Physics

Admission Requirements

- a BSc or equivalent degree in Physics or other natural science and engineering fields from a recognized University / College.
- Pass the entrance examination set by the department. The entrance exam should be in written form.
- Produce satisfactory undergraduate record suitable for the program.
- Willing to audit the course(s) that deemed appropriate for the program.
- Meet the general admission requirements set by the University.

List of Courses

I. Astrophysics

Learning Outcomes

The program in astrophysics aims at giving the students skills in modeling various astrophysical phenomena. Students specializing in observational astrophysics will obtain hand-on experience in observational techniques and data analysis at different wavelengths. Students will also learn programming, numerical and statistical methods, obtain basic knowledge of astrophysical spectroscopy, radiative processes and hydrodynamics, and study stellar physics, high-energy astrophysics, galaxies and cosmology.

Degree Nomenclature

The Degree of Master of Science in Physics (Astrophysics)
የሳይንስ ማስተር ዲግሪ በፊዚክስ (ስነ-ፈለግ)

Graduate Profile and Competency

The MSc in physics (Astrophysics) program aims to produce highly trained graduates who acquire knowledge and skills in basic and advanced physics principles, astrophysics, cosmology, analytical and numerical techniques, computations, data analysis and interpretations, and related science and technology facts, principles and techniques with their applications so that they can contribute for the advancement of science and technology in the country and for the economy development of the country. Upon completion of their study, graduates are expected to acquire observational measurements, theoretical frameworks and analytical approach that help to work their research independently. On successful completion, graduates will play key roles and become a driving force in sustaining the economy development of the country. In general the graduates are expected to:

- Have clear understanding on the physical basis of the operation of instruments used in physics.

- develop analytical skill to solve a problem by applying simple fundamental laws to more complicated situations;
- Develop skill on the essential mathematical descriptions of physical phenomena;
- Develop skills of numerical manipulations, analytical analysis, and data analysis using computer software.
- Acquainted with intellectual and communication skills necessary to present and articulate research findings in verbal and written formats.
- Be able to apply abstract concepts to real-world situations;
- Be capable of solving relatively complicated problems using approximations;
- Be capable of conducting research to facilitate the development of the country in science, technology and computations.
- Be capable of harmonically working with professionals in physics, astrophysics, space physics, mathematics, engineering, and other related technology discipline for the common good of society.

List of Courses

Compulsory courses

Course code	Course Title	ECTS
Phys 601	Mathematical methods	7
Phys 602	Computational Physics	7
Phys 603	Research development and writing	3
Phys 641	Classical Mechanics	7
Phys 681	Electromagnetic Theory	7
Phys 711	Graduate Lab	5
Phys 671	Physics of compact objects	7
Phys 672	Stellar Interior and evolution and Radiation measurements in astrophysics	7
Phys 674	High Energy Astrophysics	7
Phys 791	Seminar	3
Phys 799	MSc Thesis	30

Elective courses

A Graduate student specializing in Astrophysics has the option to choose from the following list of elective courses, but expected to take at least two of them.

Course code	Course Title	ECTS
Phys 771	Relativistic Astrophysics	7
Phys 772	Stellar structure and Evolution	7
Phys 773	Solar System and Planetary Science	7
Phys 774	Introduction to Plasma Physics	7
Phys 775	Plasma Astrophysics	7
Phys 776	Introduction to Cosmology	7
Phys 777	Galactic Dynamics and the ISM	7

Course Sequence

I- Regular/Summer Program

Year I, Semester I / Summer I		
Course code	**Course Title**	**ECTS**
Phys 601	Mathematical Methods	**7**
Phys 641	Classical Mechanics	**7**
Phys 681	Electromagnetic Theory	**7**
Phys 671	Physics of compact objects	**7**

Year I, Semester II / summer II		
Course code	**Course Title**	**ECTS**
Phys 602	Computational Physics	**7**
Phys 672	Stellar Interior and evolution and Radiation measurements in astrophysics	**7**
Phys 674	High Energy Astrophysics	**7**
Phys XXX	Elective I	**7**

Year II, Semester I / Summer III		
Course code	**Course Title**	**ECTS**
Phys 603	Research development and writing	**3**
Phys 711	Graduate Lab	**5**
Phys XXX	Elective II	**7**
Phys 791	Seminar	**3**

Year II, Semester II / Summer IV		
Course code	**Course Title**	**ECTS**
Phys 799	MSc Thesis	**30**

II- Extension Program

Year I, Semester I		
Course code	**Course Title**	**ECTS**
Phys 601	Mathematical Methods	**7**
Phys 641	Classical Mechanics	**7**
Phys 681	Electromagnetic Theory	**7**

Year I, Semester II		
Course code	**Course Title**	**ECTS**
Phys 602	Computational Physics	**7**
Phys 671	Physics of compact objects	**7**
Phys 672	Stellar Interior and evolution and Radiation measurements in astrophysics	**7**

Year II, Semester I		
Course code	**Course Title**	**ECTS**
Phys 711	Graduate Lab	**5**
Phys 674	High Energy Astrophysics	**7**
Phys XXX	Elective I	**7**

Year II, Semester II		
Phys XXX	Elective II	**7**
Phys 603	Research development and writing	**3**
Phys 791	Seminar	**3**
Year III		
Course code	**Course Title**	**ECTS**
Phys 799	MSc Thesis	**30**

II. Computational Physics

Learning Outcomes

The MSc in computational physics has the following learning outcomes. Computing competence represents a central element in scientific problem solving, from basic education and research to essentially almost all advanced problems in modern societies. Computing competence is simply central to further progress. It enlarges the body of tools available to students and scientists beyond classical tools and allows for a more generic handling of problems, focusing on algorithmic aspects results in deeper insights about scientific problems.

