JORDAN UNIVERSITY OF SCIENCE & TECHNOLOGY
DEPARTMENT OF PHYSICS
Academic Program
BSc in Physics (2018/2019)

CURRICULUM PLAN

Requirements	Compulsory Credit Hours	Elective Credit Hours	Total
University Requirements	16	9	25
Faculty Requirements	19	-	19
Department Requirements	76	12	88
Total	111	21	132

1. **University Requirements: 25** Credit Hours as Follows:
   A. Compulsory Requirements: **16** Credit Hours As Follows:

Course No.	Course	Credit Hours	Theoretical Hours	Pre- requisites
ARB 101[&]	Arabic Language	3	3	
ENG 112	English Language (2)	3	3	ENG 099 or pass in University English exam
HSS 110**	Social Responsibility	3	3	
HSS 119**	Entrepreneurship and Innovation	2	2	
HSS 129**	General skills	2	2	
MS 100*	Military Sciences	3	3	

[&] Non-Arabic speaking students must register for two courses: ARB 101A and HSS 110A
* Required from Jordanian students only. Results recorded as pass or fail.
** Courses can be taught using online or Project-Based Learning.

B. **Elective requirements: 9** credit hours selected from the following courses
   Group 1: 3 credit hours ONLY from the following courses

Course No.	Course	Credit Hours
ARB200	Appreciation of Literary Text	3
HSS 115	Islam and Recent problems	3
HSS 116	Economic System in Islam	3
HSS 121	Principles of Sociology	3
HSS 126	Principles in Psychology	3
HSS 127	Educational Technology	3
HSS 131	Islam Civilizations	3
HSS 132	The history of the City of Jerusalem	3
HSS 133	Civilization and Recent Cultures	3
HSS 135	Islamic Culture	3
HSS 137	Islamic Rights	3
HSS 161	Contemporary Problems	3
HSS 211	Sociology	3
HSS 213	Individual and Society	3
HSS 231	History of Sciences in Islam	3
HSS 251	Music Tasting	3

Group 2: 3 credit hours ONLY from the following courses

Course No.	Course	Credit Hours
CHE 191	Introduction to Nanotechnology	3
ME 102	Introduction to Renewable Energy	3
AP 200	Farm Animal Products (for Non-Animal Production, Nutrition and Food Technology Students)	3
PP 200	Home Gardens (For Non-plant Production, Soil and Irrigation Students)	3
PP 201	Beekeeping (For Non-plant Production Students)	3
PP 202	Natural Plants of Jordan (For non-Agriculture Students)	3
NF 177	Food Preservation "In English" (For Non-Nutrition and Food Technology)	3
NR 200	Natural Resources and Human (For Non-Plant Production, Soil and Irrigation Students)	3
NR 207	Earth Problems and Solutions (For Non-Plan Productions and Soil Irrigation Students)	3
ES 103	Environment Protection (For Non-Environmental Science Students)	3
NE 200	Principles in Nuclear Energy and Its Peaceful Applications	3

Group 3: 3 credit hours ONLY from the following courses

Course No.	Course	Credit Hours
PH 104	Community Health and Nutrition	3
NUR 100	Health Promotion (Non-Medicine, Nursing and Midwifery)	3
NUR 109	Family Health	3
ADS 100	Oral and Dental Health	3
VM 211	Animal Health	3
VM 212	Pet animal Care	3
VM 213	Animal Behavior and Welfare	3
VM 214	Animal Products and Public Health (For Non-Veterinary and Agriculture Students)	3
PT 100	Wellness and Lifestyle (Not for Physical and Occupational Therapy)	3
OT 100	Disability and the Society (Not Allowed for Rehabilitation Science Dept. Students)	3

