Department of Physics

The B.Sc degree in Physics is awarded to the student after he/she has successfully completed 130 credit hours comprising university, faculty, and department requirements.

The 130 credit hours are distributed as follows:

I. **University requirements**: 25 credit hours as follows

a. **Compulsory requirements:** 16 credit hours

Course No.	Course	C.H	Pre-Requisites	Co-Requisites
ARAB 101	Arabic Language	3		
ARAB 103	Applied Arabic Language	1		
ENGL 111	English Language	3		
ENGL 112	Applied English Language	3		
CIS 100	Computer Literacy	3		
MS 100*	Military Sciences	3		

*Required from Jordanian students only and the results will be recorded as pass or fail. Students graduated from the Royal Military colleges or equivalent institutions are exempted. Non-Jordanian students are required to take a course from the elective courses which will be counted in their grade point average

Non-Arabic Speaking students must register for the following Arabic language courses:

Course No.	Course	C.H	Pre- Requisites	Co- Requisites
ARAB 101 A	Arabic Language for Non-Arabic speaking	3		
ARAB 103 A	Arabic Language for Non-Arabic speaking	1		

b. **Elective requirements:** (**9**) credit hours selected from the following courses

Course No.	Course	C.H	Pre-Requisites	Co-Requisites
HUM 112	Hadith Sharif (The traditions)	3		
HUM 113	Aqida (Creed)	3		
HUM 114	Fiqih	3		
HUM 115	Islam and Current Issues	3		
HUM 116	Economic System in Islam	3		
HUM 121	Principles of Sociology	3		

HUM 126	Principles of Psychology	3		
HUM 127	Teaching Technology			
HUM 128	National Education			
HUM 131	Islamic Civilization	3		
HUM 132	The History of Jerusalem			
HUM 133	Contemporary Cultures and Civilizations			
HUM 141	Principles of Economics	3		
HUM 142	Library and Information Research			
HUM 151	Principles of Administration	3		
HUM 161	Contemporary Issues	3		
HUM 166	Man and Science			
HUM 186	Woman Studies			
HUM 212	Arab Society			
HUM 213	The Individual and Society			
HUM 216	Contemporary International Issues			
HUM 221	Introduction to Sociology in English			
HUM 222	Creativity and Problem Solving			
HUM 223	Leadership and Communication Skills			
HUM 231	Arab History of Sciences	3		
HUM 241	Economy in the Third World			
HUM 242	Information and Research			
HUM 429	The Science of Children Behavior and Treatment			
ME 211	Fundamentals of Automobile Engineering (for students not in mechanical engineering)	3		
NR 200	Natural Resources and Man			
NUR 100	Health Promotion			
PH 103	Environmental Protection (For Non-Medicine and Nursing Students)	3		
PH 104	Human Health and Nutrition (For Non-Medicine and Nursing Students)	3		
PH 200	First Aid and Emergency Procedures (For Non-Medicine or Pharmacy and Nursing Students)	3		
PHAR 104	Drugs and Medicinal Plants: Uses and Side Effect (For Non-Medicine and Pharmacy Students)	3		
PP 200	Home Gardens (For Non-Agriculture Students)	3		
PP 201	Bee Keeping (For Non-Agriculture Students)	3		
PT 100	Well-being and Life Style			

VM 211	Animal Health for students of Vet. Medicine or Agriculture	3		
VM 211	Animal Health			
VM 212	Pet Animals Care			
	Foreign Languages	3		
ADS 100	Oral and Dental Health			

II. **Faculty requirements**: 19 credit hours

Course No.	Course	C.H	Pre-Requisites	Co-Requisites
Math 101	Calculus 1	3		
Math 102	Calculus 2	3	Math101	
Phy 101	General Physics 1	3		
Phy 102	General Physics 2	3	Phy 101	
Phy 105	General Physics Laboratory 1	1		Phy 101
CS 115	C++ Programming language	3	Cls 100	
Math 131	Elements of Statistics	3		
	Total	19		

