUDIES		Advanced Quantum Mechanics	2	
HIGHER STUDIES		Advanced Nuclear Physics	2	
HIGHER STUDIES		Advanced English	2	
HIGHER STUDIES		Advanced Laser Physics	2	
HIGHER STUDIES		Advanced Electromagnetism	2	
HIGHER STUDIES		Advanced Renewable Energies	2	
HIGHER STUDIES		Advanced Mathematical Physics	2	
HIGHER STUDIES		Advanced Solid State Physics	2	
HIGHER STUDIES		Advanced Classical Mechanics	2	
HIGHER STUDIES		Advanced Materials Science	2	
HIGHER STUDIES		Advanced Nanotechnology	2	
HIGHER STUDIES		Advanced Optics	2	
HIGHER STUDIES		Advanced English II	2	
HIGHER STUDIES		Advanced Scientific Research Methods	2	
HIGHER STUDIES		Advanced Quantum Mechanics	2	
HIGHER STUDIES		Advanced Nuclear Physics	2	
HIGHER		Advanced English	2	

				STUDIES
	2	Advanced Laser Physics		HIGHER STUDIES
	2	Advanced Electromagnetism		HIGHER STUDIES
	2	Advanced Renewable Energies		HIGHER STUDIES
	2	Advanced Mathematical Physics		HIGHER STUDIES
	2	Advanced Solid State Physics		HIGHER STUDIES
	2	Advanced Classical Mechanics		HIGHER STUDIES

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 admission criteria for graduate studies (Master's/PhD) in science faculties are primarily based on the undergraduate GPA, the competitive entrance exam score, and demonstrated research skills. A comparative score is calculated (usually 70% for the GPA and 30% for the exam), and applicants must also provide proof of English language proficiency and a letter of no objection for employed individuals.

Detailed Admission Criteria:

• Cumulative GPA: Applicants must have at least a "Good" grade in their undergraduate studies. In some cases, a "Pass" grade may be accepted provided the applicant successfully completes supplementary courses.

• Competitive Exam: A rigorous scientific exam in the chosen field of science (such as chemistry, physics, or life sciences) constitutes a significant part of the selection process.

• Selection Criteria: The comparative score for Master's programs is calculated as 70% for the GPA and 30% for the competitive entrance exam score.

• Required Documents:

o Recent graduation certificate with grades.

o English language proficiency certificate (such as TOEFL or IELTS).

o Letter of no objection for employed individuals.

o Employment record for employed individuals. o Other Requirements
• Age and Qualifications: Applicants must hold a relevant undergraduate degree (Bachelor of Science).

Important Notes:
• Conditional Admission: May be granted to students with low cumulative GPAs (less than 3.74 out of 5).

• Special Requirements: Some universities may require publication of a research paper or work experience (especially for PhD programs).

• Graduate Studies Guide, prepared by the Dean of the College of Science, Al-Muthanna University

The following conditions must be met to establish a Higher Diploma and Master's program in the scientific department: First: Availability of qualified and specialized faculty members... Instructions for Applying to Graduate Studies 2024-2025

Required Documents for Applying to Graduate Studies for the Academic Year 2025-2026 * Applicant's National ID Card and the National ID Card of the applicant...

3. The most important sources of information about the program

1- The official sources of Al-Muthanna University and the College of Science are the primary references for Master's studies. These include the college's website (Graduate Studies Guide), the official Telegram channel for graduate studies, and the Ministry's online application portal. These sources provide details about the study plan, application requirements, and deadlines.

2- Key sources of reliable information:

3- • The official website of the College of Science/Al-Muthanna University (especially the Graduate Studies Guide): This explains the general structure of the curriculum, application requirements, the discussion process, and the graduate studies evaluation.

4- • The official Telegram channel - Al-Muthanna University/Graduate Studies: The fastest source for application updates, announcements, and instructions related to Master's programs.

5- • The Ministry of Higher Education's online application portal: For completing applications, reviewing general regulations, and learning about application and

admission deadlines.

6- • The Graduate Studies Department at the College of Science: Visit the college directly to obtain detailed information about available specializations.

7- • The college's notice board: Where lists of applicants and those provisionally and finally accepted are posted.

8- What can be obtained from these sources:

9- • Requirements: Civil status ID/National ID card, residency card, Bachelor's degree certificate, and personal photos. • Timings: Application period begins (usually in May) and is subject to the Ministry's schedule. • Regulations: Equivalency process and academic calendar.

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)	Advanced Quantum Mechanics	Higher studies (Master)	
#	#	#	#	#		#	#		#		(Basic)	Advanced Nuclear Physics	Higher studies	
#			#		#			#		#	(Basic)	Advanced English	(Master)	
#	#	#	#	#		#	#		#		(Basic)	Advanced Laser Physics	Higher studies	
#	#	#	#	#		#	#		#		(Basic)	Advanced Electromagnetism	(Master)	
#			#		#			#		#	(Basic)	Advanced Renewable Energies	Higher studies	
#			#		#			#		#	(Basic)	Advanced Mathematical Physics	(Master)	
#	#	#	#	#		#	#		#		(Basic)	Advanced Solid State Physics	Higher studies	
#			#		#			#		#	(Basic)	Advanced Classical Mechanics	(Master)	
#	#	#	#	#		#	#		#		(Basic)	Advanced Materials Science	Higher studies	
#			#		#			#		#	(Basic)	Advanced Nanotechnology	(Master)	
#	#	#	#	#		#	#		#		(Basic)	Advanced Optics	Higher studies	
#			#		#			#		#	(Basic)	Advanced English II	(Master)	
#	#	#	#	#		#	#		#		(Basic)	Advanced Scientific Research Methods	Higher studies	

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

Course Description Form

1. Course Name:
Advanced Nanotechnology
2. Course Code :
3. Semester / Year
Second semester 2025/2026
4. Description Preparation Date:
5/2/2026
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: Asst. Prof. Dr. Muwafaq Fadhil Jaddoa Email: Muwafaq_fj@mu.edu.iq
8.Course Objectives
9. Teaching and Learning Strategies
10. Course Structure

Evaluation method	Learning method	Unit or subject name	Required Learning Outcomes	Hours	Week
Questions and discussion	Lecture	Introduction of Nanotechnology and Nanoscience			
Questions and discussion	Lecture	Nanomaterials Techniques: Top-Down Approaches I			
Questions and discussion	Lecture	Nanomaterials Techniques: Top-Down Approaches II			
Questions and discussion	Lecture	Nanomaterials Techniques: Bottom-Up Approach I			
Questions and discussion		Nanomaterials Techniques: Bottom-Up Approach II			
Questions and discussion	Lecture	Characterization Tools of Nanomaterials: Imaging Through Electron Microscope			
Questions and discussion	Lecture	Scanning Probe Microscope			
Questions and discussion	Lecture	Characterization through Spectroscopy: UV-Visible Plasmon Absorption and Emission			
Questions and discussion	Lecture	Vibrational Spectroscopy: FTIR			
Questions and discussion	Lecture	Raman Spectroscopy			
Questions and discussion	Lecture	X-Ray Photoelectron Spectroscopy (XPS)			
		Scattering Techniques			
Questions and discussion	Lecture	Nanomaterials in Different Configurations			
Questions and discussion	Lecture	Carbon- based Nanomaterials			
Questions and	Lecture	Applications of Nanomaterials			

discussion					

11. Course Evaluation
Final exam / 70 Mid-semester exam / 25 Quizzes / 5

12. Learning and Teaching Resources	
Required textbooks	Essentials in Nanoscience and Nanotechnology Narendra Kumar and Sunita Kumbhat
Main references (sources)	Fundamentals of Nanotechnology Gabor L. Hornyak, John J. Moore, Harry F. Tibbals Joydeep Duttab
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