2. Faculty Requirements: 19 Credit Hours as Follows:

Course No.	Course	Credit Hours	Theoretical Hours	Practical Hours	Pre- Requisites
MATH 101	Calculus (1)	3	3	-	
MATH 102	Calculus (2)	3	3	-	MATH 101
PHY 101	General Physics (1)	3	3	-	
PHY 102	General Physics (2)	3	3	-	PHYS 101
PHY 105	General Physics Lab. (1)	1	-	2	PHYS 101 or concurrent
CS 115	Programming in C++	3	2	3	-
MATH 131	Elements of Statistics	3	3	-	MATH 102

3. Department requirements: 88 credit hours as follows:

A) Compulsory Courses: 76 Credit Hours As Follows:

Course No.	Course	Credit Hours	Theoretical Hours	Practical Hours	Pre- requisites
BIO 101	General Biology	3	3	-	-
CHEM 101	General Chemistry (1)	3	3	-	-
CHEM 102	General Chemistry (2)	3	3	-	CHEM 101 (pass)
CHEM 107	General Chemistry Lab.	1	-	2	CHEM 102 or concurrent
PHY 106	General Physics Laboratory (2)	1	-	2	PHY 105 (pass)+ PHY 102 or concurrent
PHY 200	Introduction to Mathematical Physics	3	3	-	MATH 102 (pass)
PHY 201	Mathematical Physics (1)	3	3	-	PHY 102 (pass)+ PHY 200 or concurrent
PHY 211	Properties of Matter and Heat	2	2	-	PHY 102 (pass)
PHY 221	Properties of Matter and Heat Lab	1	-	3	PHY 106 (pass)+ PHY 211 or concurrent
PHY 231	Electronics (1)	3	3	-	PHY 102 (pass)
PHY 233	Electronics Lab (1)	1	-	3	PHY 106 (pass)+ PHY 231 or concurrent
PHY 251	Modern Physics	3	3	-	PHY 201 or concurrent
PHY 261	Thermodynamics	3	3	-	PHY 211 (pass)
PHY 281	Vibrations and Waves	3	3	-	PHY 102 (pass)+ PHY 201 (pass)
PHY 282	Optics	3	3	-	PHY 281 or Co-Requisites
PHY 283	Optics Lab	1	-	3	PHY 282 or concurrent
PHY 301	Mathematical Physics (2)	3	3	-	PHY 251 (pass)
PHY 303	Computational Physics	3	3	-	PHY 351 or concurrent
PHY 311	Classical Mechanics (1)	3	3	-	PHY 281 (pass)
PHY 312	Classical Mechanics (2)	3	3	-	PHY 311 (pass)
PHY 331	Electromagnetic Theory (1)	3	3	-	PHY 301 (pass)
PHY 332	Electromagnetic Theory (2)	3	3	-	PHY 331 (pass)
PHY 351	Quantum Mechanics (1)	3	3	-	PHY 301 or concurrent
PHY 352	Quantum Mechanics (2)	3	3	-	PHY 351 (pass)
PHY 353	Modern Physics Lab	1	-	3	PHY 351 (pass)
PHY 449	Nuclear Physics	3	3	-	PHY 351 (pass)
PHY 461	Statistical Mechanics	3	3	-	PHY 261 (pass) + PHY 351 (pass)
PHY 471	Solid State Physics	3	3	-	PHY 351 (pass)
PHY 490	Training	2	-	-	After successfully ending 100 credit hours or more
PHY 495	Graduation Project	3	-	-	Expected to graduated

B) Elective Courses: 12 Credit Hours as follows:

Course No.	Course	Credit hours	Theoretical Hours	Practical Hours	Pre- requisites
**PHY 202	Space Physics	3	3	-	PHY 101 (pass)
MATH 203	Ordinary Differential Equations	3	3	-	MATH 102 (pass)

