

University of Mosul



First Cycle – Bachelor's Degree (B.Sc.) - Physics



Table of Contents

1. Overview
2. Undergraduate Modules 2023-2024
3. Contact

1. Overview

This catalogue is about the courses (modules) given by the program of Department of Physics to gain the Bachelor of Physics Science degree. The program delivers (50) Modules with (6000) total student workload hours and 240 total ECTS. The module delivery is based on the Bologna Process.

2. Undergraduate Courses 2025-2026

Module 1

| Code | Course/Module Title | ECTS | Semester |
|--|--------------------------------------|---------------|--------------|
| PHY1101 | Mechanics and properties of matter I | 8.00 | 1 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USSWL (hr/w) |
| 2 | 5 | 109 | 91 |
| Description | | | |
| The curriculum aims to develop analysis and innovation skills by addressing complex physical problems and applying mathematical models to find innovative solutions, documenting the steps accurately. It connects theory to application through experiments and simulations that study the effects of forces and stress on materials, providing students with practical experience relevant to the job market. The program enhances communication and creativity skills by presenting results methodically and developing innovative solutions using physical principles. The content includes theoretical lectures on units of the International System, motion studies, Newton's laws, and friction, as well as practical laboratory work to reinforce applied understanding. | | | |

Module 2

| Code | Course/Module Title | ECTS | Semester |
|---|-----------------------|---------------|-------------|
| PHY1102 | Electricity | 8.00 | 1 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 5 | 109 | 91 |
| Description | | | |
| The educational program integrates modern technologies like artificial intelligence and renewable energy into curricula to prepare graduates qualified both theoretically and practically. It focuses on enhancing the quality of scientific research through specialized | | | |

graduate programs in electricity. The program develops students' creative communication skills via specialized courses and fosters teamwork through collaborative projects. It stays updated with advancements in electrical technologies while emphasizing ethical research practices. The curriculum includes theoretical lectures on electric charges and fields, alongside practical laboratories that help students understand direct and alternating current circuits, enhancing their skills in building electrical circuits.

Module 3

| Code | Course/Module Title | ECTS | Semester |
|---|-----------------------|---------------|-------------|
| PHY1103 | General Astronomy | 8.00 | 1 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 2 | 94 | 106 |
| Description | | | |
| <p>The course aims to enhance astronomical understanding and scientific analytical skills by analyzing fundamental astronomical phenomena and applying physical principles and mathematical models. It focuses on instilling the basics of scientific research in astronomy and promotes scientific integrity and social responsibility by discussing data accuracy and the importance of research. The course incorporates modern technologies like artificial intelligence in exploring astronomy. Upon completion, students will be able to identify and analyze astronomical problems, apply scientific knowledge to solve astronomical issues, and communicate concepts effectively. The content includes the study of the celestial sphere, the solar system, the moon, and stars, providing students with a solid knowledge base in astronomy.</p> | | | |

Module 4

| Code | Course/Module Title | ECTS | Semester |
|--|-----------------------|---------------|-------------|
| Sci-101 | Mathematics | 2.00 | 1 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | | 34 | 16 |
| Description | | | |
| <p>The course aims to develop students' ability to innovate by analyzing complex physical problems and applying physical principles and mathematical models to solve them. It links theory to application through partnerships with industrial institutions and enhances scientific research skills while developing graduate programs. The focus is on enhancing creative communication skills and ethical awareness, with a commitment to the highest ethical standards. It integrates modern technology, such as artificial intelligence, into the curriculum to prepare students both theoretically and practically. Learning outcomes include the ability to identify problems, apply scientific knowledge, design experiments, effective communication skills, ethical commitment, and keeping up with technological advancements.</p> | | | |

Module 5

| Code | Course/Module Title | ECTS | Semester |
|---|-----------------------|---------------|-------------|
| UOM101 | Arabic Language | 2.00 | 1 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 0 | 34 | 16 |
| Description | | | |
| <p>The course focuses on enhancing creative communication skills using innovative strategies and techniques, enabling students to effectively express their ideas. It also incorporates the integration of modern technology to facilitate the understanding of linguistic rules through interactive methods. Students' horizons are broadened by cultural understanding of how culture influences language and communication. The program includes effective communication skills, ethical and professional awareness, and promotes teamwork, strengthening students' collaborative abilities. Additionally, students are encouraged to stay updated on modern technological developments in linguistic fields and analyze textual data. The duration includes lectures on parts of speech and reading and writing skills.</p> | | | |

Module 6

| Code | Course/Module Title | ECTS | Semester |
|---|-------------------------|---------------|-------------|
| UOM104 | Democracy & Human Right | 2.00 | 1 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | | 34 | 16 |
| Description | | | |
| <p>The academic program aims to enhance students' ability to innovate by analyzing human rights issues using precise scientific methodologies. It promotes moral awareness, considering scientific ethics as a foundation for graduating responsible leaders who embrace human rights principles. Students become equipped to identify scientific problems related to rights, such as violations and discrimination, and to apply scientific knowledge to address social and legislative issues. The program includes concepts of ethical and professional awareness, emphasizing commitment to ethics related to human rights. Additionally, it encourages teamwork by involving students in groups to discuss and raise awareness of human rights. The program features a comprehensive introduction to human rights, their history, and international standards.</p> | | | |

