Academic Programs Booklet

College of Science

2025

Prepared By: VP For Academic Programs and Graduate Studies Office

College of Science

Table of Contents

Page

BACHELOR OF SCIENCE IN PHYSICS 2

Program Components of Bachelor of Science in Physics 2

Detailed Study Plan 3

MAJOR ELECTIVE COURSES LIST 7

GENERAL STUDIES ELECTIVE COURSES LIST 8

COURSE DESCRIPTION 10

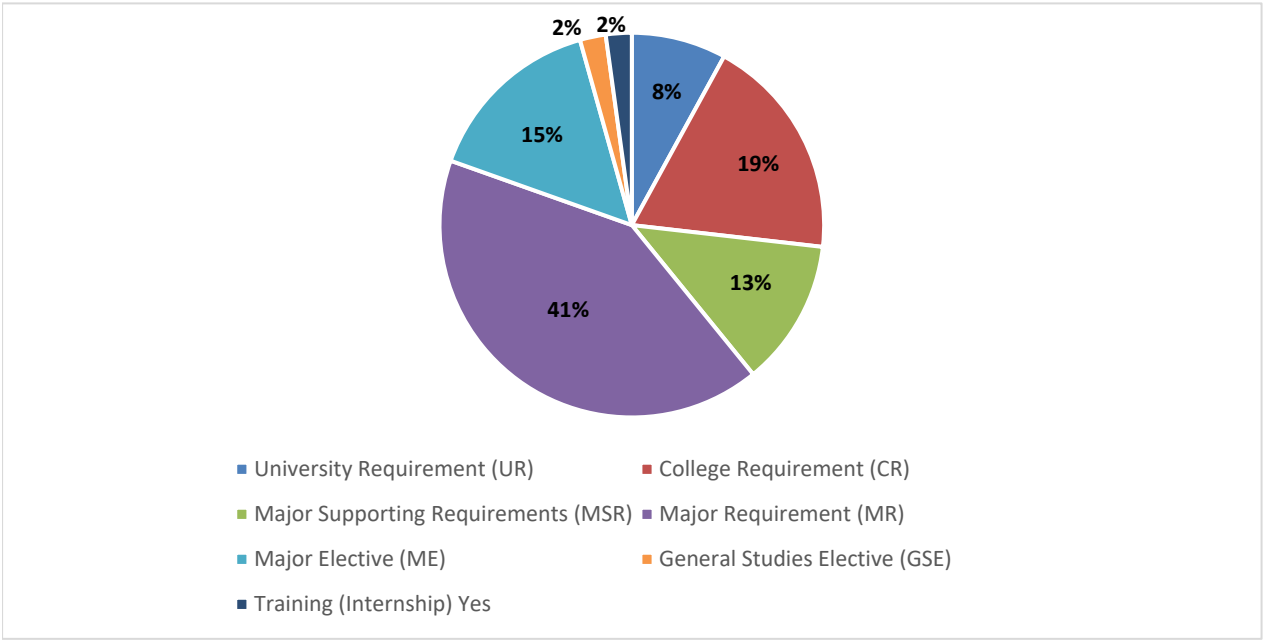
MAJOR SUPPORT REQUIREMENTS COURSES DESCRIPTIONS 14

UNIVERSITY REQUIREMENTS COURSES DESCRIPTIONS 15

COLLEGE REQUIREMENT COURSES DESCRIPTIONS 16

Bachelor of Science in Physics (2025)

Program Components



University Requirement (UR)	**11**
College Requirement (CR)	**26**
Major Supporting Requirements (MSR)	**17**
Major Requirement (MR)	**57**
Major Elective (ME)[1]	**21**
General Studies Elective (GSE)[2]	**3**
Training (Internship) Yes	**3**
Total Credit (CRD)	**138**

Teaching Language: English

[1] Student must select **Seven** (3XX & 4XX) courses from Major Elective (ME) List.

[2] Student must select **one** course from Humanities and Social Science.
Note: HU/SS Courses - Humanities and Social Science Component: Any course from the following:
Humanities: Fine Arts, History, American Studies, Classics, Communications, English, (Foreign Language) French, Music, Philosophy, Theatre, Literature (Arabic), Religion (comparative).
Social Science: Anthropology, Economics, Education, Geography, History, Psychology, Sociology, Women's Studies, Political Science.