PHY 333	Electronics (2)	3	2	3	PHY 233 (pass)
PHY 341	Radiation Physics	3	3	-	PHY 251 (pass)
PHY 371	Material Science	3	3	-	PHY 211 (pass)
PHY 375	Introduction to Nano Science and Technology	3	3	-	PHY 231 (pass)
PHY 381	Biological Physics	3	3	-	PHY 251 (pass)
PHY 395	Renewable Solar Energy	3	3	-	PHY 211 (pass)
PHY 401	Mathematical Physics (3)	3	3	-	PHY 301 (pass)
PHY 440	Atomic Physics	3	3	-	PHY 352 or concurrent
PHY 453	Advance Physics Lab	3	-	3	PHY 353 (pass)
**PHY 473	Semiconductors Physics	3	3	-	PHY 231 (pass)
PHY 474	Solar Cells	3	3	-	PHY 231 (pass)
PHY 481	Physical Optics	3	3	-	PHY 282 (pass)
PHY 493	Special Topics in Physical Sciences (A)	3	3	-	Department Approval
PHY 493	Special Topics in Physical Sciences (B)	2	2	-	Department Approval
PHY 493	Special Topics in Physical Sciences (C)	1	1	-	Department Approval

** Courses can be taught using online or Project-Based Learning.

Course Code in the Second Digit of Course Numbering in Physical Sciences Courses

Course	Course Code	Course	Course Code
General Physics	0	Heat and Statistical Physics	6
Physical Properties	1	Solid State Physics	7
Electromagnetic	3	Laser and Biophysics	8
Atomic and Nuclear Physics	4	Research and Graduate Project	9
Modern Physics	5		

Jordan University of Science and Technology
Physics Course Description

PHY 101: General Physics (1)
Kinematics in one, two and three dimensions, dynamics, work and energy, conservation of energy, conservation of momentum, many bodies and collisions, rotational motion and equilibrium of rigid body, gravitation, periodic motion.

PHY 102: General Physics (2)
Charge and matter, electric field, Gauss's law, electric potential, capacitors and dielectrics, electromotive force and electric circuits, magnetic field, Ampere's law, Faraday's law of induction, self-inductance, Maxwell's equations

PHY 103: General Physics
Vectors algebra, kinematics of motion, dynamics, elasticity, fluid mechanics, electrostatics, electric flux, electric potential, capacitors, Ohm's law, circuits and Kirchhoff's laws, magnetism, wave motion and sound waves, geometrical optics, modern physics, radioactivity, radiation doses.

PHY 105: General Physics Lab (1)
Experiments covering topics discussed in PHY 101

PHY 106: General Physics Lab (2)
Experiments covering topics discussed in PHY102

PHY 107: General Physics Lab
Experiments covering some topics discussed in PHY 101 and PHY 102.

PHY 200: Introduction to Mathematical Physics
Complex numbers, vector calculus, matrices, determinants, eigenvalues and eigenvectors

PHY 201: Mathematical Physics (1)
Coordinate systems, limits and continuities, partial differentials, double and triple integrals, divergence and stocks theorems, first order differential equations.

PHY 202: Space Physics
Kepler's laws, motion of the sun and other planets, calendars, electromagnetic spectrum and observatories.

PHY 211: Properties of Matter and Heat
Low of general gravity, fluid mechanics, mechanics of rigid body, kinetic theory of gases, magnetic induction, circuits of alternating current

PHY 221: Properties of Matter and Heat Lab
Experiments covering topics discussed in PHY 211.

PHY 231: Electronics (1)
Conduction in solids, diodes, transistors, and FET, networks, amplifiers.

PHY 233: Electronics Lab (1)

Experiments covering topics discussed in PHY 231

PHY 251: Modern Physics
Special relativity, concepts of waves and particles, introduction to quantum mechanics, atomic structure, quantum theory of the H-atom

PHY 261: Thermodynamics
Temperature and the zero law, equation of state, heat, work and the first law of thermodynamics, entropy and the second law, thermodynamic potential, chemical potential, kinetic theory

PHY 281: Vibration and Waves
Simple harmonic oscillations, forced and couples oscillations, motion of longitudinal waves, wave motion in two dimensions, Fourier method, non-linear oscillations

PHY 282: Optics
Reflection and refraction, mirrors, lenses, image formation, wave optics, nature of light, wave equation, interference, interferometers, diffraction, polarization, radiometry.