Module 7

| Code | Course/Module Title | ECTS | Semester |
|--------------|---------------------------------------|---------------|-------------|
| PHY1214 | Mechanics and properties of matter II | 8.00 | 2 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 5 | 109 | 91 |
| Description | | | |

The curriculum aims to develop innovation skills by analyzing complex physical problems related to mechanics and material properties, applying physical principles and mathematical models to solve these issues. It enhances teamwork and international collaboration through group projects, encouraging participation with academic institutions outside the university. Students learn to identify and analyze problems accurately and apply scientific knowledge in practical contexts using concepts such as pressure and density. The curriculum also includes conducting experiments and physical tests in a precise scientific manner. Theoretical lectures cover topics like pressure in fluids and Bernoulli's equation, while practical experiments focus on measuring stiffness and studying vibrations.

Module 8

| Code | Course/Module Title | ECTS | Semester |
|--|-----------------------|---------------|-------------|
| PHY1215 | Magnetism | 8.00 | 2 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 5 | 109 | 91 |
| Description | | | |
| <p>The educational program focuses on integrating modern technologies such as artificial intelligence and renewable energy into curricula, contributing to the preparation of qualified graduates. It also emphasizes improving the quality of scientific research through the development of specialized graduate programs in magnetism. Creative communication skills are enhanced among students through specialized courses, and teamwork is encouraged through collaborative projects. The program includes staying updated with technological advancements in the field of magnetism and emphasizes the importance of ethical applications. Finally, the content includes theoretical lectures on magnetic fields and forces, as well as practical laboratories that cover Wheatstone bridges and various measurement experiments.</p> | | | |

Module 9

| Code | Course/Module Title | ECTS | Semester |
|---|-----------------------|---------------|-------------|
| PHY1217 | Mathematics 2 | 4.00 | 2 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 1 | 49 | 51 |
| Description | | | |
| <p>The course aims to develop students' innovative abilities by analyzing complex physical problems and applying physical principles and mathematical models to solve them. It connects theory to practice through partnerships with industrial institutions, enhancing research skills and developing graduate programs. The focus is on fostering creative communication skills and ethical awareness while upholding high ethical standards. The curriculum integrates modern technologies, such as artificial intelligence, to prepare students both theoretically and practically. Learning outcomes include identifying problems, applying scientific knowledge, designing experiments, effective communication skills, ethical commitment, and staying updated with technological advancements in the field.</p> | | | |

Module 10

| Code | Course/Module Title | ECTS | Semester |
|--|-----------------------|---------------|-------------|
| UOM103 | Computers | 3.00 | 2 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| | 3 | 49 | 26 |
| Description | | | |
| <p>The program focuses on developing students' ability to understand and innovate by analyzing computer hardware and software systems, and applying the scientific method to solve computing problems. Students will gain practical experience in hardware components and software layers to meet the challenges of the job market. They will also acquire foundational research knowledge in emerging topics such as cloud computing and open-source software, preparing them for graduate studies. Ethical awareness and professional responsibility will be emphasized, as students will understand the ethical dimensions of computing and adhere to professional standards. Learning outcomes include the application of scientific knowledge, effective communication skills, ethical awareness, and keeping up with technological developments.</p> | | | |

Module 11

| Code | Course/Module Title | ECTS | Semester |
|---|-----------------------|---------------|-------------|
| PHY1206 | General Chemistry | 5.00 | 2 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 3 | 79 | 46 |
| Description | | | |
| <p>The program focuses on fostering innovation through solving analytical problems and understanding chemical interactions and the behavior of reagents. It also includes linking theory to practice by explaining the principles of volumetric analysis and selecting optimal conditions. The program enhances creative communication skills and environmental sustainability, enabling students to handle chemical information across various fields. It aims to develop students' abilities to analyze information accurately and apply scientific knowledge in practical settings. The content includes theoretical lectures on quantitative analysis and volumetric methods, as well as practical labs covering acid-base, precipitation, and oxidation-reduction.</p> | | | |

Module 12

| Code | Course/Module Title | ECTS | Semester |
|--------------|-----------------------|---------------|-------------|
| UOM102 | English Language | 2.00 | 2 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | | 34 | 16 |

| Description |
|--|
| <p>This summary focuses on developing students' creative communication skills by enhancing their fundamental understanding of linguistic and communicative dimensions. It also promotes ethical awareness in language use, thereby fostering social responsibility. The program contributes to strengthening teamwork, enabling students to develop effective collaboration skills. Modern technology is integrated to improve reading skills and interaction with texts. The curriculum includes theoretical lectures on parts of speech, as well as strategies for vocabulary instruction. Basic skills in speaking, listening, reading, and writing are introduced gradually, with dedicated time for error correction sessions and feedback.</p> |