1. Course Name:
Advanced Laser Physics
2. Course Code :
3. Semester / Year
Second semester 2025/2026
4. Description Preparation Date:
5/2/2026
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: Asst. Prof. Dr. Muwafaq Fadhil Jaddoa Email: Muwafaq_fj@mu.edu.iq
8.Course Objectives
9. Teaching and Learning Strategies

10. Course Structure

Evaluation method	Learning method	Unit or subject name	Required Learning Outcomes	Hours	Week
Questions and discussion	Lecture	Fundamentals of laser			
Questions and discussion	Lecture	Pumping, pumping method, active medium			
Questions and discussion	Lecture	Optical resonator			
Questions and discussion	Lecture	Critical population inversion, steady state oscillation, cavity resonance			
Questions and discussion	Lecture	Line broadening methods			
Questions and discussion	Lecture	Gain bandwidth			
Questions and discussion	Lecture	Laser modes			
Questions and discussion	Lecture	Laser rate equations			
Questions and discussion	Lecture	Narrow frequency range, selection of laser mode			
Questions and discussion	Lecture	Generation of high power pulses, Q factor			
Questions and discussion	Lecture	Q switching for giant pulses,			
Questions and discussion	Lecture	Methods of Q switching			
Questions and discussion	Lecture	Cavity dumping, mode locking			
Questions and discussion	Lecture	techniques for mode locking			

Questions and discussion	Lecture	Polarization of cavity medium			

11. Course Evaluation
Final exam / 70 Mid-semester exam / 25 Quizzes / 5

12. Learning and Teaching Resources	
Required textbooks	Lasers, fundamentals and applications K. Thyagarajan
Main references (sources)	An introduction to lasers, Theory and Applications Avadhanulu M.N. Laser Physics Peter W. Milonni, Joseph H. Eberly
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

1. Course Name
Advanced Optics
2. Course Code :
3. Semester / Year
Second semester 2025/2026
4. Description Preparation Date:
February/ 2026
5. Available Attendance Forms:
Attendance in classrooms
6.Number of Credit Hours (Total) / Number of Units (Total)
2 hours
4. Course administrator's name (mention all, if more than one name)
The name: Asst. Prof. Dr. Thill Akeel Almusawi Email: thillakeel@mu.edu.iq
8.Course Objectives
By the end of this course, students will be able to: 1.Develop the ability to solve complex problems in wave optics, nanophotonics, and atom-field interactions. 2.Assess the advantages and limitations of existing and emerging optical techniques (e.g., spectroscopy, interferometry, microscopy). 3.Analyze scientific papers and experimental data in optics with a critical mindset. 4.Apply theoretical models to practical optical systems, including imaging, diffraction, and near-field optics. 5.Gain the foundation needed for independent research in advanced optical science and engineering.
9. Teaching and Learning Strategies
1.Blend traditional lectures with current research findings to keep content cutting-edge.

2.Encourage students to critically analyze recent journal articles in optics.

3.Problem-based learning (PBL) where students solve real-world optical design challenges.

4.Group discussions and peer teaching to reinforce concepts.

5.Demonstrations & Simulations

6.Use optical experiments (polarization, diffraction, interference) as live demos.

7.Incorporate computational simulations for modeling wave

8.Connect optics with physics, materials science, and engineering applications.

9.Case studies on lasers, fiber optics, and quantum technologies.

10. Course Structure

Evaluation method	Learning method	Unit or subject name	Required Learning Outcomes	Hours	Week
Quizzes, Assignments	Lecture	ELECTROMAGNETIC OPTICS	1.ELECTROMAGNETIC THEORY OF LIGHT. 2.Maxwell's Equations in Free Space.	2	1
Quizzes, Assignments	Lecture	The Wave Equation	1.The Wave Equation. 2. Maxwell's Equations in a Medium. 3. Intensity, Power, and Energy.	2	2
Quizzes, Assignments	Lecture	ELECTROMAGNETIC WAVES IN DIELECTRIC MEDIA	1. Definitions. 2. Linear, Nondispersive, Homogeneous, and Isotropic Media.	2	3
Quizzes, Assignments	Lecture	Nonlinear, Dispersive, Inhomogeneous, or Anisotropic Media	1. Inhomogeneous Media. 2. Anisotropic Media. 3. Dispersive Media. 4. Nonlinear Media.	2	4
Quizzes, Assignments	Lecture	MONOCHROMATIC ELECTROMAGNETIC WAVES	1. Maxwell's Equations in a Medium 2. Intensity and Power	2	5
Quizzes, Assignments	Lecture	Linear, Nondispersive, Homogeneous, and Isotropic Media	1. Inhomogeneous Media 2. Dispersive Media	2	6
Mid-term Exam				2	7
Quizzes, Assignments	Lecture	ELEMENTARY ELECTROMAGNETIC WAVES	1.Plane, Spherical, and Gaussian Electromagnetic Waves. 2. The Transverse Electromagnetic (TEM) Plane Wave	2	8
Quizzes, Assignments	Lecture	The Spherical Wave	1. The Spherical Wave 2. paraxial approximation	2	9
Quizzes, Assignments	Lecture	The Gaussian Beam	1. The Gaussian Beam 2. The Paraboloidal Wave and the Gaussian Beam	2	10
Quizzes, Assignments	Lecture	The Gaussian Beam	1.Parameters of a Gaussian beam. 2.Determination of a beam with given	2	11

			width and curvature.		
Quizzes, Assignments	Lecture	ABSORPTION	1.Absorption 2.Weakly Absorbing Media	2	12
Quizzes, Assignments	Lecture	ABSORPTION	1.Dilute Absorbing Medium 2.Strongly Absorbing Media	2	13
Quizzes, Assignments	Lecture	Dispersion	1. Dispersion 2. Measures of Dispersion	2	14
Quizzes, Assignments	Lecture	Dispersion	1. The Kramers Kronig Relations 2. The Resonant Medium	2	15

11. Course Evaluation

daily preparation → 5

Quiz → 25

Assignment → 30

monthly exams → 30

.....average → 30

final exam →70

12. Learning and Teaching Resources

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

Course Description Form (M.SC)

5. Course Name:
Advance Solid State Physics
6. Course Code :
7. Semester / Year
Second semester 2025/2026
4. Description Preparation Date:
13/2/2026
5. Available Attendance Forms:
Attendance in classrooms
6.Number of Credit Hours (Total) / Number of Units (Total)
2 hours/ units
8. 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
• **Give a review for crystalline structure and types of previous lattices.** **Defined Energy levels in 1D and 3D, Hall effect for the semiconductors, Free Electron Theory of Metals, Lorentz Theory ...etc.**
9. Teaching and Learning Strategies
Integrate theoretical foundations of Solid State physics with hands-on practical experience and Real-world application