Degree Nomenclature

The Degree of Master of Science in Physics (Computational Physics)
የሳይንስ ማስተር ዲግሪ በፊዚክስ (ኮምፒዉቴሽናል ፊዚክስ)

Graduate Profile and Competency

The MSc in physics (Computational Physics) program aims to produce highly trained graduates who acquire knowledge and skills in physics, mathematics, algorithm, computer programing, numerical techniques, advanced computations, modelling and simulation, data interpretations, and related science and technology facts, principles and techniques with their applications so that they can contribute for the advancement of science and technology in the country and for the economy development of the country. Upon completion of their study, graduates are expected to acquire numerical computations, theoretical frameworks and analytical approach that help to work their research independently. On successful completion, graduates will play key roles and become a driving force in sustaining the economy development of the country. In general the graduates are expected to:

- Develop analytical skill to solve a problem by applying simple fundamental laws to more complicated situations;
- Develop skill on the essential mathematical descriptions of physical phenomena;
- Develop skills of numerical manipulations, analytical analysis, and data analysis using computer software.
- Modell and simulate physical phenomena, processes and systems.
- Acquire the necessary skill to write a programing code and scripts used for numerical solution of complicated mathematical relations and to perform different simulations.
- Acquainted with intellectual and communication skills necessary to present and articulate research findings in verbal and written formats.
- be able to apply abstract concepts to real-world situations;
- be capable of solving relatively complicated problems using approximations;
- be capable of conducting research to facilitate the development of the country in science, technology and computations

List of Courses

Compulsory Courses

Course code	Course Title	ECTS
Phys 601	Mathematical Methods	7
Phys 602	Computational Physics	7
Phys 603	Research development and writing	3
Phys 621	Statistical Mechanics	7
Phys 681	Electromagnetic Theory	7
Phys 711	Graduate Lab	5
Phys 625	Advanced Numerical Methods for Physicists	7
Phys 626	Modelling and Simulation Methods in Physics	7
Phys 628	Introduction to High Performance Computing	7
Phys 791	Seminar	3
Phys 799	MSc Thesis	30

Elective courses

A Graduate student specializing in Computational Physics has the option to choose from the following list of elective courses, but expected to take at least two of them.

Course code	Course Title	ECTS
Phys 726	Computational Condensed Matter Physics	7
Phys 727	Programming and Computer Science for Physicists	7
Phys 728	Introduction to Quantum Information and Quantum Computation	7
Phys 729	Computational Biophysics	7
Phys 641	Classical Mechanics	7
Phys 642	Quantum Mechanics	7
Phys 643	Atomic and Molecular Physics	7

Course Sequence

I- Regular/Summer Program

Year I, Semester I / Summer I		
Course code	**Course Title**	**ECTS**
Phys 601	Mathematical Methods	**7**
Phys 621	Statistical Mechanics	**7**
Phys 681	Electromagnetic Theory	**7**
Phys 625	Advanced Numerical Methods for Physicists	**7**

Year I, Semester II / summer II		
Course code	**Course Title**	**ECTS**
Phys 602	Computational Physics	**7**
Phys 626	Modelling Simulation Methods in Physics	**7**
Phys 628	Introduction to High Performance Computing	**7**
Phys XXX	Elective I	**7**

Year II, Semester I / Summer III		
Course code	**Course Title**	**ECTS**
Phys 603	Research development and writing	**3**
Phys 711	Graduate Lab	**5**
Phys XXX	Elective II	**7**
Phys 791	Seminar	**3**

Year II, Semester II / Summer IV		
Course code	**Course Title**	**ECTS**
Phys 799	MSc Thesis	**30**

II- Extension Program

Year I, Semester I		
Course code	**Course Title**	**ECTS**
Phys 601	Mathematical Methods	**7**
Phys 621	Statistical Mechanics	**7**
Phys 681	Electromagnetic Theory	**7**

Year I, Semester II		
Course code	**Course Title**	**ECTS**
Phys 602	Computational Physics	**7**
Phys 625	Advanced Numerical Methods for Physicists	**7**
Phys 626	Modelling and Simulation Methods in Physics	**7**

Year II, Semester I		
Course code	**Course Title**	**ECTS**
Phys 711	Graduate Lab	**5**
Phys 628	Introduction to High Performance Computing	**7**
Phys XXX	Elective I	**7**

Year II, Semester II		
Phys XXX	Elective II	**7**
Phys 603	Research development and writing	**3**
Phys 791	Seminar	**3**
Year III		
Course code	**Course Title**	**ECTS**
Phys 799	MSc Thesis	**30**

III. Condensed Matter Physics

Learning Outcomes

The MSc in condensed matter physics programme is designed to give specialization in the field for an enhanced preparation for an industrial career or further specialized studies in the field. It includes substantially increased breadth and depth of study, and an increased emphasis on technological application of the field. The dissertation project within the MSc in condensed matter physics programme includes an individual research/design project with strong industrial relevance and involvement. The programme provides opportunities for students to develop and demonstrate knowledge, understanding, skills, qualities and other attributes in the area.