Detailed Study Plan

Year 1 - Semester 1

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
Arab 110	Arabic Language Skills	3	0	3	UR	-	NO
CHEMY 101	General Chemistry I	3	2	4	CR	-	NO
ENGL 125	English for Science I	3	0	3	CR	-	NO
MATHS 131	Calculus I	4	0	4	CR	-	NO
PHYCS 101	General Physics I	3	2	4	CR	-	YES

Year 1 - Semester 2

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
ITCS 106	Computer Programming I	3	2	4	CR	-	NO
HIST 122	Modern History of Bahrain & Citizenship	3	0	3	UR	-	NO
MATHS 132	Calculus II	4	0	4	MSR	MATHS 131	NO
PHYCS 102	General Physics II	3	2	4	MR	PHYCS 101	YES
ENGL 126	English for Science II	3	0	3	CR	ENGL 125	NO

Year 2 - Semester 3

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
BIOLS 102	General Biology I	3	2	4	CR	-	NO
MATHS 211	Linear Algebra	3	0	3	MSR	MATHS 131	NO
PHYCS 206	Bulk Properties of Matter	3	2	4	MR	PHYCS 101	YES
PHYCS 240	Introductory Electronics	3	2	4	MR	PHYCS 102	YES
HRLC 107	Human Rights	2	0	2	UR	-	NO

Year 2 - Semester 4

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CHEMY 102	General Chemistry II	3	2	4	MSR	CHEMY 101	NO
MATHS 205	Differential Equations	3	0	3	MSR	MATHS132	NO
PHYCS 221	Methods of Mathematical Physics I	3	0	3	MR	PHYCS 102 & MATHS 132	YES
PHYCS 220	Modern Physics	3	0	3	MR	PHYCS 102	YES
ENGL 226	Scientific Report Writing	3	0	3	MSR	ENGL 126	NO

Year 3 - Semester 5

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
PHYCS 314	Classical Mechanics	3	0	3	MR	PHYCS 221 or MATHS 205	YES
PHYCS 330	Physical Optics	3	0	3	MR	PHYCS 102	YES
PHYCS 365	Thermal Physics	3	0	3	MR	PHYCS 206	YES
PHYCS 320	Atomic & Molecular Physics	3	0	3	MR	PHYCS 220	YES
PHYCS 3XX	Major Elective 1	X	X	3	ME	As per ME list	YES
PHYCS 391	Intermediate Physics Lab	0	4	2	MR	PHYCS 220	YES

Year 3 - Semester 6

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
PHYCS 326	Quantum Mechanics I	3	0	3	MR	PHYCS 220 & PHYCS 221	YES
PHYCS 348	Electromagnetic Theory	3	0	3	MR	PHYCS 221	YES
PHYCS 350	Solid State Physics I	3	0	3	MR	PHYCS 220	YES
PHYCS 3XX	Major Elective 2	X	X	3	ME	As per ME list	YES
PHYCS 392	Advanced Physics Lab I	0	4	2	MR	PHYCS 391	YES
PHYCS 425	Computational Physics	2	2	3	MR	PHYCS 221 OR MATHS 205	YES

Training Requirement

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
PHYCS 397	Internship	0	6	3	MR	Passing 75 cr. Hrs.	YES

Year 4 - Semester 7

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
PHYCS 430	Laser Physics	3	0	3	MR	PHYCS 320 & PHYCS 330	YES
PHYCS 470	Nuclear Physics	3	0	3	MR	PHYCS 326	YES
PHYCS 3XX	Major Elective 3	X	X	3	ME	As per ME list	YES
PHYCS 4XX	Major Elective 4	X	X	3	ME	As per ME list	YES
PHYCS 491	Advanced Physics Lab II	0	4	2	MR	PHYCS 392	YES
HU/SS XXX	Humanities / Social Science	3	0	3	GSE	As per GSE List	NO

Year 4 - Semester 8

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
ISLM 101	Islamic Culture	3	0	3	UR	-	NO
PHYCS 4XX	Major Elective 5	X	X	3	ME	As per ME list	YES
PHYCS 4XX	Major Elective 6	X	X	3	ME	As per ME list	YES
PHYCS 4XX	Major Elective 7	X	X	3	ME	As per ME list	YES
PHYCS 499	Senior Research Project	0	6	3	MR	Department Approval	YES