PHY 283: Optics Lab
Experiments covering topics discussed in PHY 282

PHY 301: Mathematical Physics (2)
Evaluation of integrals, integral transformation, special functions, partial differential equations

PHY 303: Computational Physics
Using computer and programming languages to solve physical problems such as: differentiating and integrating, partial differential equation, linear algebra and matrices, modern physics, vibration and waves

PHY 311: Classical Mechanics (1)
Elements of Newtonian mechanics, motion in one, two, and three dimensions, motion of a system of particles, motion of rigid bodies, gravitation, moving coordinate systems.

PHY 312: Classical Mechanics (2)
Quick review of static's, Lagrange equations, Hamilton equations, tensor algebra, rotational dynamics of rigid bodies, theory of small oscillations

PHY 331: Electromagnetic Theory (1)
Quick review of vector analysis and electrostatics, solution of electrostatic problems in vacuum and in dielectric media, electrostatic energy, magnetic field of steady currents, magnetic properties of matter

PHY 332: Electromagnetic Theory (2)
Electromagnetic induction, magnetic energy, Maxwell's equations, propagation of electromagnetic waves, polarization, reflection and refraction of EM waves, wave guides, radiation.

PHY 333: Electronics (2)
Power amplifiers, oscillator principles, digital circuits, digital switching using integrated circuits, introduction to microprocessors

PHY 341: Radiation Physics
Radiation sources (alpha, beta, gamma, neutrons, heavy ions), radiation interaction with matter, radiation detection and measurements using gaseous detectors, concept of exposure, absorbed dose and dose equivalent, dose limits, external and internal radiation control, radiation protection in factories, transport of radioactive materials.

PHY 351: Quantum Mechanics (1)
Limits of classical mechanics, wave packets and uncertainty principle, Schrödinger wave equation, potential well, eigen-functions and eigenvalues, operators, angular momentum operators, the H-atom

PHY 352: Quantum Mechanics (2)
Review of ideal H-atom, interaction of electrons with magnetic field, operators and spin using matrices, addition of angular momentum and spin, time independent and time dependent perturbation theory, real hydrogen atom, helium atom, scattering theory

PHY 353: Modern Physics Lab
This course includes basic concepts of modern physics in the following fields: many electron atoms, molecular structure, solid state, statistical mechanics, nuclear physics, elementary particles.

PHY 371: Material Science
Introduction to material science (metals and alloys, ceramics, polymers and semiconducting), atomic structure and interatomic bonding, the structure of crystalline solid, imperfections in solid objects, diffusion, mechanical properties of metals (elastic, shear, torsional deformations and hardness), mechanism of reinforcement and distortion (restoration of normal sate, crystallization and growth of aggregated atoms in the form of small blocks), dislocations and strengthening mechanisms, dislocations, fracture, fatigue and creep.

PHY 375: Introduction to Nano-Science and Technology
Introduction to the underlying principles and applications of the emerging field of nanotechnology and Nano-science, introduces tools and principles relevant at the Nano-scale dimension, discusses current and future nanotechnology applications in engineering, materials, physics, chemistry, biology, electronics, and energy.

PHY 381: Biological Physics
Physics of living systems, mechanics of the human body, electrical properties of nerves, physical techniques used in studying macromolecules, some biophysics instruments.

PHY 395: Renewable Solar Energy
Introduction to energy systems and resources, Fossil fuels-past, present and future, introduction to renewable energy, Solar radiation, Solar- thermal, Solar-PV, concentrated solar power (CSP), wind energy, hydro power, tidal energy, geothermal energy, biomass energy, Fuel cells, Energy efficiency and conservation.

PHY 401: Mathematical Physics (3)
Vector analysis, group Theory, tensors, complex theory and residue theorem, Laplace and Fourier transformations

PHY 440: Atomic Physics
Review of the atomic nature of matter, one electron-atom, fine structure, hyperfine structure and interaction with external electric and magnetic fields, the spectrum of the He-atom, many electron-atoms, X-ray spectra, inner shells, Auger effect, molecular structure and chemical bonding, Coulomb Scattering.