Degree Nomenclature

The Degree of Master of Science in Physics (Condensed Matter Physics)
የሳይንስ ማስተር ዲግሪ በፊዚክስ (ኮንደንስድ ማተር ፊዚክስ)

Graduate Profile and Competency

The MSc in physics (Condensed matter physics) program aims to produce highly trained graduates who acquire knowledge and skills in basic and advanced physics principles, condensed matter, solid states, analytical and numerical techniques, computations, data analysis and interpretations, and related science and technology facts, principles and techniques with their applications so that they can contribute for the advancement of science and technology in the country and for the economy development of the country. Upon completion of their study, graduates are expected to acquire observational measurements, theoretical frameworks and analytical approach that help to work their research independently. On successful completion, graduates will play key roles and become a driving force in sustaining the economy development of the country. In general the graduates are expected to:

- Have clear understanding on the physical basis of the operation of instruments used in physics.
- Acquire a fundamental understanding of a range of physical phenomena in condensed matter systems
- Have clear understanding on the role of quantum effects in micro- and meso-scopic systems
- Develop analytical skill to solve a problem by applying simple fundamental laws to more complicated situations;
- Develop skill on the essential mathematical descriptions of physical phenomena;
- Develop skills of numerical manipulations, analytical analysis, and data analysis using computer software.
- Acquainted with intellectual and communication skills necessary to present and articulate research findings in verbal and written formats.
- Be able to apply abstract concepts to real-world situations;
- Be capable of solving relatively complicated problems using approximations;
- Be capable of conducting research to facilitate the development of the country in science, technology and computations.
- Be capable of harmonically working with professionals in physics, astrophysics, space physics, mathematics, engineering, and other related technology discipline for the common good of society.

List of Courses

Compulsory Courses

Course code	Course Title	ECTS
Phys 601	Mathematical Methods	7
Phys 602	Computational Physics	7
Phys 603	Research development and writing	3
Phys 621	Statistical Mechanics	7
Phys 631	Solid State Physics	7
Phys 642	Quantum Mechanics	7

Phys 681	Electromagnetic Theory	7
Phys 711	Graduate Lab	5
Phys 632	Principles of Condensed Matter	7
Phys 791	Seminar	3
Phys 799	MSc Thesis	30

Elective courses

A Graduate student specializing in Condensed Matter Physics has the option to choose from the following list of elective courses, but expected to take at least two of them.

Course code	**Course Title**	**ECTS**
Phys 643	Atomic and Molecular Physics	7
Phys 731	Electronic Structure of Condensed Matter	7
Phys 733	Advanced Condensed Matter Theory	7

Course Sequence

I- Regular/Summer Program

Year I, Semester I / Summer I		
Course code	**Course Title**	**ECTS**
Phys 601	Mathematical Methods	**7**
Phys 621	Statistical Mechanics	**7**
Phys 631	Solid State Physics	**7**
Phys 681	Electromagnetic Theory	**7**

Year I, Semester II / summer II		
Course code	**Course Title**	**ECTS**
Phys 602	Computational Physics	**7**
Phys 642	Quantum Mechanics	**7**
Phys XXX	Elective I	**7**
Phys 632	Principles of Condensed Matter	**7**

Year II, Semester I / Summer III		
Course code	**Course Title**	**ECTS**
Phys 603	Research development and writing	**3**
Phys 711	Graduate Lab	**5**
Phys XXX	Elective II	**7**
Phys 791	Seminar	**3**

Year II, Semester II / Summer IV		
Course code	**Course Title**	**ECTS**
Phys 799	MSc Thesis	**30**

II- Extension Program

Year I, Semester I		
Course code	**Course Title**	**ECTS**
Phys 601	Mathematical Methods	**7**
Phys 621	Statistical Mechanics	**7**
Phys 681	Electromagnetic Theory	**7**

Year I, Semester II		
Course code	**Course Title**	**ECTS**
Phys 602	Computational Physics	**7**
Phys 631	Solid State Physics	**7**
Phys 642	Quantum Mechanics	**7**

Year II, Semester I		
Course code	**Course Title**	**ECTS**
Phys 711	Graduate Lab	**5**
Phys XXX	Elective I	**7**
Phys 632	Principles of Condensed Matter	**7**

Year II, Semester II		
Phys XXX	Elective II	**7**
Phys 603	Research development and writing	**3**
Phys 791	Seminar	**3**
Year III		
Course code	**Course Title**	**ECTS**
Phys 799	MSc Thesis	**30**

IV. Medical Physics

Learning Outcomes

The University Training Course in Medical Physics aims at providing post-graduate training for physicists and university graduates of related disciplines in the field of medical physics with focus on tasks performed in hospitals and other clinical institutions. The curriculum of the Course is designed to provide both theoretical knowledge and practical skills in medical physics, thus enabling postgraduates of the Course to perform various tasks at hospitals and other clinical institutions as medical physicists in diagnosis and therapy as well as to hold a responsible position in the development and manufacture of novel medical devices at industrial enterprises producing medical devices. Besides, Medical physicists may participate professionally, for example, in the radiation treatment of cancer patients, in advanced diagnostic imaging procedures such as ultrasound, bio-magnetism, PET, CT, and MRI, and in related research, teaching and quality assurance.