10. Course Structure					
Evaluation method	Learning method	Unit or subject name	Required Learning Outcomes	Hours	Week
Questions and discussion	Lecture	**Introduction of Crystalline Structures**	Students will learn the Crystalline Structures	2	1
Questions and discussion	Lecture	**Energy levels in one dimension** **Energy levels in three dimension**	Students will learn Energy levels in 1D and 3D	2	2
Questions and discussion	Lecture	**The Free-electron theory**	Students will learn the **Free-electron theory**	2	3
Questions and discussion	Lecture	**MOTION IN MAGNETIC FIELDS**	Students will learn the magnetic field	2	4
Questions and discussion	Lecture	**Hall effect**	Students will learn the **Hall effect**	2	5
Questions and discussion	Lecture	**The Fermi Gas**	Students will learn the Fermi-Gas	2	6
Questions and discussion	Lecture	**Heat Capacity of Solids** **Einstein Model**	Students will learn the Heat capacity of Solid	2	7
Questions and discussion	Lecture	**Free Electron Theory of Metals**, **Electrical conductivity**	Students will learn the Electrical conductivity	2	8
Questions and discussion	Lecture	**Thermal Conductivity** **Wiedemann–Franz Law**	Students will learn the **Wiedemann–Franz Law**	2	9
Questions and discussion	Lecture	**Lorentz Theory, Relaxation Time Approximation**	Students will learn the **Relaxation Time Approximation**	2	10
Questions and discussion	Lecture	**Sommerfeld Theory of Metals**	Students will learn the **Sommerfeld Theory**	2	11
Questions and discussion	Lecture	**Fermi–Dirac Distribution Function**	Students will learn the Fermi Dirac and	2	12

		Thermodynamic Potential **Entropy**	entropy		
Questions and discussion	Lecture	**Fermi Function Integration Formula**	Students will learn the Fermi function	2	13
Questions and discussion	Lecture	**Heat Capacity of a Fermi Gas** **Electrical and Thermal Conductivities**	Students will learn the Heat capacity	2	14
Questions and discussion	Lecture	**Magnetoconductivity** **Dielectric Function**	Students will learn the **Dielectric Function**	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), Introduction of Solid state Physics by (Queen)
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form (M.SC)

9. Course Name:
Advance Solid State Physics
10. Course Code :
11. Semester / Year
Second semester 2025/2026
4. Description Preparation Date:
13/2/2026
5. Available Attendance Forms:
Attendance in classrooms
6.Number of Credit Hours (Total) / Number of Units (Total)
2 hours/ units
12. 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
• **Give a review for crystalline structure and types of previous lattices.** **Defined Energy levels in 1D and 3D, Hall effect for the semiconductors, Free Electron Theory of Metals, Lorentz Theory ...etc.**
9. Teaching and Learning Strategies
Integrate theoretical foundations of Solid State physics with hands-on practical experience and Real-world application

10. Course Structure					
Evaluation method	Learning method	Unit or subject name	Required Learning Outcomes	Hours	Week
Questions and discussion	Lecture	**Introduction of Crystalline Structures**	Students will learn the Crystalline Structures	2	1
Questions and discussion	Lecture	**Energy levels in one dimension** **Energy levels in three dimension**	Students will learn Energy levels in 1D and 3D	2	2
Questions and discussion	Lecture	**The Free-electron theory**	Students will learn the **Free-electron theory**	2	3
Questions and discussion	Lecture	**MOTION IN MAGNETIC FIELDS**	Students will learn the magnetic field	2	4
Questions and discussion	Lecture	**Hall effect**	Students will learn the **Hall effect**	2	5
Questions and discussion	Lecture	**The Fermi Gas**	Students will learn the Fermi-Gas	2	6
Questions and discussion	Lecture	**Heat Capacity of Solids** **Einstein Model**	Students will learn the Heat capacity of Solid	2	7
Questions and discussion	Lecture	**Free Electron Theory of Metals**, **Electrical conductivity**	Students will learn the Electrical conductivity	2	8
Questions and discussion	Lecture	**Thermal Conductivity** **Wiedemann–Franz Law**	Students will learn the **Wiedemann–Franz Law**	2	9
Questions and discussion	Lecture	**Lorentz Theory, Relaxation Time Approximation**	Students will learn the **Relaxation Time Approximation**	2	10
Questions and discussion	Lecture	**Sommerfeld Theory of Metals**	Students will learn the **Sommerfeld Theory**	2	11
Questions and discussion	Lecture	**Fermi–Dirac Distribution Function**	Students will learn the Fermi Dirac and	2	12

		Thermodynamic Potential **Entropy**	entropy		
Questions and discussion	Lecture	**Fermi Function Integration Formula**	Students will learn the Fermi function	2	13
Questions and discussion	Lecture	**Heat Capacity of a Fermi Gas** **Electrical and Thermal Conductivities**	Students will learn the Heat capacity	2	14
Questions and discussion	Lecture	**Magnetoconductivity** **Dielectric Function**	Students will learn the **Dielectric Function**	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), Introduction of Solid state Physics by (Queen)
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

13. Course Name
Adv. Research Methodology
14.Course Code :
15.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)
2 hours/ 2 units
16.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
17.Course Objectives

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

- **Establish Scientific Foundations**: Define the core concepts of scientific research and understand the fundamental goals and assumptions of the scientific method.
- **Classify Research Methodologies**: Distinguish between various types of scientific research and categorize different forms of academic writing, including original research, review papers, and short communications.
- **Master Topic Selection**: Develop the ability to identify research gaps within a specific field to select original, feasible, and significant research topics.

- **Construct Research Components**: Gain proficiency in drafting the essential elements of a study, specifically the research introduction, problem statement, objectives, and hypotheses.
- **Develop Synthesis Skills**: Learn to search for, summarize, and critically analyze previous studies to build a robust literature review.
- **Perfect Abstract Composition**: Master the art of writing concise, informative abstracts that accurately

reflect the research problem, methodology, and key results while adhering to international word count constraints.

- **Navigate Academic Publishing**: Acquire the skills to select reputable journals (indexed in Scopus or Web of Science), identify predatory journals, and understand the peer-review process.
- **Uphold Research Integrity**: Apply rigorous academic honesty standards to avoid plagiarism and master professional academic phrasing and punctuation.
- **Implement Reference Management**: Gain practical expertise in using citation styles (such as APA, MLA, or Harvard) and utilizing digital tools like EndNote, or Mendeley for bibliography organization.

9. Teaching and Learning Strategies

• **Interactive Lectures:** Presenting basic concepts of scientific research methodology while engaging students in discussions, Q&A, and analysis of research examples.

•**Problem-Based Learning (PBL):** Assigning students to study real research problems and formulate them as research questions or scientific hypotheses.

•**Project-Based Learning:** Requiring students to prepare a comprehensive Research Proposal, including the problem, objectives, methodology, and data collection tools.