PHY 449: Nuclear Physics
Review, nuclear properties, nuclear models, nuclear radioactivity, alpha decay, beta decay, Gamma decay, nuclear reactions (fission and fusion), applications.

PHY 453 Advance Physics Lab
A set of experiments in solid state, nuclear physics and radiation physics can be determined by the department.

PHY 461: Statistical Mechanics
Maxwell-Boltzmann statistics and its application, Bose-Einstein statistics and its applications, Fermi-Dirac statistics and its application, concepts of temperature and entropy, thermodynamics of gases and application of statistical thermodynamics, the canonical ensemble, the grand canonical ensemble.

PHY 471: Solid State Physics
Crystal structure and binding, diffraction in crystals, reciprocal lattice and lattice vibrations, phonons and specific heat, free-electron model

PHY 473: Semiconductor Physics
Basic principles of semiconductors, unstable properties of semiconductors, fabrication of semiconductors devices, solar cells and light emitting diodes

PHY 474: Solar Cells
Basic principles of physics of converting solar energy, basic elements of solar cells, technology of solar cells, Si solar cells, thin films solar cells.

PHY 481: Physical Optics
Brief history of optics, mathematics of wave motion, electromagnetic theory of light, Fresnel coefficients, optics of thin films, polarization, nature of polarized light, polarizes, Dichroism, Birefringence, retarders, Faraday rotation, Kerr effect, optical activity, John matrices, interference of two beams, interference of more than two beams, Mich. Interferometer, Fabry-Perot interferometer, diffraction, theory of diffraction, theory of diffraction, diffraction from slits and apertures, diffraction Gratings.

PHY 490: Graduation Project

This course is offered to students majoring in physics and must be completed during the graduation semester of the student. The students in this course are divided into groups. In each group 3-4 students form a research group under the supervision of a faculty member. The members of each group have the opportunity to work on a research project in a physics field of their interest under the supervision of a department professor. This course provides the students with the opportunity to study a specific problem by themselves, either theoretical or experimental; under the supervision of an academic staff, using the knowledge that student gained in all years of his/her major study. Students should get enough training in research literature reading and reviewing scientific articles, presentation skills and writing scientific articles. At the end of the semester, each group must submit a prepared report in the form of a research manuscript and present it in a practical presentation in front of assigned committee.

PHY 495: Training

The practical training course consists of two parts. The first part is the field training in the public or private schools of the Ministry of Education for duration of 5 weeks. Participating in this part ensures that the students should be able to practice teaching school students using modern teaching techniques under the supervision of qualified educational experts. At the end of this part, the students are expected to be equipped with the knowledge, skills and dispositions necessary for high quality teaching and learning methods. The second training part of a duration of 5 weeks is designated to train the students to use experimental and theoretical scientific research methods in various fields of physics. For instance, the students have the opportunity to get the necessary training in centers such as: research laboratories in the department, national research laboratories, Royal Scientific Society, Jordan Atomic Energy Commission and Synchrotron-light for Experimental Science and Applications in the Middle East (SESAME). Participating in this part ensures that the students are equipped with the modern research skills to enable their transition to the graduate school. A faculty member is assigned to the students, visits them while training and makes sure that everything goes as planned and resolve any problem they may encounter.

Recommended Plan

First Year

First Semester

Course No.	Course	Credit Hours	Pre-requisites	Concurrent
PHY 101*	General Physics (1)	3	---	---
MATH 101*	Calculus (1)	3	---	---
CHEM 101	General Chemistry (1)	3	---	---
PHY 105*	General Physics Lab (1)	1	PHY 101	PHY 101
HSS 110	Social Responsibility	3	---	---
ENG 112	English Language (2)	3	ENG 99 or pass in Univ. English Exam.	---
	Sum of Credit Hours	**16**		

Second Semester

Course No.	Course	Credit Hours	Pre-requisites	Concurrent
ARB 101	Arabic Language	3	---	---
HSS 119	Entrepreneurship and Innovation	3	----	---
PHY 102*	General Physics (2)	3	PHY 101	---
MATH 102*	Calculus (2)	3	MATH 101	---
CHEM 102	General Chemistry (2)	3	CHEM 101	---
PHY 106*	General Physics Lab (2)	1	PHY 105	PHY 102
	Sum of Credit Hours	**16**		

*The courses in which the students must pass them before moving to the second year.