The MSc degree provides students with rigorous education in essential graduate level physics courses as well as more customary coursework in medical physics, anatomy, and radiation biology. The traditional problem solving techniques emphasized in physics graduate education give students a unique perspective and enable them to address a wide variety of problems encountered in the modern medical environment. Such a fundamental education also allows them to evolve with the field of medical physics as it continues to embrace the most advanced technologies.

Degree Nomenclature

The Degree of Master of Science in Physics (Medical Physics)
የሳይንስ ማስተር ዲግሪ በፊዚክስ (ሜዲካል ፊዚክስ)

Graduate Profile and Competency

The MSc in physics (Medical physics) program aims to produce highly trained graduates who acquire knowledge and skills in basic and advanced physics principles, medical physics, radiation protection, operating and using medical instruments, analytical and numerical techniques, computations, data analysis and interpretations, and related science and technology facts, principles and techniques with their applications so that they can contribute for the advancement of science and technology in the country and for the economy development of the country. Upon completion of their study, graduates are expected to acquire observational measurements, theoretical frameworks and analytical approach that help to work their research independently. On successful completion, graduates will play key roles and become a driving force in sustaining the economy development of the country. In general the graduates are expected to:

- Have clear understanding on the physical basis of the operation of instruments used in physics.
- Acquaint with all necessary theoretical knowledge and practical skills in medical physics
- Acquire general knowledge of the medical, mathematical, physical, and technical basics which enable them to exercise the profession of medical physicist in any relevant clinical institution,
- Have profound knowledge and skills in medical radiation protection and in the management and quality assurance of major medical appliances,
- Expertise in medical physics in radiation therapy, nuclear medicine, X-ray diagnostics and other medical diagnosis and treatment instruments
- Capable of solving the current technological problems related to health and other related science to meet social and economic needs of the community.
- Develop analytical skill to solve a problem by applying simple fundamental laws to more complicated situations;
- Develop skill on the essential mathematical descriptions of physical phenomena;
- Develop skills of numerical manipulations, analytical analysis, and data analysis using computer software.
- Acquainted with intellectual and communication skills necessary to present and articulate research findings in verbal and written formats.
- Be able to apply abstract concepts to real-world situations;

- Be capable of solving relatively complicated problems using approximations;
- Be capable of conducting research to facilitate the development of the country in science, technology and computations.
- Be capable of harmonically working with professionals in physics, astrophysics, space physics, mathematics, engineering, and other related technology discipline for the common good of society.

List of Courses

Compulsory Courses

Course code	Course Title	ECTS
Phys 601	Mathematical Methods	7
Phys 602	Computational Physics	7
Phys 621	Statistical Physics	7
Phys 681	Electromagnetic Theory	7
Phys 683	Anatomy and physiology for medical physics	7
Phys 685	Introduction to Radiation Protection	7
Phys 684	Basic Medical Electronics and Instrumentation	7
Phys 686	Physics and radiotherapy	7
Phys 688	Radiobiology	7
Phys 789	Field Practical Assignment	12
Phys 791	Seminar	3
Phys 603	Research development and writing	3
Phys 799	Thesis	30

Elective Courses

A Graduate student specializing in Medical Physics has the option to choose from the following list of elective courses, but expected to take at least two of them.

Course code	Course Title	ECTS
Phys 781	Health Physics	7
Phys 782	Radiation physics and dosimetry	7
Phys 783	Radio diagnostics	7
Phys 784	Physics of Nuclear Medicine I	7
Phys 785	Physics of Nuclear medicine II	7
Phys 786	Physics of Medical Imaging I	7
Phys 787	Physics of Medical Imaging II	7

Course Sequence

I- Regular/Summer Program

Year I, Semester I / Summer I		
Course code	**Course Title**	**ECTS**
Phys 601	Mathematical Methods	**7**
Phys 621	Statistical Mechanics	**7**
Phys 681	Electromagnetic Theory	**7**
Phys 683	Anatomy and physiology for medical physics	**7**
Phys 685	Introduction to Radiation Protection	**7**

Year I, Semester II / summer II		
Course code	**Course Title**	**ECTS**
Phys 602	Computational Physics	**7**
Phys 684	Basic Medical Electronics and Instrumentation	**7**
Phys 686	Physics and radiotherapy	**7**
Phys 688	Radiobiology	**7**
Phys XXX	Elective I	**7**

Year II, Semester I / Summer III		
Course code	**Course Title**	**ECTS**
Phys 603	Research development and writing	**3**
Phys 789	Field Practical Assignment	**12**
Phys XXX	Elective II	**7**
Phys 791	Seminar	**3**
Year II, Semester II / Summer IV		
Course code	**Course Title**	**ECTS**
Phys 799	MSc Thesis	**30**

II- Extension Program

Year I, Semester I		
Course code	**Course Title**	**ECTS**
Phys 601	Mathematical Methods	**7**
Phys 621	Statistical Mechanics	**7**
Phys 681	Electromagnetic Theory	**7**
Phys 683	Anatomy and physiology for medical physics	

Year I, Semester II		
Course code	**Course Title**	**ECTS**
Phys 602	Computational Physics	**7**
Phys 685	Introduction to Radiation Protection	**7**
Phys 684	Basic Medical Electronics and Instrumentation	**7**
Phys 686	Physics and radiotherapy	**7**