•**Scientific Seminars:** Discussing published research from peer-reviewed journals to analyze methodologies, results, and develop critical thinking skills.

•**Guided Self-Learning:** Assigning students to review modern scientific sources and write reports or literature reviews related to their specializations.

10. Course Structure

Evaluation method	Learning method	Unit or subject name	Required Learning Outcomes	Hours	Week
Quizzes, Assignments	Lectures & Class Discussions	Definition of Scientific Research and its basic concepts	Understand the foundations of scientific research	2	1.
Quizzes, Assignments	Lectures & Class Discussions	Types of Scientific Research	Distinguish between types of scientific research	2	2.
Quizzes, Assignments	Lectures & Class Discussions	What is a Research Paper?	Distinguish between types of research papers (review, original, short)	2	3.
Quizzes, Assignments	Lectures & Class Discussions	How to Choose a Research Topic	Criteria for selecting a research topic; analyzing research gaps; formulating	2	4.

			clear topics		
Quizzes, Assignments	Lectures & Class Discussions	Scientific Research Introduction and its content	Identify key elements of the introduction: background, problem, objectives, significance, and hypotheses	2	5.
Quizzes, Assignments	Lectures & Class Discussions	Literature Review (Previous Studies)	Searching for previous studies in databases; critical analysis and summary of literature	2	6.
Mid-term Exam					7.
Quizzes, Assignments	Lectures & Class Discussions	How to Write a Research Abstract	Purpose of an abstract; writing a clear abstract (problem, objectives, methodology, results)	2	8.
Quizzes, Assignments	Lectures & Class Discussions	Characteristics of a Good Abstract	Characteristics of a good abstract	2	9.
Quizzes, Assignments	Lectures & Class Discussions	Academic Writing Style	Academic writing styles	2	10.
Quizzes, Assignments	Lectures & Class Discussions	Journal Selection Criteria & Indexed Journals (Scopus/WoS)	Distinguish reputable vs. predatory journals; peer-review process; cover letters	2	11.
Quizzes, Assignments	Lectures & Class Discussions	Scientific Journal Requirements	Evaluating research abstracts; aligning with international publishing standards	2	12.
Quizzes, Assignments	Lectures & Class Discussions	Avoiding Scientific Plagiarism	Using formal academic language; cohesion; grammar/punctuation; avoiding plagiarism	2	13.
Quizzes, Assignments	Lectures & Class Discussions	Preparing Sources and References	Primary vs. secondary sources; citation styles (APA, MLA, etc.); reference management tools (EndNote, Zotero)	2	14.
Second Exam					15.

11. Course Evaluation	
Quiz → 10 Assignment → 10 monthly exams → 10 final exam → 70	
12. Learning and Teaching Resources	
Required textbooks	
Main references (sources)	Kumar, R. (2021). *Research Methodology: A Step-by-Step Guide for Beginners*. 5th Edition
Recommended books and references (scientific journals, reports...)	Creswell, J. W. (2018). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. 5th Edition.
Electronic References, Websites	

Course Description Form

1. Course Name: Advanced English language
2. Course Code:
3. Semester / Year: 1st semester /2025-2026
4. Description Preparation Date: 01-09-2025
5. Available Attendance Forms: onsite (classroom)
6. Number of Credit Hours (Total) / Number of Units (Total)
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	2	Reading skills, writing skills, vocabulary development	Unit 1: International student	Presentation (ppt) with participating students throw readings, solve exercises	homework
2	2	Reading skills, writing skills, vocabulary development	Unit 1: International student	Presentation (ppt) with participating students throw readings, solve exercises	homework
3	2	Reading skills, writing skills, vocabulary development	Unit 2: Where in the world	Presentation (ppt) with participating students throw readings, solve exercises	Quizzes
4	2	Reading skills, writing skills, vocabulary development	Unit 2: Where in the world	Presentation (ppt) with participating students throw readings, solve exercises	Quizzes

5	2	Reading skills, writing skills, vocabulary development	Unit 3: Newspaper articles	Presentation (ppt) with participating students throw readings, solve exercises	homework
6	2	Reading skills, writing skills, vocabulary development	Unit 3: Newspaper articles	Presentation (ppt) with participating students throw readings, solve exercises	homework
7	2	Reading skills, writing skills, vocabulary development	Unit 4: Modern technology	Presentation (ppt) with participating students throw readings, solve exercises	Quizzes
8	2	Reading skills, writing skills, vocabulary development	Unit 4: Modern technology	Presentation (ppt) with participating students throw readings, solve exercises	Quizzes
9	2	Reading skills, writing skills, vocabulary development	Unit 5: Conferences and visits	Presentation (ppt) with participating students throw readings, solve exercises	homework
10	2	Reading skills, writing skills, vocabulary development	Unit 5: Conferences and visits	Presentation (ppt) with participating students throw readings, solve exercises	homework
11	2	Reading skills, writing skills, vocabulary development	Unit 1: *listening* Moving on	Presentation (ppt) with participating students throw readings, solve exercises	Quizzes
12	2	Reading skills, writing skills, vocabulary development	Unit 1: *listening* Moving on	Presentation (ppt) with participating students throw readings, solve exercises	Quizzes
13	2	Reading skills, writing skills, vocabulary development	Unit 2: *listening* Island states	Presentation (ppt) with participating students throw readings, solve exercises	Quizzes
14	2	Reading skills, writing skills, vocabulary	Unit 2: *listening* Island states	Presentation (ppt) with participating students throw	Quizzes

		development		readings, solve exercises	
15	2	Reading skills, writing skills, vocabulary development	Unit 2: *listening* Island states	Presentation (ppt) with participating students throw readings, solve exercises	Quizzes

11. Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	
12.	
	Headway, academic skills, level 2
	https://elt.oup.com/student/headway/nt/download?cc=global&selLanguage=

Course Description Form

13.	Course Name: Advanced English language
14.	Course Code:
15.	Semester / Year: 2nd semester /2025-2026
16.	Description Preparation Date: 01-09-2025
17.	Available Attendance Forms: onsite (classroom)
18.	Number of Credit Hours (Total) / Number of Units (Total)
19.	Course administrator's name (mention all, if more than one name)
Name: Nawrass N. Ameen Email: nawrass@mu.edu.iq	
20.	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.

21. 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.

22. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	**2**	Reading skills, writing skills, vocabulary development	Unit 6: Science and our world	Presentation (ppt) with participating students throw readings, solve exercises	homework
2	**2**	Reading skills, writing skills, vocabulary development	Unit 6: Science and our world	Presentation (ppt) with participating students throw readings, solve exercises	homework
3	**2**	Reading skills, Research, writing Skills	Unit 7: People: past and present	Presentation (ppt) with participating students throw readings, solve exercises	Quizzes
4	**2**	Reading skills, Research, writing Skills	Unit 7: Where in the world	Presentation (ppt) with participating students throw readings, solve exercises	Quizzes

5	**2**	Reading skills, writing skills, vocabulary, research	Unit 8: The world of IT	Presentation (ppt) with participating students throw readings, solve exercises	homework
6	**2**	Reading skills, writing skills, vocabulary, research	Unit 8: The world of IT	Presentation (ppt) with participating students throw readings, solve exercises	homework
7	**2**	Reading skills, writing skills, research	Unit 9: Inventions, discoveries, and processes	Presentation (ppt) with participating students throw readings, solve exercises	Quizzes
8	**2**	Reading skills, writing skills, research	Unit 9: Inventions, discoveries, and processes	Presentation (ppt) with participating students throw readings, solve exercises	Quizzes
9	**2**	Reading skills, writing skills, vocabulary development	Unit 10: Travel and tourism	Presentation (ppt) with participating students throw readings, solve exercises	homework
10	**2**	Reading skills, writing skills, vocabulary development	Unit 10: Travel and tourism	Presentation (ppt) with participating students throw readings, solve exercises	homework
11	2	listening skills, speaking skills, vocabulary development	Unit 3: *listening* Careers in the media	Presentation (ppt) with participating students throw readings, solve exercises	Quizzes
12	2	listening skills, speaking skills, vocabulary development	Unit 3: *listening* Careers in the media	Presentation (ppt) with participating students throw readings, solve exercises	Quizzes
13	2	listening skills, speaking skills, Research vocabulary development	Unit 4: *listening* Innovatio ns from nature	Presentation (ppt) with participating students throw readings, solve exercises	Quizzes
14	2	listening skills, speaking skills, Research	Unit 4: *listening* Innovatio ns from	Presentation (ppt) with participating students throw	Quizzes

		vocabulary development	nature	readings, solve exercises	
15	2	listening skills, speaking skills, vocabulary development	Unit 5: *listening* Conversation	Presentation (ppt) with participating students throw	Quizzes
				readings, solve exercises	

23. Recommended books and references (scientific journals, reports…)

Electronic References, Websites

24.

	Headway, academic skills, level 2
	https://elt.oup.com/student/headway/nt/download?cc=global&selLanguage=

18.Course Name
Advance Nuclear Physics
19.Course Code :
20.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)
2 hours/2 units
21.Course administrator's name (mention all, if more than one name)
The name: Prof. Dr. Hassan M.Jaber Al-Ta'ii Email: hassankirkukly@mu.edu.iq
8.Course Objectives
•
9. Teaching and Learning Strategies
10. Course Structure

Evaluation method	Learning method	Unit or subject name	Required Learning Outcomes	Hours	Week
Quizzes, Assign	Lecture, tutorial	INTRODUCTION TO NUCLEAR PHYSICS		2	

ments					
Quizzes, Assign ments	Lecture, tutorial	PERTINENT NUCLEAR PROPERTIES		2	
Quizzes, Assign ments	Lecture, tutorial	MODE OF RADIOACTIVE DECAY AND NUCLEAR REACTIONS		2	
Quizzes, Assign ments	Lecture, tutorial	RADIOACTIVE DECAY DYNAMIC		2	
Quizzes, Assign ments	Lecture, tutorial	QUANTUM MECHANICAL BEHAIVIOR OF NUCLEI		2	
Quizzes, Assign ments	Lecture, tutorial	NUCLEAR FORCES AND INTERACTIONS		2	
Mid-term Exam					
Quizzes, Assign ments	Lecture, tutorial	INTERACTION OF CHARGED PARTICLES WITH MATTER (DIRECT IONIZING RADIATION)		2	
Quizzes, Assign ments	Lecture, tutorial	INTERACTION OF GAMMA RAY WITH MATTER (INDIRECT IONIZING RADIATION)		2	
Quizzes, Assign ments	Lecture, tutorial	NEUTRON PHYSICS AND INTERACTIONS (INDIRECT IONIZING RADIATION)		2	
Quizzes, Assign ments	Lecture, tutorial	Cellular damage (mechanisms of radiation damage)		2	
Quizzes, Assign ments	Lecture, tutorial	Sensitivity to Radiation, Risks of radiation at Health Effects		2	
Quizzes, Assign ments	Lecture, tutorial	Radiation dose limits, Biological Effects of High Dose exposure: External and Internal Dose Calculation		2	

Quizzes, Assignments	Lecture, tutorial	Radiation Detectors		2	16
Second Exam					17

11. Course Evaluation
daily preparation → Quiz → Assignment → monthly exams → final exam →

12. Learning and Teaching Resources	
Required textbooks	Solid State Nuclear Detector Fundamental Nuclear Physics
Main references (sources)	Fundamental Nuclear Physics
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

22. Course Name:
Advanced Quantum Mechanics
23. Course Code :
24. Semester / Year
First semester 2025/2026
4. Description Preparation Date:
12/2/2026
5. Available Attendance Forms:
Attendance in classrooms
6.Number of Credit Hours (Total) / Number of Units (Total)
2 hours/ units
25. Course administrator's name (mention all, if more than one name)
The name: Prof. Dr. Hadey K. Mohamad Email: hadey.mohamad@mu.edu.iq; hadeyk2002@yahoo.com
8.Course Objectives
• **To understand the Simple Harmonic Oscillator by Dirac Representation, and Creation- Annihilation Operators Technique from given applications.** • **This course deals with angular momenta components operators in Quantum Mechanics.** • **To develop problem solving skills and understanding of spherically symmetrical systems problem through the application of techniques.** • **To perform Clebsch-Gordan Coefficients in Advanced Quantum Mechanics.**
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 Dirac's Operator Technique, and Raising- Lowering operators.**
- **Solve the simple harmonic oscillator problem by Dirac's Operator Technique.**
- **Evaluate Clebsch-Gordan Coefficients from given applications.**
- **Solve the perturbed harmonic oscillator problem.**
- **Study the time-independent Perturbation Theory.**
- **Obtain the Eigen values of energy of the perturbed harmonic oscillator problem.**

10. Course Structure

Evaluation method	Learning method	Unit or subject name	Required Learning Outcomes	Hours	Week
Questions and discussion	Lecture	**Simple Harmonic Oscillator using "Ladder Operator", Solution of Schrödinger's Equation using Creation and Annihilation Operators**	Students will learn the Ladder Operators	2	1
Questions and discussion	Lecture	**Matrix representations of raising and lowering operators, Problems, Angular Momentum**	Students will learn the Matrix representations	2	2
Questions and discussion	Lecture	**Angular Momentum Operators. Commutation Relations, Representation of Angular Momentum in Spherical**	Students will learn the Angular Momentum	2	3