Module 13

| Code | Course/Module Title | ECTS | Semester |
|---|-----------------------|---------------|-------------|
| PHY2308 | Modern Physics 1 | 6.00 | 3 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 3 | 79 | 71 |
| Description | | | |
| <p>The modern physics curriculum aims to connect theory with application by enhancing partnerships with industrial and research institutions, providing practical training for students and preparing them for the job market. It promotes effective teamwork through collaborative projects that develop cooperation skills. Scientific knowledge is applied to address problems in engineering, medicine, technology, and energy, leading to innovative solutions that meet community needs. Students are committed to ethical research practices while considering environmental and social issues. Theoretical lectures cover topics such as special relativity, the particle and wave nature of waves, and atomic structure, enriching students' understanding of scientific principles.</p> | | | |

Module 14

| Code | Course/Module Title | ECTS | Semester |
|--|------------------------|---------------|-------------|
| PHY2309 | Heat and Thermodynamic | 6.00 | 3 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 3 | 79 | 71 |
| Description | | | |
| <p>This module focuses on the study of thermodynamics, aiming to develop innovation and scientific communication skills among students. It covers the four laws of thermodynamics, thermodynamic processes, and the behavior of energy and matter. Key concepts include energy, temperature, heat capacity, heat engines, and refrigerators. The module links theory to practice by providing hands-on experiences in partnership with industrial institutions, enabling students to gain practical skills that meet labor market needs. Additionally, it emphasizes the integration of modern technologies such as artificial intelligence and nanotechnology. Through this module, students acquire problem-solving abilities and effective communication skills, preparing them to contribute to research and the job market.</p> | | | |

Module 15

| Code | Course/Module Title | ECTS | Semester |
|--|------------------------|---------------|-------------|
| PHY23010 | Analytical Mechanics 1 | 5.00 | 3 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 2 | 64 | 61 |
| Description | | | |
| <p>This content focuses on developing innovative abilities by enabling students to create advanced mathematical and physical models to analyze mechanical phenomena systematically. It encourages the use of innovative mathematical tools to solve complex mechanics problems and motivates exploration of new applications in fields such as engineering, space, and robotics. Additionally, it enhances social communication skills through team projects that require collaboration and knowledge exchange, while promoting scientific sustainability. It also emphasizes ethical awareness, instilling values of scientific integrity and accuracy in results, and preparing students to meet high academic and professional research standards. Finally, it addresses the ability to analyze complex mechanical systems and apply advanced concepts effectively.</p> | | | |

Module 16

| Code | Course/Module Title | ECTS | Semester |
|--|-----------------------|---------------|-------------|
| PHY23011 | Analog Electronics | 5.00 | 3 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 3 | 79 | 46 |
| Description | | | |
| <p>The course covers key topics in electronics, starting with fostering innovation by understanding the role of analog electronics in technical applications. The content includes linking theory to practice by identifying circuit components and explaining key elements such as diodes and transistors. The curriculum involves identifying scientific problems and understanding semiconductors of n-type and p-type, as well as applying scientific knowledge through the analysis of diode and Zener circuits. It also focuses on conducting scientific tests to understand and analyze transistors. The practical section includes familiarization with devices and conducting experiments to enhance practical understanding.</p> | | | |

Module 17

| Code | Course/Module Title | ECTS | Semester |
|--------------|------------------------------------|---------------|-------------|
| UOM2050 | Crimes of the Baath regime in Iraq | 2.00 | 3 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | | 34 | 16 |
| Description | | | |

This course aims to introduce students to the concept of totalitarian and dictatorial regimes that exercise force and violence against their people. It focuses on the crimes committed by the Ba'athist regime during the period (1979-2003) against the Iraqi people of all sects and ethnicities, and the injustices they suffered. The course addresses international and humanitarian crimes, methods of torture, and practices of repression employed by the former regime.

Module 18

| Code | Course/Module Title | ECTS | Semester |
|---|-----------------------|---------------|-------------|
| PHY23112 | Mathematics III | 4.00 | 3 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 1 | 49 | 51 |
| Description | | | |
| <p>The course aims to develop students' innovative abilities by analyzing complex physical problems and applying physical principles and mathematical models to solve them. It connects theory to practice through partnerships with industrial institutions, enhancing research skills and developing graduate programs. The focus is on fostering creative communication skills and ethical awareness while upholding high ethical standards. The curriculum integrates modern technologies, such as artificial intelligence, to prepare students both theoretically and practically. Learning outcomes include identifying problems, applying scientific knowledge, designing experiments, effective communication skills, ethical commitment, and staying updated with technological advancements in the field.</p> | | | |

Module 19

| Code | Course/Module Title | ECTS | Semester |
|--|-----------------------|---------------|-------------|
| UOM2022 | English Language2 | 2.00 | 3 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | | 34 | 16 |
| Description | | | |
| <p>This summary focuses on developing students' creative communication skills by enhancing their fundamental understanding of linguistic and communicative dimensions. It also promotes ethical awareness in language use, thereby fostering social responsibility. The program contributes to strengthening teamwork, enabling students to develop effective collaboration skills. Modern technology is integrated to improve reading skills and interaction with texts. The curriculum includes theoretical lectures on parts of speech, as well as strategies for vocabulary instruction. Basic skills in speaking, listening, reading, and writing are introduced gradually, with dedicated time for error correction sessions and feedback.</p> | | | |