Year II, Semester I		
Course code	**Course Title**	**ECTS**
Phys 789	Field Practical Assignment	**12**
Phys 688	Radiobiology	**7**
Phys XXX	Elective I	**7**
Year II, Semester II		
Phys 603	Research development and writing	**3**
Phys XXX	Elective II	**7**
Phys 791	Seminar	**3**
Year III		
Course code	**Course Title**	**ECTS**
Phys 799	MSc Thesis	**30**

V. Metrology

Learning Outcomes

The MSc in Metrology programme is designed to give specialization in the field of for an enhanced preparation for an industrial career or further specialized studies in the field. The main aim of the program is to produce graduates with extensive knowledge and skill in the area of measurement, instrumentation and standardization. It includes substantially increased breadth and depth of study, and an increased emphasis on industrial relevance. The dissertation project within the MSc in Nanotechnology programme includes an individual research/design project with strong industrial relevance and involvement. The programme provides opportunities for students to develop and demonstrate knowledge, understanding, skills, qualities and other attributes in the area.

Degree Nomenclature

The Degree of Master of Science in Physics (Metrology)
የሳይንስ ማስተር ዲግሪ በፊዚክስ (ስነ-ልክ)

Graduate Profile and Competency

The MSc in physics (Metrology) program aims to produce highly trained graduates who acquire knowledge and skills in basic and advanced physics principles, measurements, standardization, operating and using instruments in metrology, hands-on experience on metrology laboratory, analytical and numerical techniques, computations, data analysis and interpretations, and related science and technology facts, principles and techniques with their applications so that they can contribute for the advancement of science and technology in the country and for the economy development of the country. Upon completion of their study, graduates are expected to acquire observational measurements, theoretical frameworks and analytical approach that help to work their research independently. On successful completion, graduates will play key roles and become a driving force in sustaining the economy development of the country. In general the graduates are expected to:

- Have clear understanding on the physical basis of the operation of instruments used in physics.
- Acquaint with all necessary theoretical knowledge and practical skills in metrology.
- Understand the physical basis of the operation of apparatus for measurement, so that the impact of the apparatus on the physical observations can be understood.
- Capable of operating sophisticated metrology instruments.
- To recognize and account for any measurement error.
- To examine the role of variability in the measurement process and understand how this variability influences a measurement.
- To identify features and patterns in a graphical display of data that illustrates the contributions to variability from different sources of measurement error.
- Develop analytical skill to solve a problem by applying simple fundamental laws to more complicated situations;
- Develop skill on the essential mathematical descriptions of physical phenomena;
- Develop skills of numerical manipulations, analytical analysis, and data analysis using computer software.
- Acquainted with intellectual and communication skills necessary to present and articulate research findings in verbal and written formats.
- Be able to apply abstract concepts to real-world situations;
- Be capable of solving relatively complicated problems using approximations;
- Be capable of conducting research to facilitate the development of the country in science, technology and computations.
- Be capable of harmonically working with professionals in physics, astrophysics, space physics, mathematics, engineering, and other related technology discipline for the common good of society.

List of Courses

Compulsory Courses

Course code	Course Title	ECTS
Phys 601	Mathematical Methods	7
Phys 602	Computational Physics	7
Phys 621	Statistical Physics	7
Phys 681	Electromagnetic Theory	7
Phys 661	Introduction to Mechatronics	7
Phys 663	Laboratory management System	7
Phys 662	Instrumentation and Process Control	7
Phys 664	Quality and Standardization	7
Phys 668	Conformity Assessment	7
Phys 603	Research development and writing	3
Phys 765	Field Practical Assignment	12
Phys 791	Seminar	3
Phys 799	Thesis	30

Elective Courses

A Graduate student specializing in Metrology has the option to choose from the following list of elective courses, but expected to take at least two of them.

Course code	Course Title	ECTS
Phys 761	Testing product characteristics	7
Phys 762	Measurement of process properties	7
Phys 763	Geometrical product specification	7
Phys 764	Measurement of Uncertainty analysis	7

Course Sequence

I- Regular/Summer Program

Year I, Semester I / Summer I		
Course code	**Course Title**	**ECTS**
Phys 601	Mathematical Methods	**7**
Phys 621	Statistical Mechanics	**7**
Phys 681	Electromagnetic Theory	**7**
Phys 661	Introduction to Mechatronics	**7**
Phys 663	Laboratory management System	**7**

Year I, Semester II / summer II		
Course code	**Course Title**	**ECTS**
Phys 602	Computational Physics	**7**
Phys 662	Instrumentation and Process Control	**7**
Phys 664	Quality and Standardization	**7**
Phys 668	Conformity Assessment	**7**
Phys XXX	Elective I	**7**

Year II, Semester I / Summer III		
Course code	**Course Title**	**ECTS**
Phys 603	Research development and writing	**3**
Phys 765	Field Practical Assignment	**12**
Phys XXX	Elective II	**7**
Phys 791	Seminar	**3**
Year II, Semester II / Summer IV		
Course code	**Course Title**	**ECTS**
Phys 799	MSc Thesis	**30**

II- Extension Program

Year I, Semester I		
Course code	**Course Title**	**ECTS**
Phys 601	Mathematical Methods	**7**
Phys 621	Statistical Mechanics	**7**
Phys 681	Electromagnetic Theory	**7**
Phys 661	Introduction to Mechatronics	**7**