		Polar Coordinates.	Operators.		
Solved problems	Lecture	**Eigenvaluesand Eigenfunction for L^2, Eigenvalues and Eigenfunction for the Components of Angula Momentum $\vec{L}$ (Spherical Harmonics).**	Students will learn the operators and commutation relations	2	4
		Examination 1		1.5	5
Questions and discussion	Lecture	**Ladder Operators, Representation of Orbital Angular Momentum Operator by Matrices.**	Students will learn the Angular Momentum Operators by Matrices	2	6
Questions and discussion	Lecture	**The Internal Angular Momentum, Commutation Relations.**	Students will learn the Spin Operator	2	7
Questions and discussion	Lecture	**Pauli Spin Matrices, Representation for Spin Angular Momentum Wave Function, Representation of an Operator in Spin Space.**	Students will learn the **Pauli Spin Matrices**	2	8
Questions and discussion	Lecture	**Eigenvalues and Eigenvectors for Spin-1/2 Particle, Eigenvalues and Eigenvectors for Spin-1 Particle.**	Students will learn the **Eigenvalues and Eigenvectors**	2	9
Questions and discussion	Lecture	**Generalized Angular Momentum, Relations between J^2, J_z, J_+ and J_-, Eigenvalue Spectrum for J^2 and J_z and Matrix Elements for J_+ and J_-**	Students will learn the **Generalized Angular Momentum**	2	10
Questions and discussion	Lecture	**Addition of (Total) Angular Momenta(Clebsch-Gordan**	Students will learn the **Addition of Total**	2	11

		Coefficients).	**Angular Momenta**		
		Examination 2		1.5	12
Questions and discussion	Lecture	**Approximation Method I: Time Independent Perturbation Theory, Evaluation of First Order Energy, Evaluation of First Order Wave Function.**	Students will learn the **Time Independent Perturbation Theory**	2	13
Questions and discussion	Lecture	**Evaluation of Second Order Energy, - Evaluation of Second Order Wave Function,** **Physical Application of Perturbation Theory.**	Students will learn the calculation of second order energy in Perturbation Theory	2	14
Questions and discussion	Lecture	**Approximation Method II: The Variation Method, The Mathematical Principle,**	Students will learn the **Approximation Method II**	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	1.Textbook of Quantum Mechanics, 2nd Edition, 20 authored by A.K.Saxena
Main references (sources)	2.Textbook of Quantum Mechanics, 2nd Edition, 20 authored by A.K.Saxena
Recommended books and references (scientific journals, reports...)	Quantum Mechanics 3. Davydov, 2nd Ed., 1976
Electronic References, Websites	

Course Description Form

1. Course Name
Advanced Renewable energy
2. Course Code :
Master degree
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)
2hours/ 2 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
• **To differentiate between conventional energy sources and renewable energy sources** and understand their characteristics in terms of sustainability, efficiency, and environmental impact. • **To understand the concept of energy and energy transformation** including different forms such as solar, wind, hydro, biomass, and geothermal energy. • **To apply fundamental energy conversion laws** in calculating power output, efficiency, and performance of renewable energy systems.

- **To understand the operating principles of solar energy systems**
including photovoltaic (PV) cells, solar thermal systems, and energy storage methods.

- **To analyze wind and hydro energy systems**
and evaluate the effects of wind speed, air density, water flow rate, and height on power generation.

- **To understand the principles of energy storage systems**
including batteries and other storage technologies, and calculate storage capacity and efficiency.

- **To analyze electrical components used in renewable energy systems**
such as charge controllers, inverters, converters, and grid-connected systems.

- **To understand different renewable energy system configurations**
including off-grid, on-grid, and hybrid systems.

- **To evaluate system performance using concepts such as power, efficiency, capacity factor, and energy losses.**

- **To develop problem-solving skills in designing and analyzing renewable energy systems**
including load estimation, system sizing, component selection, and basic economic evaluation.

9. Teaching and Learning Strategies

An advanced teaching strategy will be adopted for delivering the Renewable Energy course at the postgraduate level, focusing on deep theoretical understanding and the development of research-oriented analytical skills. The module will be delivered through specialized lectures, critical discussions of recent scientific publications, and in-depth analysis of emerging technologies and global trends in renewable energy systems.

Emphasis will be placed on the modeling, simulation, and optimization of solar, wind, and hybrid energy systems using advanced mathematical tools and software platforms. Students will critically evaluate the technical, economic, and environmental performance of renewable energy projects.

Furthermore, students will be required to conduct applied research, prepare technical reports and presentations, and develop innovative design proposals. This approach aims to enhance their ability to solve complex energy problems and make scientifically sound decisions in the field of renewable energy.

10. Course Structure

Evaluation method	Learning method	Unit or subject name	Required Learning Outcomes	Hours	Week
Direct Questions	Giving lectures	Introduction to Renewable Energy	**Acquiring knowledge**	2	1
Participation	Giving lectures	A Review of Thermal Sciences	**Acquiring cognitive skills**	2	2
Exam	Giving lectures	Fundamentals of Solar Energy	**Acquiring mathematical skills**	2	4
Participation	Giving lectures	**Solar Energy Applications**	**Developing intelligence skills**	2	5
Assignments	Giving lectures	**Wind Energy**	**Acquiring interpretive skills**	2	6
Exam	Giving lectures	**Hydropower**	**Acquiring cognitive skills**	2	7
Direct Questions	Giving lectures	**Geothermal Energy**	**Acquiring mathematical skills**	2	8
Participation	Giving lectures	**Biomass Energy**	**Acquiring interpretive skills**	2	9
Report	Giving lectures	**Ocean Energy**	**Acquiring problem-solving skills**	2	10
Exam	Giving lectures	**Hydrogen and Fuel Cells**	**Knowledge skills**	2	11
Participation	Giving lectures	**Economics of Renewable Energy**	**Mathematical skills**	2	12
Direct Questions	Giving lectures	**Energy**	**Intelligence skills**	2	13
Assignment	Giving lectures	**the Environment**	**Comprehension skills**	2	14
Questions	Giving lectures	**Preparatory week before the final Exam**	**Interpretive skills**	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	Fundamentals and Applications of Renewable Energy **MEHMET KANOĞLU**
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

1. Course Name
Advanced Materials Science
2. Course Code :
Master degree
3. Semester / Year
Second / 2025−2026
4. Description Preparation Date:
1−2−2026
5. Available Attendance Forms:
Attendance in classrooms
6.Number of Credit Hours (Total) / Number of Units (Total)
2hours/ 2 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
• **To differentiate between various classes of materials and their fundamental properties** such as metals, ceramics, polymers, and composites, and to understand their industrial and technological applications. • **To understand the microstructure of materials and its relationship to their properties** including crystal structure, defects, and atomic/molecular interactions. • **To apply physical and chemical principles to analyze material behavior** including mechanical, electrical, thermal, and magnetic properties of different materials.

- **To understand modern materials characterization and analysis techniques**
such as electron microscopy, X-ray diffraction, spectroscopy, and nanoscale imaging.

- **To apply theoretical principles in the design of functional and advanced materials**
including smart materials, nanomaterials, and energy-related materials (e.g., batteries, solar cells).

- **To develop the ability to analyze the relationship between processing, properties, and performance**
and understand how material properties can be tailored through manufacturing and treatment processes.

- **To analyze experimental data and theoretical models of materials**
and use them to solve problems related to mechanical, thermal, and electrochemical properties.

- **To understand the role of materials in modern engineering and technological applications**
such as renewable energy, electronics, aerospace, and nanotechnology.

- **To develop research skills and problem-solving abilities**
including experimental design, data collection, result analysis, and preparation of advanced scientific reports.

- **To encourage innovation and critical thinking in materials science**
by proposing novel solutions to materials-related challenges, analyzing technical and research problems, and evaluating material performance under different conditions.