Module 20

| Code | Course/Module Title | ECTS | Semester |
|---------|---------------------|------|----------|
| UOM2032 | Computers 2 | 3.00 | 4 |

| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
|---|-----------------------|---------------|-------------|
| 1 | 2 | 49 | 26 |
| Description | | | |
| <p>The content focuses on several key areas, starting with the definition of networks, their types, and the functions of basic components such as routers and switches. It also covers the fundamentals of network security and common threats like viruses and DDoS attacks, in addition to e-commerce and electronic banking services. It reviews common hardware and software problems and troubleshooting techniques. The content includes an introduction to artificial intelligence, defining it, discussing its history, its role in smartphones, and its impact on society and international relations. It addresses ethical challenges related to artificial intelligence and concludes with a discussion on the future of AI, with a week allocated for final exam preparation.</p> | | | |

Module 21

| Code | Course/Module Title | ECTS | Semester |
|---|-----------------------|---------------|-------------|
| PHY24114 | Modern Physics 2 | 6.00 | 4 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 3 | 79 | 71 |
| Description | | | |
| <p>The modern physics curriculum connects theory to application by partnering with industrial and research institutions, providing practical training for students. It emphasizes teamwork through collaborative projects, enhancing cooperation skills. Students apply scientific knowledge to real-world problems in engineering, medicine, technology, and energy, contributing to innovative community solutions. Ethical research practices are emphasized, considering environmental and social impacts. The curriculum covers essential topics such as quantum mechanics, the Schrödinger equation, energy quantization, the quantum theory of the hydrogen atom, quantum numbers, the exclusion principle, and particle physics, ensuring a well-rounded understanding of modern physics.</p> | | | |

Module 22

| Code | Course/Module Title | ECTS | Semester |
|--|-------------------------------|---------------|-------------|
| PHY24015 | Thermodynamic and Statistical | 6.00 | 4 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 3 | 79 | 71 |
| Description | | | |
| <p>The course aims to cultivate analytical thinking and innovation in students for tackling complex physical problems through statistical concepts and models. It enhances research skills, preparing students for participation in advanced research and graduate programs. Emphasis is placed on developing scientific and creative communication skills, enabling clear and effective presentation of ideas and results. Additionally, the course instills ethical awareness and scientific responsibility in handling data and conducting physical research. Content covers an introduction to statistical</p> | | | |

mechanics, probabilistic concepts, statistical ensembles, partition functions, quantitative statistics, and applications in gases and solids, along with advanced topics in modern statistical mechanics.

Module 23

| Code | Course/Module Title | ECTS | Semester |
|---|------------------------|---------------|-------------|
| PHY24116 | Analytical Mechanics 2 | 5.00 | 4 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 2 | 64 | 61 |
| Description | | | |
| <p>This content focuses on enhancing the ability to innovate by enabling students to develop advanced mathematical and physical models to analyze mechanical phenomena. It encourages the use of innovative mathematical tools and methods to solve complex problems and motivates students to explore new applications in fields such as engineering and space. It also enhances social communication skills through teamwork and knowledge exchange while reinforcing values of scientific integrity and accuracy. Additionally, it addresses the ability to identify scientific problems and analyze mechanical systems accurately, demonstrating students' capacity to apply scientific concepts to solve real-world issues and keep up with technological advancements in modeling and analysis.</p> | | | |

Module 24

| Code | Course/Module Title | ECTS | Semester |
|---|-----------------------|---------------|-------------|
| PHY24017 | Digital Electronics | 5.00 | 4 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 3 | 79 | 46 |
| Description | | | |
| <p>The educational content includes the development of innovation and technological application skills through understanding the differences between digital and analog quantities, and using voltage levels to represent digital quantities. It also encompasses enhancing the understanding of basic logic functions such as NOT, AND, and OR, as well as analyzing logic circuits. Additionally, it focuses on applying knowledge in advanced arithmetic operations, such as distinguishing between half-adders and full-adders. The content is divided into two parts: the theoretical part that reviews the applications of the digital system, and the practical part that includes eight experiments to apply digital principles, providing students with a comprehensive understanding of digital concepts.</p> | | | |

Module 25

| Code | Course/Module Title | ECTS | Semester |
|--------------|-----------------------|---------------|-------------|
| UOM2012 | Arabic 2 | 2.00 | 4 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | | 34 | 16 |

| Description |
|--|
| The course focuses on enhancing creative communication skills using innovative strategies and techniques, enabling students to effectively express their ideas. It also incorporates the integration of modern technology to facilitate the understanding of linguistic rules through interactive methods. Students' horizons are broadened by cultural understanding of how culture influences language and communication. The program includes effective communication skills, ethical and professional awareness, and promotes teamwork, strengthening students' collaborative abilities. Additionally, students are encouraged to stay updated on modern technological developments in linguistic fields and analyze textual data. The duration includes lectures on parts of speech and reading and writing skills. |