Year I, Semester II		
Course code	**Course Title**	**ECTS**
Phys 602	Computational Physics	**7**
Phys 663	Laboratory management System	**7**
Phys 662	Instrumentation and Process Control	**7**
Phys 664	Quality and Standardization	**7**

Year II, Semester I		
Course code	**Course Title**	**ECTS**
Phys 765	Field Practical Assignment	**12**
Phys 668	Conformity Assessment	**7**
Phys XXX	Elective I	**7**
Year II, Semester II		
Phys 603	Research development and writing	**3**
Phys XXX	Elective II	**7**
Phys 791	Seminar	**3**
Year III		
Course code	**Course Title**	**ECTS**
Phys 799	MSc Thesis	**30**

VI. Nano Physics

Learning Outcomes

The MSc in Nanotechnology programme is designed to give specialization in the field of Nanotechnology for an enhanced preparation for an industrial career or further specialized studies in the field. It includes substantially increased breadth and depth of study, and an increased emphasis on industrial relevance. The dissertation project within the MSc in Nanotechnology programme includes an individual research/design project with strong industrial relevance and involvement. The programme provides opportunities for students to develop and demonstrate knowledge, understanding, skills, qualities and other attributes in the area.

Degree Nomenclature

The Degree of Master of Science in Physics (Nano Physics)

የሳይንስ ማስተር ዲግሪ በፊዚክስ (ናኖ ፊዚክስ)

Graduate Profile and Competency

The MSc in physics (Nano physics) program aims to produce highly trained graduates who acquire knowledge and skills in basic and advanced physics principles, nano-physics, condensed matter physics, solid states, analytical and numerical techniques, computations, data analysis and interpretations, and related science and technology facts, principles and techniques with their applications so that they can contribute for the advancement of science and technology in the country and for the economy development of the country. Upon completion of their study, graduates are expected to acquire observational measurements, theoretical frameworks and analytical approach that help to work their research independently. On successful completion, graduates will play key roles and become a driving force in sustaining the economy development of the country. In general the graduates are expected to:

- Have clear understanding on the physical basis of the operation of instruments used in physics.
- Acquire advanced knowledge and understanding of the key principles in nanotechnology, their analysis and design techniques and of details of new concepts and technologies relevant to the area
- develop analytical skill to solve a problem by applying simple fundamental laws to more complicated situations;
- Demonstrate practical transferrable engineering skills in nanotechnology such as the imaging, nano-manipulation and fabrication techniques for nanotechnology.
- Use knowledge of underlying principles of physics and mathematics on which nanotechnology materials and devices are based, including semiconductor devices
- Develop skill on nano-scale processing and characterization, optics and nano-electronics used to tackle a wide range of tasks, including analysis and design of materials, devices and systems.
- Develop skill on the essential mathematical descriptions of physical phenomena;
- Develop skills of numerical manipulations, analytical analysis, and data analysis using computer software.
- Acquainted with intellectual and communication skills necessary to present and articulate research findings in verbal and written formats.
- Be able to apply abstract concepts to real-world situations;
- Be capable of solving relatively complicated problems using approximations;
- Be capable of conducting research to facilitate the development of the country in science, technology and computations.
- Be capable of harmonically working with professionals in physics, astrophysics, space physics, mathematics, engineering, and other related technology discipline for the common good of society.

List of Courses

Compulsory Courses

Course code	Course Title	ECTS
Phys 601	Mathematical Methods	7
Phys 602	Computational Physics	7
Phys 603	Research development and writing	3
Phys 631	Solid State Physics	7
Phys 681	Electromagnetic Theory	7
Phys 711	Graduate Lab	5
Phys 635	Nano science and Nanotechnology	7
Phys 636	Semiconductor Quantum Nanostructures	7
Phys 638	Materials Science and Engineering	7
Phys 791	Seminar	3
Phys 799	MSc Thesis	30

Elective courses

A Graduate student specializing in Nanophysics has the option to choose from the following list of elective courses, but expected to take at least three of them.

Course code	Course Title	ECTS
Phys 621	Statistical Mechanics	7
Phys 642	Quantum Mechanics	7
Phys 643	Atomic and Molecular Physics	7
Phys 735	Polymer Chemistry and Physics	7
Phys 736	Computational Methods in Quantum Nano structures	7
Phys 737	Advanced fabrication and Characterization Of Nano materials	7

Course Sequence

I- Regular/Summer Program

Year I, Semester I / Summer I		
Course code	**Course Title**	**ECTS**
Phys 601	Mathematical Methods	**7**
Phys 631	Solid State Physics	**7**
Phys 681	Electromagnetic Theory	**7**
Phys 635	Nano science and Nanotechnology	**7**

Year I, Semester II / summer II		
Course code	**Course Title**	**ECTS**
Phys 602	Computational Physics	**7**
Phys 636	Semiconductor Quantum Nanostructures	**7**
Phys 638	Materials Science and Engineering	**7**
Phys XXX	Elective I	**7**

Year II, Semester I / Summer III		
Course code	**Course Title**	**ECTS**
Phys 603	Research development and writing	**3**
Phys 711	Graduate Lab	**5**
Phys XXX	Elective II	**7**
Phys 791	Seminar	**3**
Year II, Semester II / Summer IV		
Course code	**Course Title**	**ECTS**
Phys 799	MSc Thesis	**30**