9. Teaching and Learning Strategies

An advanced teaching strategy will be adopted for delivering the Advanced Materials Science course at the postgraduate level, with a strong emphasis on deep theoretical understanding and the development of independent research and critical analytical skills. The module will be delivered through specialized lectures, critical evaluation of contemporary research papers, and in-depth discussions of recent advancements in materials characterization, nanomaterials, smart materials, and functional materials.

Furthermore, students will be required to conduct literature reviews, present seminar topics, and develop research-based reports or proposals addressing current challenges in materials science. This strategy aims to strengthen their ability to analyze complex material systems, design innovative materials solutions, and contribute effectively to scientific and technological advancements in the field.

10. Course Structure

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

			Outcomes		
Direct Questions	Giving lectures	**Classification and Selection of Materials**	**Acquiring knowledge**	2	1
Participation	Giving lectures	**Atomic Structure, and Electronic Configuration**	**Acquiring cognitive skills**	2	2
Exam	Giving lectures	**Crystal Geometry, Structure and Defects**	**Acquiring mathematical skills**	2	4
Participation	Giving lectures	**Mechanical Properties of Materials and Mechanical Tests**	**Developing intelligence skills**	2	5
Assignments	Giving lectures	**Alloy Systems, Phase Diagrams and Phase Transformations**	**Acquiring interpretive skills**	2	6
Exam	Giving lectures	**Heat Treatment**	**Acquiring cognitive skills**	2	7
Direct Questions	Giving lectures	**Deformation of Materials**	**Acquiring mathematical skills**	2	8
Participation	Giving lectures	**Oxidation and Corrosion**	**Acquiring interpretive skills**	2	9
Report	Giving lectures	**Thermal and Optical Properties of Materials**	**Acquiring problem-solving skills**	2	10
Exam	Giving lectures	**Organic Materials: Polymers and Elastomers**	**Knowledge skills**	2	11
Participation	Giving lectures	**Composites**	**Mathematical skills**	2	12
Direct Questions	Giving lectures	**Nanostructured Materials**	**Intelligence skills**	2	13
Assignment	Giving lectures	**Superconductivity and Superconducting Materials**	**Comprehension skills**	2	14
Questions	Giving lectures	**ceramics**	**Interpretive skills**	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	Material Science S.L. KAKANI
Main references (sources)	
Recommended books and references (scientific journals, reports...)	
Electronic References, Websites	

Course Description Form

Course Name:
Advanced Classical Mechanics
Course Code :
Semester / Year
First semester 2025/2026
4. Description Preparation Date:
12/2/2026
5. Available Attendance Forms:
Attendance in classrooms
6.Number of Credit Hours (Total) / Number of Units (Total)
2 hours/ units
26. Course administrator's name (mention all, if more than one name)
The name: Prof. Dr. Hadey K. Mohamad Email: hadey.mohamad@mu.edu.iq; hadeyk2002@yahoo.com
8.Course Objectives
• **To understand Newton's 2nd and 3rd laws and the Lagrangian from given applications.** • **This course deals with the Lagrange and Hamilton's equations.** • **To develop problem solving skills and understanding of Holonomic and non-Holonomic systems** • **To perform the Hamilton's equations in different coordinate systems.**
9. Teaching and Learning Strategies
• **Derive and use the Lagrangian equations in many applications.**

- **Recognize how Lagrangian equations work on pullies systems.**
- **Summarize what is meant by variational principle.**
- **Solve the harmonic oscillator problem by Hamilton's equations.**
- **Solve the Holonomic and non-Holonomic systems .**
- **Study the central force problem.**

10. Course Structure

Evaluation method	Learning method	Unit or subject name	Required Learning Outcomes	Hours	Week
Questions and discussion	Lecture	**Survey of the elementary principles.**	Students will learn the mechanics of the system	2	1
Questions and discussion	Lecture	**D'Alemberts principle and Lagrange's equations**	Students will learn the Lagrange's equations	2	2
Questions and discussion	Lecture	**Applications on Newton's 2nd law and Lagrange's equations**	Students will learn the solutions of problems.	2	3
Solved problems	Lecture	**Equation of motion of pullies system.**	Students will learn the calculation of system acceleration.	2	4
		Examination 1		1.5	5
Questions and discussion	Lecture	**Hamilton's principle for Holonomic system**	Students will learn the Hamiltonian function	2	6
Questions and discussion	Lecture	**Hamilton's canonical equations of motion**	Students will learn the derived Hamilton's equations	2	7
Questions and discussion	Lecture	**Hamilton's equations from variational principle**	Students will learn the calculated Hamilton's	2	8

			equations		
Questions and discussion	Lecture	**Hamilton's equations in different coordinate systems**	Students will learn the equations of motion	2	9
Questions and discussion	Lecture	**Important systems: simple harmonic oscillator, simple pendulum, compound pendulum, bob pendulum.**	Students will learn the **calculated Lagrangian function**	2	10
Questions and discussion	Lecture	**Hamilton's principle for non-holonomic system**	Students will learn the equations of motion	2	11
		Examination 2		1.5	12
Questions and discussion	Lecture	**Equations of motion with constraints**	Students will learn important applications	2	13
Questions and discussion	Lecture	**Central Force Problem**	Students will learn the equations of motion in a central force field	2	14
Questions and discussion	Lecture	**Centrifugal energy and effective potential**	Students will learn the angular momentum of a body under central force	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	1. Classical Mechanics, 3rd Edition, 2000, authored by H. Goldstein.
Main references (sources)	2. Classical Mechanics, 3rd Edition, 2000, authored by H. Goldstein.
Recommended books and references (scientific journals, reports...)	3. Analytical Mechanics, 7thEdition,1988, authored G. Fowles
Electronic References, Websites	

Course Description Form

Course Name:
Advanced Quantum Mechanics
Course Code :
Semester / Year
First semester 2025/2026
4. Description Preparation Date:
12/2/2026
5. Available Attendance Forms:
Attendance in classrooms
6.Number of Credit Hours (Total) / Number of Units (Total)
2 hours/ units
27. Course administrator's name (mention all, if more than one name)
The name: Prof. Dr. Hadey K. Mohamad Email: hadey.mohamad@mu.edu.iq; hadeyk2002@yahoo.com
8.Course Objectives
• **To understand the Simple Harmonic Oscillator by Dirac Representation, and Creation- Annihilation Operators Technique from given applications.** • **This course deals with angular momenta components operators in Quantum Mechanics.** • **To develop problem solving skills and understanding of spherically symmetrical systems problem through the application of techniques.** • **To perform Clebsch-Gordan Coefficients in Advanced Quantum Mechanics.**

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 Dirac's Operator Technique, and Raising- Lowering operators.**
- **Solve the simple harmonic oscillator problem by Dirac's Operator Technique.**
- **Evaluate Clebsch-Gordan Coefficients from given applications.**
- **Solve the perturbed harmonic oscillator problem.**
- **Study the time-independent Perturbation Theory.**
- **Obtain the Eigen values of energy of the perturbed harmonic oscillator problem.**