Second Year

First Semester

Course No.	Course	Credit Hours	Pre-requisites	Concurrent
BIO 101	General Biology (1)	3	---	---
CHEM 107	General Chemistry Lab	1	CHEM 102	CHEM 102
Programming in C++	CS 115	3	---	---
PHY 200	Introduction to Mathematical Physics	3	MATH 102 (pass)	---
PHY 201	Mathematical Physics (1)	3	PHY 102 (pass)+ PHY 200	PHY 200
PHY 211	Properties of Matter and Heat	2	PHY 102(pass)	---
MS 100	Military Sciences	3	---	---
	Sum of Credit Hours	**18**		

Second Semester

Course No.	Course	Credit Hours	Pre-requisites	Concurrent
	Dept. Elective	3	---	---
HSS 129	General skills	2	---	---
MATH 131	Elements of Statistics	3	MATH 102 (pass)	---
PHY 221	Properties of Matter and Heat Lab	1	PHY 106 (pass)+ PHY 211	PHY 211
PHY 251	Modern Physics	3	PHY 201	PHY 201
PHY 261	Thermodynamics	3	PHY 211 (pass)	---
PHY 281	Vibrations and Waves	3	PHY 102 (pass)+ PHY 201 (pass)	---
	Sum of Credit Hours	**18**		

Third Year

First Semester

Course No.	Course	Credit Hours	Pre-requisites	Concurrent
PHY 231	Electronics (1)	3	PHY 102 (pass)	---
PHY 233	Electronics Lab (1)	1	PHY 106 (pass)+ PHY 231	PHY 231
PHY 282	Optics	3	PHY 281	PHY 281
PHY 301	Mathematical Physics (2)	3	PHY 251 (pass)	
PHY 311	Classical Mechanics (1)	3	PHY 281 (pass)	
PHY 351	Quantum Mechanics (1)	3	PHY 301	PHY 301
	Sum of Credit Hours	**16**		

Second Semester

Course No.	Course	Credit Hours	Pre-requisites	Concurrent
	Dept. Elective	3	---	---
	Univ. Elective	3		
PHY 312	Classical Mechanics (2)	3	PHY 311 (pass)	
PHY 352	Quantum Mechanics (2)	3	PHY 351 (pass)	
PHY 353	Modern Physics Lab	1	PHY 351 (pass)	
PHY 283	Optics Lab	1	PHY 282	PHY 282
	Sum of Credit Hours	**14**		

Forth Year

First Semester

Course No.	Course	Credit Hours	Pre-requisites	Concurrent
	Dept. Elective	3		
	Univ. Elective	3		
PHY 331	Electromagnetic Theory (1)	3	PHY 301 (pass)	
PHY 449	Nuclear Physics	3	PHY 351 (pass)	
PHY 471	Solid State Physics	3	PHY 351 (pass)	
PHY 490	Training	2	Pass 100 C.Hs	
	Sum of Credit Hours	**17**		

Second Semester

Course No.	Course	Credit Hours	Pre-requisites	Concurrent
	Dept. Elective	3		
	Univ. Elective	3		
PHY 303	Computational Physics	3	PHY 351	PHY 351
PHY 332	Electromagnetic Theory (2)	3	PHY 331 (pass)	
PHY 461	Statistical Mechanics	3	PHY 261 (pass) + PHY 351 (pass)	
PHY 495	Graduation Project	3	Expected to graduate	
	Sum of Credit Hours	**18**		