II- Extension Program

Year I, Semester I		
Course code	**Course Title**	**ECTS**
Phys 601	Mathematical Methods	**7**
Phys 631	Solid State Physics	**7**
Phys 681	Electromagnetic Theory	**7**

Year I, Semester II		
Course code	**Course Title**	**ECTS**
Phys 602	Computational Physics	**7**
Phys 635	Nanoscience and Nanotechnology	**7**
Phys 636	Semiconductor Quantum Nanostructures	**7**

Year II, Semester I		
Course code	**Course Title**	**ECTS**
Phys 711	Graduate Lab	**5**
Phys 638	Materials Science and Engineering	**7**
Phys XXX	Elective I	**7**

Year II, Semester II		
Phys XXX	Elective II	**7**
Phys 603	Research development and writing	**3**
Phys 791	Seminar	**3**
Year III		
Course code	**Course Title**	**ECTS**
Phys 799	MSc Thesis	**30**

VII. Space Science

Learning Outcomes

Students specializing in space physics will acquire the knowledge of plasma physics and its various applications to the phenomena from the Solar system to relativistic jets in active galaxies (therefore, the introductory course in plasma physics is strongly recommended). Students can contribute for the development of the space instrumentation in country.

Degree Nomenclature

The Degree of Master of Science in Physics (Space Physics)
የሳይንስ ማስተር ዲግሪ በፊዚክስ (ህዋ ፊዚክስ)

Graduate Profile and Competency

The MSc in physics (Space physics) program aims to produce highly trained graduates who acquire knowledge and skills in basic and advanced physics principles, space physics, plasma physics, solar system, analytical and numerical techniques, computations, data analysis and interpretations, and related science and technology facts, principles and techniques with their applications so that they can contribute for the advancement of science and technology in the country and for the economy development of the country. Upon completion of their study, graduates are expected to acquire observational measurements, theoretical frameworks and analytical approach that help to work their research independently. On successful completion, graduates will play key roles and become a driving force in sustaining the economy development of the country. In general the graduates are expected to:

- Have clear understanding on the physical basis of the operation of instruments used in physics.

- Understand the physical basis and operation of apparatus for measurement and space observation.
- Acquire the required knowledge and skill to conduct original and significant space physics researches.
- Capable of harmonically working with professionals in space science, physics, mathematics, engineering, and other related technology discipline for the common good of society
- develop analytical skill to solve a problem by applying simple fundamental laws to more complicated situations;
- Develop skill on the essential mathematical descriptions of physical phenomena;
- Develop skills of numerical manipulations, analytical analysis, and data analysis using computer software.
- Acquainted with intellectual and communication skills necessary to present and articulate research findings in verbal and written formats.
- Be able to apply abstract concepts to real-world situations;
- Be capable of solving relatively complicated problems using approximations;
- Be capable of conducting research to facilitate the development of the country in science, technology and computations.
- Be capable of harmonically working with professionals in physics, astrophysics, space physics, mathematics, engineering, and other related technology discipline for the common good of society.

List of Courses

Compulsory courses

Course code	Course title	ECTS
Phys 601	Mathematical Methods	7
Phys 602	Computational Physics	7
Phys 603	Research development and writing	3
Phys 654	Computations in Space Physics	7
Phys 621	Statistical Physics	7

Phys 681	Electromagnetic Theory	7
Phys 651	Introduction to solar physics, Magnetospheric Physics and space weather	7
Phys 652	Introduction to Space technology	7
Phys 711	Graduate Lab	5
Phys 791	Seminar	3
Phys 799	MSc Thesis	30

Elective courses

A Graduate student specializing in Space Physics has the option to choose from the following list of elective courses, but expected to take at least three of them.

Course code	**Course title**	**ECTS**
Phys 751	Ionospheric Physics I	7
Phys 752	Ionospheric Physics II	7
Phys 753	Instrumentation in space science	7
Phys 754	Atmospheric Physics	7

Course Sequence

I- Regular/Summer Program

Year I, Semester I / Summer I		
Course code	**Course Title**	**ECTS**
Phys 601	Mathematical Methods	**7**
Phys 621	Statistical Mechanics	**7**
Phys 681	Electromagnetic Theory	**7**
Phys 651	Introduction to solar physics, Magnetospheric Physics and space weather	**7**

Year I, Semester II / summer II		
Course code	**Course Title**	**ECTS**
Phys 602	Computational Physics	**7**
Phys 652	Introduction to Space technology	**7**
Phys 654	Computations in Space Physics	**7**
Phys XXX	Elective I	**7**

Year II, Semester I / Summer III		
Course code	**Course Title**	**ECTS**
Phys 603	Research development and writing	**3**
Phys 711	Graduate Lab	**5**
Phys XXX	Elective II	**7**
Phys 791	Seminar	**3**

Year II, Semester II / Summer IV		
Course code	**Course Title**	**ECTS**
Phys 799	MSc Thesis	**30**

II- Extension Program

Year I, Semester I		
Course code	**Course Title**	**ECTS**
Phys 601	Mathematical Methods	**7**
Phys 621	Statistical Mechanics	**7**
Phys 681	Electromagnetic Theory	**7**

Year I, Semester II		
Course code	**Course Title**	**ECTS**
Phys 602	Computational Physics	**7**
Phys 651	Introduction to solar physics, Magnetospheric Physics and space weather	**7**
Phys 652	Introduction to Space technology	**7**