Module 26

| Code | Course/Module Title | ECTS | Semester |
|--|-----------------------|---------------|-------------|
| PHY24018 | Sound and wave motion | 3.00 | 4 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 1 | 49 | 26 |
| Description | | | |
| The course focuses on developing innovation skills among students by analyzing acoustic and wave phenomena using scientific methodology and mathematical models. It encourages teamwork and the exchange of experiences in projects, integrating modern technology such as artificial intelligence in the study of sound. The content covers several chapters, starting from the basic concepts of wave motion, through free vibrations and the composition of movements, to forced vibrations and transverse and longitudinal waves. It also addresses ultrasound waves and their medical effects. The course concludes with a review of exam questions to enhance understanding. | | | |

Module 27

| Code | Course/Module Title | ECTS | Semester |
|--|-----------------------|---------------|-------------|
| PHY35019 | Geometrical Optics | 6.00 | 5 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 2 | 79 | 71 |
| Description | | | |
| The course aims to develop students' ability to analyze complex optical problems and apply physical principles and mathematical models to solve them innovatively. It connects theoretical concepts to practical applications through laboratory experiments and the use of modern optical devices, preparing graduates to meet the needs of industrial and research institutions. The course also integrates artificial intelligence and nanotechnology in the study of optical systems. Learning outcomes include identifying and analyzing problems using theoretical and experimental methods, applying scientific knowledge in various fields, and keeping up with technological advancements through the use of AI tools. The content covers the study of light properties, reflection, lenses, and factors affecting image quality. | | | |

Module 28

| Code | Course/Module Title | ECTS | Semester |
|--|-----------------------|---------------|-------------|
| PHY35020 | Laser Physics 1 | 6.00 | 5 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 2 | 79 | 71 |
| Description | | | |
| <p>This content emphasizes fostering innovation through the use of laser tools in education, particularly in physics and engineering. It aims to enhance the quality of scientific research and develop graduate programs in laser physics and photonics. The focus includes analyzing optical emission problems and understanding population inversion, as well as applying knowledge of laser system components and their principles. It also involves designing experiments to explore laser properties with modern measurement tools. Additionally, the importance of staying updated on laser technology advancements and their applications in science, industry, and medicine is highlighted, alongside the concept of light amplification through stimulated emission compared to traditional light sources.</p> | | | |

Module 29

| Code | Course/Module Title | ECTS | Semester |
|---|-----------------------|---------------|-------------|
| PHY35021 | Quantum Mechanics I | 5 | 5 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 2 | 64 | 61 |
| Description | | | |
| <p>The objectives of the Quantum Mechanics course focus on developing innovation and practical application skills through modern educational strategies that link theory to practice. Goals include improving the quality of scientific research and developing graduate programs, along with integrating modern technology into education. The course aims to prepare qualified graduates for the job market by applying scientific knowledge in various fields, such as electronics and renewable energy technologies. It also seeks to enhance effective communication skills, ethical awareness, teamwork, and keeping up with technological advancements. The course content includes studying fundamental concepts governing the behavior of physical systems at atomic and subatomic levels.</p> | | | |

Module 30

| Code | Course/Module Title | ECTS | Semester |
|--------------|-----------------------|---------------|-------------|
| PHY35022 | Material Physics 1 | 5 | 5 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 2 | 64 | 61 |
| Description | | | |

The program focuses on fostering innovation by enhancing students' abilities to analyze material properties and find innovative solutions to practical challenges. It also promotes communication and sustainability skills, training students to present the environmental applications of materials with a focus on sustainable technologies. Ethical awareness is instilled through studying the ethical aspects of materials research, which enhances scientists' responsibilities towards society and the environment. The program encourages international teamwork through collaborative projects and promotes the execution of scientific tests and data analysis. It also includes the development of communication skills, a commitment to research ethics, and keeping up with technological advancements in the field of materials.

Module 31

| Code | Course/Module Title | ECTS | Semester |
|--|-----------------------|---------------|-------------|
| PHY36029 | Molecular Physics | 4.00 | 5 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 1 | 49 | 51 |
| Description | | | |
| <p>The program focuses on fostering scientific innovation through the analysis and resolution of physical problems using precise methodologies. It also enhances communication and creativity skills to empower students to disseminate scientific knowledge and contribute to environmental sustainability. Additionally, it includes instilling ethical awareness and preparing scientists committed to ethical standards. The educational outcomes encompass the ability to identify scientific problems, apply knowledge to solve issues in chemistry and physics, conduct scientific experiments to explore the properties of molecules, and keep up with technological developments in computational modeling. The theoretical lectures include an introduction to types of molecules, bonds, energy, and spectra.</p> | | | |

Module 32

| Code | Course/Module Title | ECTS | Semester |
|--|-----------------------|---------------|-------------|
| PHY35025 | Elective 1 | 4.00 | 5 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 1 | 49 | 51 |
| Description | | | |
| <p>The curriculum aims to develop students' ability to innovate in nuclear medicine by analyzing complex diagnostic and therapeutic problems using precise scientific methodology. The department strengthens partnerships with hospitals to provide hands-on training in techniques such as MRI and CT scans, preparing students for the job market. The curriculum focuses on ethics in medical research to ensure responsible use of nuclear technologies. Students learn how to identify problems, apply scientific knowledge, conduct accurate experiments, and present scientific findings effectively. Topics include imaging concepts, radiation therapy, and positron emission therapy, equipping students for a comprehensive understanding of this vital field.</p> | | | |