Major Elective Courses List

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
PHYCS 333	Oscillations and Waves	3	0	3	ME	PHYCS 221	YES
PHYCS 334	Optoelectronics	2	2	3	ME	PHYCS 240	YES
PHYCS 340	Electronics II	2	2	3	ME	PHYCS 240	YES
PHYCS 342	Digital Electronics I	2	2	3	ME	PHYCS 240	YES
PHYCS 353	Physics of Materials	2	2	3	ME	PHYCS 206	YES
PHYCS 364	Meteorology	2	2	3	ME	PHYCS 206	YES
PHYCS 366	Environmental Physics	2	2	3	ME	PHYCS 206	YES
PHYCS 371	Sensors and Transducers	2	2	3	ME	PHYCS 101	YES
PHYCS 372	Advanced Metrology	2	2	3	ME	PHYCS 371	YES
PHYCS 373	High Precision Metrology	3	0	3	ME	PHYCS 371	YES
PHYCS 382	Astronomy	3	0	3	ME	PHYCS 102	YES
PHYCS 383	Space Science and Technology	3	0	3	ME	PHYCS 102	YES
PHYCS 408	Medical Physics	2	2	3	ME	PHYCS 206	YES
PHYCS 421	Mathematical Physics	3	0	3	ME	PHYCS 221	YES
PHYCS 422	Particle Physics	3	0	3	ME	PHYCS 326	YES
PHYCS 424	Machine Learning in Physics	2	2	3	ME	PHYCS 425	YES
PHYCS 426	Advanced Computational Physics	2	2	3	ME	PHYCS 425	YES
PHYCS 427	Quantum Mechanics II	3	0	3	ME	PHYCS 326	YES
PHYCS 428	Space and Time	3	0	3	ME	PHYCS 220 & PHYCS 314	YES
PHYCS 444	Electrodynamics	3	0	3	ME	PHYCS 348	YES
PHYCS 462	Statistical Physics	3	0	3	ME	PHYCS 365	YES
PHYCS 465	Solar Energy	2	2	3	ME	PHYCS 365	YES
PHYCS 484	Astrophysics	3	0	3	ME	PHYCS 382	YES
PHYCS 492	Selected Topics in modern physics	3	0	3	ME	Department Approval	YES

General Studies Elective Courses List

Course Code	Course Title	Course Hours			Course Type	Pre requisite
		LEC	PRAC	CRD		
ARAB 141	Modern Arabic Lit.	3	0	3	GSE	------
ARAB 242	Arabic Poetry in The Renaissance Period	3	0	3	GSE	------
ART 133	Fundamentals of Music and Its Appreciation	3	0	3	GSE	------
ART 141	Drawing and Painting	2	1	3	GSE	------
ART 221	Traditional Music of Bahrain and Its Application	3	0	3	GSE	------
CHL 101	Introduction to Chinese Language	3	0	3	GSE	------
CHL 102	Basic Chinese Language	3	0	3	GSE	CHL 101
EDAR 126	Playing on Piano and Org 1	3	0	3	GSE	------
EDPS 144	Psychology of Learning and Memory	3	0	3	GSE	------
EDTC 100	Teaching and Learning Technology	3	0	3	GSE	------
ENGL 130	Introduction to Literature	3	0	3	GSE	------
FREN 141	French I	3	0	3	GSE	------
FREN 142	French II	3	0	3	GSE	FREN 141
GERM 101	Introduction to German	3	0	3	GSE	------
HISTO 212	Contemporary History of The Arab World	3	0	3	GSE	------
HISTO 281	Landmarks of Islamic Civilisation	3	0	3	GSE	------
ISLM 114	Quranic Sciences	3	0	3	GSE	------
ISLM 136	Biography of The Prophet	3	0	3	GSE	------
ISLM 141	Introduction to Shari'A	3	0	3	GSE	------
ISLM 252	Islamic Doctrine	3	0	3	GSE	------
JAPN 101	Japanese Level I	3	0	3	GSE	------
JAPN 102	Japanese Level II	3	0	3	GSE	JAPN 101
KL 101	Korean Language I	3	0	3	GSE	------
KL 102	Korean Language II	3	0	3	GSE	KL 101
LAW 101	Introduction to Legal Studies	3	0	3	GSE	------
LAW 102	History of Law	3	0	3	GSE	------

Course Code	Course Title	Course Hours			Course Type	Pre requisite
		LEC	PRAC	CRD		
LAW 106	Constitutional Law I	3	0	3	GSE	------
PHEDE 214	Principles of Educational Statistics	3	0	3	GSE	------
PSYC 103	Introduction to Psychology	3	0	3	GSE	------
PSYC 120	Psychology of Marriage	3	0	3	GSE	------
PSYC 211	Educational Psychology	3	0	3	GSE	------
PSYC 281	Thinking Skills	3	0	3	GSE	PSYC 103 or EDPS 241
SOCIO 161	Introduction to Sociology	3	0	3	GSE	------
SOCIO 181	Introduction to Anthropology	3	0	3	GSE	------
SOCIO 191	Citizenship, Identity and Globalization	3	0	3	GSE	------
SOCIO 224	Sociology of Health	3	0	3	GSE	------
SOCIO 226	Sociology of Arabian Gulf	3	0	3	GSE	------
TL 101	Turkish Language	3	0	3	GSE	------
GSE XXX	Other electives	X	X	3	GSE	Department Approval

Course Description

Course Code: PHYCS 102 **Course Title:** General Physics II
Electric charges and fields; Coulomb's and Gauss's laws; electric potential; capacitors and dielectrics; direct current circuits; Kirchoff's rules; magnetic field and flux; ampere's law; induced emf; Lenz's law; mutual and self inductance.