III. **Department requirements**: 86 credit hours

a. **Compulsory requirements:** 74 credit hours

Course No.	Course	C.H	Pre-Requisites	Co-Requisites
Bio 101	General Biology 1	3		
Chem 101	General Chemistry 1	3		
Chem 102	General Chemistry 2	3	Chem 101	
Chem 107	General Chemistry Lab	1		Chem 102
Phy 106	General Physics Laboratory 2	1	Phy 105	Phy 102
Phy 200	Introduction to Mathematical Physics	3	Math 102	
Phy 201	Mathematical Physics 1	3	Phy 102	Phy 200
Phy 211	Properties of Matter and Heat	3	Phy 102	
Phy 221	Properties of Matter and Heat Lab	1	Phy 106	Phy 211
Phy 231	Electronics 1	3	Phy 102	
Phy 233	Electronics Lab 1	1	Phy 106	Phy 231

Phy 251	Modern Physics	3		Phy 201
Phy 261	Thermodynamics	3	Phy 211	
Phy 281	Vibrations and Waves	3	Phy 201	
Phy 282	Optics	3		Phy 281
Phy 283	Optics Lab	1		Phy 282
Phy 301	Mathematical Physics 2	3	Phy 201	
Phy 303	Computational Physics	3	Cls 100	
Phy 311	Classical Mechanics 1	3	Phy 281	
Phy 312	Classical Mechanics 2	3	Phy 311	
Phy 331	Electromagnetic Theory 1	3		Phy 301
Phy 332	Electromagnetic Theory 2	3	Phy 331	
Phy 351	Quantum Mechanics 1	3	Phy 251	
Phy 352	Quantum Mechanics 2	3	Phy 351	
Phy 353	Modern Physics Lab	1	Phy 251	
Phy 440	Atomic Physics	3		Phy 352
Phy 449	Nuclear Physics	3	Phy 351	
Phy 461	Statistical Mechanics	3	Phy 261	
Phy 471	Solid State Physics 1	3	Phy 251	

b. **Elective requirements:** 12 credit hours which the student can choose from the table below:

Course No.	Course	C.H	Pre-Requisites	Co-Requisites
Phy 202	Space Physics	3	Phy 101	
Math 203	Ordinary Differential Equations	3	Math 102	
Phy 333	Electronics 2	3	Phy 233	
Phy 341	Radiation Physics	3	Phy 251	
Phy 346	Nuclear Techniques Lab	3		Phy 341
Phy 395	Renewable Solar Energy	3	Phy 211	
Phy 401	Mathematical Physics 3	3	Phy 301	
Phy 430	Plasma Physics	3	Phy 331	
Phy 441	Introduction to Radio Biology	3	Bio 101	Phy 251
Phy 442	Elementary Particle Physics	3	Phy 440	
Phy 445	Non-destructive testing	3		Phy 341

Phy 472	Solid State Physics 2	3	Phy 471	
Phy 473	Semiconductors Physics	3	Phy 231	
Phy 474	Solar Cells	3		Phy 395
Phy 481	Physical Optics	3	Phy 331	
Phy 482	Introduction to Laser Sciences	3	Phy 282	
Phy 492	Seminar	1	Dept Perm	
Phys 493	Special Topics A Special Topics B Special Topics C	3 2 1	Dept. Perm	

Course description

Phy101: 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.

Phy102: 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

Phy103: General Physics
Vectors algebra, kinematics of motion, dynamics, elasticity, fluid mechanics, electrostatics, electric flux, electric potential, capacitors, Ohm's law, circuits and kirschoff's laws, magnetism, wave motion and sound waves, geometrical optics, modern physics, radioactivity, radiation doses.

Phy105: General Physics Lab 1
Experiments covering topics discussed in Phy101

Phy106: General Physics Lab 2
Experiments covering topics discussed in Phy102

Phy107: General Physics Lab
Experiments covering some topics discussed in Phy101 and Phy102

Phy200: Introduction to mathematical physics
Complex numbers, vector calculus, matrices and determinants, eigenvalues and eigenvectors.

Phy201: Mathematical Physics 1
Coordinate systems, limits and continuities, partial differentials, double and triple integrals, divergence and stocks theorems, first order differential equations.