Module 33

| Code | Course/Module Title | ECTS | Semester |
|---|-----------------------|---------------|-------------|
| PHY36026 | Physical Optics | 6.00 | 6 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 3 | 79 | 71 |
| Description | | | |
| <p>The Physical Optics course aims to enhance students' innovation skills by training them to visualize the behavior of light and analyze wave phenomena. It develops creative communication skills by transforming optical phenomena into visual models and promotes environmental sustainability through low-energy optical technologies. The course encourages teamwork by fostering collaboration in designing experiments and analyzing data. Learning outcomes include the ability to identify scientific problems, apply knowledge, and develop effective communication skills, along with ethical awareness and teamwork. The curriculum covers topics such as properties of light, electromagnetic waves, the Doppler effect, energy flow, polarization, and diffraction, providing a comprehensive understanding of optical principles.</p> | | | |

Module 34

| Code | Course/Module Title | ECTS | Semester |
|---|-----------------------|---------------|-------------|
| PHY36127 | Laser Physics 2 | 6.00 | 6 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 3 | 79 | 71 |
| Description | | | |
| <p>The principles of laser use contribute to various fields such as industry, medicine, communications, and scientific research. Key applications include laser cutting and welding, holography, lidar, and spectroscopy. Laser properties, such as coherence and monochromaticity, enhance the effectiveness of these applications. The advantages and disadvantages of lasers compared to traditional tools are recognized, along with the ability to identify optical emission problems and understand the role of population inversion. Knowledge about the components of a laser system and its operating principle is applied in diverse contexts, along with designing experiments to examine properties using modern tools. Technological developments are monitored to ensure maximum benefit.</p> | | | |

Module 35

| Code | Course/Module Title | ECTS | Semester |
|--------------|-----------------------|---------------|-------------|
| PHY36128 | Quantum Mechanics 2 | 5.00 | 6 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 2 | 64 | 61 |
| Description | | | |

The objectives of the Quantum Mechanics course focus on developing innovation and practical application skills through modern educational strategies that link theory to practice. Goals include improving the quality of scientific research and developing graduate programs, along with integrating modern technology into education. The course aims to prepare qualified graduates for the job market by applying scientific knowledge in various fields, such as electronics and renewable energy technologies. It also seeks to enhance effective communication skills, ethical awareness, teamwork, and keeping up with technological advancements. The course content includes studying fundamental concepts governing the behavior of physical systems at atomic and subatomic levels.

Module 36

| Code | Course/Module Title | ECTS | Semester |
|--|-----------------------|---------------|-------------|
| PHY36129 | Material physics 2 | 5.00 | 6 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 2 | 64 | 61 |
| Description | | | |
| <p>The program aims to foster innovation by developing students' abilities to analyze the properties of materials and find innovative solutions to practical challenges. It enhances communication and sustainability by training students to present the environmental applications of materials, with a focus on sustainable technologies such as renewable energy. The program also instills scientific ethics by studying the ethical aspects of materials research. Additionally, it encourages international teamwork through the implementation of collaborative projects. The program includes conducting scientific tests on the properties of materials, analyzing data, and writing clear reports. It emphasizes keeping up with technological advancements and concludes with a final exam to assess the knowledge gained.</p> | | | |

Module 37

| Code | Course/Module Title | ECTS | Semester |
|---|-----------------------|---------------|-------------|
| PHY36031 | Nano physics | 5.00 | 6 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 1 | 49 | 51 |
| Description | | | |
| <p>The course provides an introduction to nanotechnology, including essential definitions and terms. It reviews the properties of nanomaterials, such as optical, electrical, and mechanical properties at the nanoscale, along with their various classifications. The techniques used for synthesizing nanomaterials include both physical and chemical methods, as well as characterization techniques such as scanning electron microscopy, transmission electron microscopy, and atomic force microscopy (AFM). Spectroscopic analysis, including ultraviolet-visible light, Fourier-transform infrared spectroscopy, and X-ray diffraction (XRD), is utilized for material characterization. The course covers nanotechnology applications in electronics and their impacts on nature, offering a review and future outlook, along with opportunities for students to present and discuss their projects.</p> | | | |

Module 38

| Code | Course/Module Title | ECTS | Semester |
|--|-----------------------|---------------|-------------|
| PHY35025 | Elective 2 | 5.00 | 6 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 1 | 49 | 51 |
| Description | | | |
| <p>The course aims to enhance logical thinking and solve complex problems using artificial intelligence techniques, where students learn to select appropriate algorithms and evaluate their performance. It also seeks to apply theoretical concepts in various fields such as medicine and industry. The course focuses on developing scientific research skills through projects that address applications of artificial intelligence in data analysis and computer vision. Ethical values are instilled in the design of intelligent systems, emphasizing responsibility towards privacy and fairness. Additionally, it enables students to keep up with technological advancements through continuous learning and the use of modern programming tools.</p> | | | |