10. Course Structure

Evaluation method	Learning method	Unit or subject name	Required Learning Outcomes	Hours	Week
Questions and discussion	Lecture	**Simple Harmonic Oscillator using "Ladder Operator", Solution of Schrödinger's Equation using Creation and Annihilation Operators**	Students will learn the Ladder Operators	2	1
Questions and discussion	Lecture	**Matrix representations of raising and lowering operators, Problems, Angular Momentum**	Students will learn the Matrix representations	2	2
Questions and discussion	Lecture	**Angular Momentum Operators. Commutation Relations, Representation of Angular Momentum in Spherical Polar Coordinates.**	Students will learn the Angular Momentum Operators.	2	3
Solved problems	Lecture	**Eigenvaluesand Eigenfunction for L^2, Eigenvalues and Eigenfunction for the Components of Angular Momentum $\vec{L}$ (Spherical Harmonics).**	Students will learn the operators and commutation relations	2	4

		Examination 1		1.5	5
Questions and discussion	Lecture	**Ladder Operators, Representation of Orbital Angular Momentum Operators by Matrices.**	Students will learn the Angular Momentum Operators by Matrices	2	6
Questions and discussion	Lecture	**The Internal Angular Momentum, Commutation Relations.**	Students will learn the Spin Operator	2	7
Questions and discussion	Lecture	**Pauli Spin Matrices, Representation for Spin Angular Momentum Wave Function, Representation of an Operator in Spin Space.**	Students will learn the **Pauli Spin Matrices**	2	8
Questions and discussion	Lecture	**Eigenvalues and Eigenvectors for Spin-1/2 Particle, Eigenvalues and Eigenvectors for Spin-1 Particle.**	Students will learn the **Eigenvalues and Eigenvectors**	2	9
Questions and discussion	Lecture	**Generalized Angular Momentum, Relations between J^2, J_z, J_+ and J_-, Eigenvalue Spectrum for J^2 and J_z and Matrix Elements for J_+ and J_-**	Students will learn the **Generalized Angular Momentum**	2	10
Questions and discussion	Lecture	**Addition of (Total) Angular Momenta(Clebsch-Gordan Coefficients).**	Students will learn the **Addition of Total Angular Momenta**	2	11
		Examination 2		1.5	12
Questions and discussion	Lecture	**Approximation Method I: Time Independent Perturbation Theory, Evaluation of First Order Energy, Evaluation of First Order Wave Function.**	Students will learn the **Time Independent Perturbation Theory**	2	13
Questions and discussion	Lecture	**Evaluation of Second Order Energy, - Evaluation of Second Order Wave Function, Physical Application of Perturbation Theory.**	Students will learn the calculation of second order energy in Perturbation	2	14

			Theory		
Questions and discussion	Lecture	**Approximation Method II: The Variation Method, The Mathematical Principle,**	Students will learn the **Approximation Method II**	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	1.Textbook of Quantum Mechanics, 2nd Edition, 20 authored by A.K.Saxena
Main references (sources)	2.Textbook of Quantum Mechanics, 2nd Edition, 20 authored by A.K.Saxena
Recommended books and references (scientific journals, reports...)	Quantum Mechanics 3. Davydov, 2nd Ed., 1976
Electronic References, Websites	

Course Description Form

28. Course Name
Advanced Mathematical Physics – M.Sc. in Physics
29.Course Code :
30.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)
2hours/2 units
31.Course administrator's name (mention all, if more than one name)
The name: Asst. Prof. Dr. Amer Himza Ali Email: rasha.lasereng@mu.edu.iq
8.Course Objectives
1- That the student should be familiar with and have a solid understanding of t mathematical functions used in physical applications, such as the Beta and Gam functions. 2- The ability to use these functions and others, and to understand their derivations.
9. Teaching and Learning Strategies
• **Interactive Lectures** Presentation of fundamental theoretical concepts using visual aids and applied examples to promote a deep understanding of mathematical principles.

• **In-Class Problem Solving**
Allocating part of the lectures and class sessions to discussing and solving problems.

• **Class Discussions**
Encouraging students to ask questions and actively participate in discussions to better understand complex ideas and connect them with practical applications.

• **Regular Homework Assignments**
Assigning periodic homework to enhance independent learning and develop problem-solving skills.

• **Group Activities**
Implementing group-based activities to analyze complex problems and develop teamwork and scientific communication skills.

• **Supplementary Reading**
Encouraging students to consult additional references and external readings to deepen their knowledge and broaden their understanding.

10. Course Structure

Evaluation method	Learning method	Unit or subject name	Required Learning Outcomes	Hours	Week
Quizzes, Assignments	Lecture, tutorial	Vector spaces (vector addition, inner product, distance, etc.).	The student learns how to apply algebraic operations in vector spaces.	2	18.
Quizzes, Assignments	Lecture, tutorial	Vector spaces (divergence and curl).	The student becomes familiar with how to apply the divergence operator and compute the curl of vector fields.	2	19.
Quizzes, Assignments	Lecture, tutorial	Vector spaces (differentiation and integration).	The student learns how to differentiate and integrate functions within vector spaces.	2	20.
Quizzes, Assignments	Lecture, tutorial	Vector spaces (selected applications, such as Stokes' and Gauss' theorems).	Connecting mathematical relationships to selected physical applications.	2	21.

Quizzes, Assignments	Lecture, tutorial	Tensor functions (single and double tensors).	The student becomes familiar with the different types of tensor functions.	2	22.
Quizzes, Assignments	Lecture, tutorial	Tensor functions (algebraic operations).	The student learns about algebraic operations and how to apply them to tensor functions.	2	23.
Mid-term Exam					24.
Quizzes, Assignments	Lecture, tutorial	The concept of a group and a subgroup.	The student becomes familiar with the concept of a group and a subgroup through their defining conditions.	2	25.
Quizzes, Assignments	Lecture, tutorial	Types of groups and their operations.	The student becomes familiar with the different types of groups.	2	26.
Quizzes, Assignments	Lecture, tutorial	Beta function.	The student becomes familiar with the mathematical concept of the Beta function and its applications.	2	27.
Quizzes, Assignments	Lecture, tutorial	Gamma function.	The student becomes familiar with the mathematical concept of the Gamma function and its applications.	2	28.
Quizzes, Assignments	Lecture, tutorial	Matrices (their types and algebraic operations).	The student learns what a matrix is, what its inverse is, and how to compute it.	2	29.
Quizzes, Assignments	Lecture, tutorial	Matrices (eigenvalues and eigenvectors).	The student learns algebraic operations, eigenvalues, and eigenvectors, and how to compute them.	2	30.
Quizzes, Assignments	Lecture, tutorial	Complex numbers (operations and functions).	The student learns what the field of complex numbers is and its relationship to real numbers.	2	31.
Second Exam					32.
11. Course Evaluation					

Quiz → 5 Assignment → 5 monthly exams → 20 final exam →70

12. Learning and Teaching Resources	
Required textbooks	
Main references (sources)	Mathematical Physics, By H.K.Dass, S. Chand and Company PVT.Ltd, 2008.
Recommended books and references (scientific journals, reports...)	Mathematical Physics A Modern Introduction to its Foundations, By Sadir Hassani, Spriger, 1999.
Electronic References, Websites	