Phy202: Space Physics
Kebler's laws, motion of the sun and other planets, calendars, electromagnetic spectrum and observatories

Phy211: Properties of Matter and Heat
Elasticity, flow of non-viscous fluids, flow of viscous fluids, heats and nature of matter, heat transfer, kinetic theory of gases, gravity

Phy221: Properties of Matter and Heat Lab
Experiments covering topics discussed in Phy211.

Phy231: Electronics 1
Alternating current circuits, conduction in solids, diodes, transistors, and FET, networks, amplifiers

Phy233: Electronics Lab
Experiments covering topics discussed in Phy231

Phy251: Modern Physics
Special relativity, concepts of waves and particles, introduction to quantum mechanics, atomic structure, quantum theory of the H-atom

Phy261: 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

Phy281: Vibration and Waves
Simple harmonic oscillations, forced and couples oscillations, motion of longitudinal waves, wave motion in two dimensions, Fourier method, non linear oscillations

Phy282: Optics
Reflection and refraction, mirrors, lenses, image formation, wave optics, nature of light, wave equation, interference, interferometers, diffraction, polarization, radiometry.

Phy283: Optics Lab
Experiments covering topics discussed in Phy282

Phy301: Mathematical Physics 2
Evaluation of integrals, integral transformation, special functions, partial differential equations

Phy303: 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

Phy311: 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.

Phy312: Classical Mechanics 2
Quick review of static's, Lagrange equations, Hamilton equations, tensor algebra, rotational dynamics of rigid bodies, theory of small oscillations

Phy331: 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.

Phy332: Electromagnetic Theory 2
Electromagnetic induction, magnetic energy, Maxwell's equations, propagation of electromagnetic waves, polarization, reflection and refraction of EM waves, wave guides, radiation.

Phy333: Electronics 2
Power amplifiers, Oscillator principles, digital circuits, digital switching using integrated circuits, introduction to microprocessors

Phy341: 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.

Phy351: Quantum Mechanics 1
Limits of classical mechanics, wave packets and uncertainty principle, Schrödinger wave equation, potential well, eigenfunctions and eigenvalues, operators, angular momentum operators, the H-atom

Phy352: 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

Phy353: 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.

Phy440: Atomic Physics:
Review of the atomic nature of matter. One electron-atom, fine structure, Hyperfine structure and interaction with external electric and magnetic fields. Many electron-atoms (the spectrum of the He-atom), X-ray spectra, Inner shells, Auger effect. Molecular structure and chemical bonding. Coulomb Scattering.

Phy441: Introduction to Radiobiology
Introductionto human biology, Radiobiology covering primary events in the cell. Deposition of energy, Molecular events, Biological expression of molecular damage.

Radiation effects on various cells. Metabolism, Toxity& therapy of radionuclides incorporated in man .

Phy445: Non-Destructive Testing
Introduction & scop. of NDT. Wildments & casting surface and internal defects, industrial Radiopraphy, Ultrasonic examination of welds. Infrared inspection. Surface defects and their detection, Magnetic particles, Dyepenetrants & Eddy current flow detection, International Standards Codes of Practice.

Phy449: Nuclear physics (3 credits)
Review, Nuclear Properties, nuclear models, nuclear radioactivity, Alpha decay, Beta,decay, Gamma decay, Nuclear reactions (fission and fusion), applications.

Phy461: Statistical Mechanics
Maxwell – Boltzmann statistics and its application Bose – Einstein statistics and its applications, Fermi – Dirac statistics and its application. Concepts of Temp, and Entropy, Thermodynamics of gases, and application of statistical thermodynamics, The Canonical ensemble, The Gramd Canonical ensemble.

Phy471: Solid State Physics
Crystal structure and binding, Diffraction in crystals, Reciprocal lattice and lattice vibrations, Phonons and specific heat, Free-electron model.

Phy481: Physical Optics
Brief history of optics, Mathematics of wave motion, Electromagnetic theoy of light, Fresnel Doefficients, 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, Diffraction, theory of diifraction, Diffraction from slits and apertures, Diffraction Gratings.

Phy482: Introduction to the Laser Sciences:
Principles of laser operation and laser cavity design, laser systems such as solid state, gas, and dye laser, Variety of laser applications such as communications systems, high resolution spectroscopy and laser interactions with solids.

Phy492: Seminar
Graduation project & Seminar.