Module 39

| Code | Course/Module Title | ECTS | Semester |
|---|-----------------------|---------------|-------------|
| PHY47033 | Nuclear physics 1 | 6 | 7 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 3 | 79 | 71 |
| Description | | | |
| <p>The program focuses on enhancing innovation in education through the analysis of complex physical problems, such as magnetic dipole and quadruple electric moment, and the application of precise scientific methodologies. It also connects theory to practice to prepare students in the field of radiation, thereby meeting labor market needs. In addition, it supports improving research quality through advanced studies on the interaction of radiation with matter. It encourages teamwork by organizing projects on the production of radioactive isotopes. The program aims to develop skills in problem identification, knowledge application, experimental design, and presentation, which enhances students' ability to communicate scientific concepts effectively.</p> | | | |

Module 40

| Code | Course/Module Title | ECTS | Semester |
|--|-----------------------|---------------|-------------|
| PHY47034 | Solid State Physics 1 | 6 | 7 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 3 | 79 | 71 |
| Description | | | |
| <p>The program focuses on fostering innovation by analyzing complex physical problems, such as</p> | | | |

network dynamics. It connects theory to practice, enhancing students' qualifications in necessary skill areas and improving the quality of scientific research and the development of graduate programs. The program also encourages creative skills and effective communication among students, making them ambassadors of science. Additionally, it aims to promote ethical awareness and prepare scientists committed to high standards. It fosters teamwork and international cooperation, integrating modern technologies, such as artificial intelligence, into the curriculum. The program also includes learning mathematical equations and enhancing students' abilities to apply physical concepts.

Module 41

| Code | Course/Module Title | ECTS | Semester |
|---|--------------------------|---------------|-------------|
| PHY47035 | Electromagnetic Theory 1 | 5 | 7 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 2 | 64 | 61 |
| Description | | | |
| <p>The Electromagnetic Theory I course aims to develop students' innovation skills by analyzing complex electromagnetic phenomena and formulating them mathematically using Maxwell's methodology. Students will apply fundamental laws and advanced mathematical models to derive and analyze solutions, with comprehensive documentation of hypotheses and steps. The department also seeks to connect theory to practice by enhancing partnerships with telecommunications, energy, and technology industries. Students will be guided to apply theoretical concepts in practical projects and real-world case studies, enabling them to acquire direct technical skills and qualify for careers in fields such as telecommunications engineering and precision instruments.</p> | | | |

Module 42

| Code | Course/Module Title | ECTS | Semester |
|--|-----------------------|---------------|-------------|
| PHY47036 | Research Methodology | 3 | 7 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | | 34 | 41 |
| Description | | | |
| <p>The course on Research Methodology is an academic study aimed at teaching students the fundamental principles of scientific research. It explains the concept of research and its importance while discussing various types of research, such as quantitative and qualitative. The course covers how to design a research project, identify problems, and formulate hypotheses, along with strategies for data collection and analysis using statistical tools. Additionally, it instructs students on how to write research reports logically and coherently, emphasizing the significance of ethics in research. Through this course, students acquire the necessary skills to conduct their own research and critically evaluate scientific studies.</p> | | | |

Module 43

| Code | Course/Module Title | ECTS | Semester |
|------|---------------------|------|----------|
|------|---------------------|------|----------|

| | | | |
|--|------------------------------|----------------------|--------------------|
| PHY47038 | Plasma physics | 5.00 | 7 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 2 | 64 | 61 |
| Description | | | |
| <p>The course aims to enhance students' ability to innovate by analyzing complex physical problems using a precise scientific methodology, in addition to connecting theory with practice through partnerships with industrial and research institutions to meet labor market needs. It also seeks to improve the quality of scientific research in plasma physics, preparing a generation of researchers. The course includes developing students' creative communication skills, enabling them to become ambassadors of science. Students utilize physical knowledge to address plasma-related problems and deliver impactful scientific presentations, while keeping up with technological developments through self-learning, courses, and scientific workshops.</p> | | | |

Module 44

| | | | |
|---|------------------------------|----------------------|--------------------|
| Code | Course/Module Title | ECTS | Semester |
| PHY47039 | Elective3 | 5.00 | 7 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 2 | 64 | 61 |
| Description | | | |
| <p>The course focuses on developing innovation and technological application skills in students through the design of solar systems using project-based learning. It also aims to improve the quality of scientific research and equip students with the necessary knowledge to understand the scientific foundations of solar energy. Additionally, it covers the explanation of the solar constant and the movement of the sun to enhance a deep understanding of the principles of solar energy. The course integrates modern technology in the direct conversion of solar energy into photovoltaic energy. Educational outcomes include the ability to identify scientific problems, apply scientific knowledge, conduct experiments, and keep up with technological developments, thereby enhancing students' opportunities in the job market.</p> | | | |

Module 45

| | | | |
|---|------------------------------|----------------------|--------------------|
| Code | Course/Module Title | ECTS | Semester |
| PHY48140 | Nuclear Pysics 2 | 6 | 8 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 3 | 79 | 71 |
| Description | | | |
| <p>The program focuses on enhancing innovation by empowering students to analyze complex physical problems, such as magnetic dipole and quadruple electric moment, and applying precise scientific methodologies. Additionally, the program strengthens the connection between theory and practice to prepare students in the field of radiation, thereby meeting labor</p> | | | |

market needs. Research quality is improved through studies on the interaction of radiation with matter, and the program encourages teamwork through projects on the production of radioactive isotopes. The program aims to develop skills in problem identification, knowledge application, experimental design, and report preparation, which enhances students' ability to communicate scientific concepts effectively.