Year II, Semester I		
Course code	**Course Title**	**ECTS**
Phys 711	Graduate Lab	**5**
Phys 654	Computations in Space Physics	**7**
Phys XXX	Elective I	**7**

Year II, Semester II		
Phys XXX	Elective II	**7**
Phys 603	Research development and writing	**3**
Phys 791	Seminar	**3**
Year III		
Course code	**Course Title**	**ECTS**
Phys 799	MSc Thesis	**30**

VIII. Statistical Physics

Learning Outcomes

The MSc in Statistical Physics programme is designed to give specialization in the field for an enhanced preparation for an industrial and/or research centre career or further specialized studies in the field. It includes substantially increased breadth and depth of study, and an increased emphasis on societal relevance. The dissertation project within the MSc in Statistical Physics programme includes an individual research/design project with strong industrial relevance and involvement. The programme provides opportunities for students to develop and demonstrate knowledge, understanding, skills, qualities and other attributes in the area.

Degree Nomenclature

The Degree of Master of Science in Physics (Statistical Physics)
የሳይንስ ማስተር ዲግሪ በፊዚክስ (ስታቲስቲካል ፊዚክስ)

Graduate Profile and Competency

The MSc in physics (Statistical physics) program aims to produce highly trained graduates who acquire knowledge and skills in basic and advanced physics principles, statistical physics, condensed matter physics, stochastic and deterministic processes, statistical quantities, analytical and numerical techniques, computations, data analysis and interpretations, and related science and technology facts, principles and techniques with their applications so that they can contribute for the advancement of science and technology in the country and for the economy development of the country. Upon completion of their study, graduates are expected to acquire observational measurements, theoretical frameworks and analytical approach that help to work their research independently. On successful completion, graduates will play key roles and become a driving force in sustaining the economy development of the country. In general the graduates are expected to:

- Have clear understanding on the basic and advanced concepts of Statistical physics.

- Develop analytical skill to solve a problem by applying simple fundamental laws to more complicated situations;
- Develop skill on the essential mathematical descriptions of physical phenomena;
- Develop skills of numerical manipulations, analytical analysis, and data analysis using computer software.
- Acquainted with intellectual and communication skills necessary to present and articulate research findings in verbal and written formats.
- Be able to apply abstract concepts to real-world situations;
- Be capable of solving relatively complicated problems using approximations;
- Be capable of conducting research to facilitate the development of the country in science, technology and computations.
- Be capable of harmonically working with professionals in physics, mathematics, engineering, and other related technology discipline for the common good of society.

List of Courses

Compulsory Courses

Course code	Course Title	ECTS
Phys 601	Mathematical Methods	7
Phys 602	Computational Physics	7
Phys 603	Research development and writing	3
Phys 621	Statistical Mechanics	7
Phys 642	Quantum Mechanics	7
Phys 681	Electromagnetic Theory	7
Phys 711	Graduate Lab	5
Phys 623	Advanced Statistical Mechanics	7
Phys 624	Theory and Application of Stochastic processes	7
Phys 791	Seminar	3
Phys 799	MSc Thesis	30

Elective courses

A Graduate student specializing in Statistical Physics has the option to choose from the following list of elective courses, but expected to take at least one of them.

Course code	Course Title	ECTS
Phys 722	Statistical Physics of Fields	7
Phys 641	Classical Mechanics	7
Phys 643	Atomic and Molecular Physics	7
Phys 725	Introduction to Nonlinear Dynamics	7

Course Sequence

I- Regular/Summer Program

Year I, Semester I / Summer I		
Course code	**Course Title**	**ECTS**
Phys 601	Mathematical Methods	**7**
Phys 621	Statistical Mechanics	**7**
Phys 681	Electromagnetic Theory	**7**
Phys 623	Advanced Statistical Mechanics	**7**

Year I, Semester II / summer II		
Course code	**Course Title**	**ECTS**
Phys 602	Computational Physics	**7**
Phys 642	Quantum Mechanics	**7**
Phys XXX	Elective I	**7**
Phys 624	Theory and Application of Stochastic processes	**7**

Year II, Semester I / Summer III		
Course code	**Course Title**	**ECTS**
Phys 603	Research development and writing	**3**
Phys 711	Graduate Lab	**5**
Phys XXX	Elective II	**7**
Phys 791	Seminar	**3**

Year II, Semester II / Summer IV		
Course code	**Course Title**	**ECTS**
Phys 799	MSc Thesis	**30**

II- Extension Program

Year I, Semester I		
Course code	**Course Title**	**ECTS**
Phys 601	Mathematical Methods	**7**
Phys 621	Statistical Mechanics	**7**
Phys 681	Electromagnetic Theory	**7**

Year I, Semester II		
Course code	**Course Title**	**ECTS**
Phys 602	Computational Physics	**7**
Phys 642	Quantum Mechanics	**7**
Phys 623	Advanced Statistical Mechanics	**7**

Year II, Semester I		
Course code	**Course Title**	**ECTS**
Phys 711	Graduate Lab	**5**
Phys XXX	Elective I	**7**
Phys 624	Theory and Application of Stochastic processes	**7**

Year II, Semester II		
Phys XXX	Elective II	**7**
Phys 603	Research development and writing	**3**
Phys 791	Seminar	**3**
Year III		
Course code	**Course Title**	**ECTS**
Phys 799	MSc Thesis	**30**