Module 46

| Code | Course/Module Title | ECTS | Semester |
|--|-----------------------|---------------|-------------|
| PHY48141 | Solid State Physics 2 | 6 | 8 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 3 | 79 | 71 |
| Description | | | |
| <p>The program focuses on developing students' ability to innovate by analyzing errors in classical or quantum band theory and studying the properties of semiconductor materials. It connects theory with practice through partnerships with industrial institutions, preparing graduates for the job market. It also aims to improve the quality of scientific research in solid-state physics and develop creative communication skills. The program enhances students' ethical awareness regarding manufacturing techniques and the challenges in semiconductor fabrication. It encourages teamwork and collaboration, while students keep up with technological developments in this field through research projects and practical experiments. The content includes theoretical lectures and practical laboratories.</p> | | | |

Module 47

| Code | Course/Module Title | ECTS | Semester |
|---|--------------------------|---------------|-------------|
| PHY48142 | Electromagnetic Theory 2 | 5 | 8 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 2 | 64 | 61 |
| Description | | | |
| <p>The Electromagnetic Theory II course aims to develop students' innovation skills by analyzing complex electromagnetic phenomena and formulating them mathematically using Maxwell's methodology. Students will be able to apply fundamental laws and advanced mathematical models to derive and analyze solutions. The course seeks to connect theory to practice by enhancing partnerships with telecommunications and energy institutions, enabling students to acquire direct technical skills. Learning outcomes include applying electromagnetic principles, effective communication skills, ethical awareness, teamwork, and keeping up with technological developments. The guiding content includes topics such as electric current, magnetic induction, electromagnetic induction, and Maxwell's equations.</p> | | | |

Module 48

| Code | Course/Module Title | ECTS | Semester |
|--|-----------------------|---------------|-------------|
| PHY48044 | Research project | 3 | 8 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 1 | 48 | 27 |
| Description | | | |
| <p>The graduation project in the fourth year for physics students is an academic experience aimed at applying the concepts and skills in physics that they have learned throughout their studies. The project requires students to select a research topic focused on specific physical phenomena or to develop mathematical models. Students work on designing experiments, collecting and analyzing data, and then presenting the results in a scientific report. The project encourages critical thinking and creativity, while enhancing research and communication skills. It aims to prepare students to face future academic and professional challenges and is considered an important step in their educational and professional journey.</p> | | | |

Module 49

| Code | Course/Module Title | ECTS | Semester |
|---|-----------------------|---------------|-------------|
| PHY48045 | Mathematical physics | 5.00 | 8 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 2 | 64 | 61 |
| Description | | | |
| <p>This academic program aims to develop students' skills in using matrices and complex functions to solve mathematical and physical problems. It focuses on fostering innovation, improving the quality of scientific research, and encouraging teamwork through applied projects. The program integrates modern technology, such as MATLAB, for analysis and simulation. Learning outcomes include: identifying and analyzing scientific problems, applying physics knowledge in engineering, medicine, and technology, designing precise scientific experiments, and keeping pace with technological advancements. The content covers: types of matrices and their operations, complex numbers and their properties, with practical applications in physics and electrical engineering.</p> | | | |

Module 50

| Code | Course/Module Title | ECTS | Semester |
|--------------|-----------------------|---------------|-------------|
| PHY48046 | Elective 4) | 5.00 | 8 |
| Class (hr/w) | Lect/Lab./Prac./Tutor | SSWL (hr/sem) | USWL (hr/w) |
| 2 | 2 | 64 | 61 |
| Description | | | |

The curriculum aims to enhance students' ability to innovate through the understanding of nuclear processes, such as fission and fusion. They are trained to analyze and formulate problems, contributing to the improvement of the quality of scientific research in nuclear physics. The curriculum also focuses on developing scientific communication skills and promoting ethical awareness among students. Topics include studying the energy extracted from nuclear fuel, understanding the principles of fusion, and designing scientific experiments to study plasma interactions. Additionally, neutron balances and challenges in nuclear waste management are addressed to provide students with a comprehensive understanding of applications and issues in this vital field.

5. **Contact**

Program Manager:

Ass. Prof. Dr. Samir Mahmoud Ahmed/ PhD in Renewable Energy / Assistant Professor
dr.samir@uomosul.edu.iq
07729221404

Program Coordinator:

Dr. Huda Muhammad Munir Abdulqadir/ PhD in Renewable Energy / Lecture
hu.muneer@uomosul.edu.iq
07702785643