Course Code: PHYCS 206 **Course Title:** Bulk Properties of Matter
Elasticity; fluid statics and dynamics; mechanical waves; vibrating bodies; acoustic phenomena; kinetic theory of gases; first and second law of thermodynamics; geometrical optics.

Course Code: PHYCS 221 **Course Title:** Methods of Mathematical Physics I
Curvilinear coordinates; vector calculus; multiple integrals; ordinary differential equations; power series; complex numbers; linear equations; matrices and determinants; Fourier series; application to physics problems**.**

Course Code: PHYCS 220 **Course Title:** Modern Physics
The special theory of relativity; relativistic dynamics; blackbody radiation; the photoelectric effect; Compton effect; pair production and annihilation; bremsstrahlung and x-ray production; wave-particle duality; de Broglie's hypothesis; the uncertainty relationships; the Schrodinger equations and applications; elementary particles.

Course Code: PHYCS 240 **Course Title:** Introductory Electronics
Properties of semiconductors; diode characterization; Zener diodes; tunnel diodes; photodiodes; construction and operation of bipolar junction and field effect transistors; dc biasing; stabilization; small signal analysis of BJT; JFET and MOSFET amplifiers; multistage systems; operational amplifiers.

Course Code: PHYCS 314 **Course Title:** Classical Mechanics
Dynamics of particles; conservation theorem and symmetries; linear harmonic oscillations; Lagrangian and Hamiltonian dynamics; motion of particles and systems in a central force field; dynamics of a system of particles (collision and scattering).

Course Code: PHYCS 320 **Course Title:** Atomic and Molecular Physics
Atomic model; the Rutherford nuclear atom; the Bohr model; line spectra; the Schrodinger equation in spherical coordinates; quantum numbers and degeneracy; the hydrogen atom wave functions; intrinsic spin and spin angular momentum; the Pauli exclusion principle; addition of angular momenta; the hydrogen molecule; molecular vibrations and rotations; molecular spectra.

Course Code: PHYCS 326 **Course Title:** Quantum Mechanics I
Postulates of quantum mechanics; operators; eigenfunctions and eigenvalues; Dirac formalism in Hilbert space; timevariation of expectation values and conservation laws; Hamiltonian operator; harmonic oscillator; angular momentum algebra; eigenvalues and eigenfunctions of the Schrodinger equation for central forces with hydrogen- atom as an example; time independent perturbation theory.

Course Code: PHYCS 330 **Course Title:** Physical Optics
Periodic motion; superposition of periodic motions; free vibrations of physical systems; properties of light; interference of light; Fraunhofer diffraction; the double slit experiment; diffraction; the double slit experiment; the diffraction grating; Fresnel diffraction; absorption and scattering; dispersion; reflection and polarization of light.

Course Code: PHYCS 333 **Course Title:** Oscillations and Waves
Free and forced vibrations; resonance; coupled oscillations and normal modes; normal modes of continuous systems; Fourier analysis; progressive waves; normal modes and travelling waves; transmission and reflection of waves; impedance matching; standing waves; acoustical phenomena; non-linear oscillations.

Course Code: PHYCS 334 **Course Title:** Optoelectronics
Nature of light; electrical and optical processes in semiconductors; the p-n junction; optical effects; luminescence and display devices; solar cells; lasers and applications; photodetectors; fiber optics; waveguides; optical communication systems.

Course Code: PHYCS 340 **Course Title:** Electronics II
Multistage systems and frequency considerations; differential and operational amplifiers; feedback amplifiers and oscillator circuits; active filters; voltage regulators; pn-npn and other devices; introduction to electronic communication and modulation: AM and FM.

Course Code: PHYCS 342 **Course Title:** Digital Electronics I
Number systems and codes; logic gates and Boolean algebra; combinational logic; introduction to sequential logic; counters and shift registers; design of sequential circuits; introduction to microprocessors.

Course Code: PHYCS 348 **Course Title:** Electromagnetic Theory
Vector calculus; electrostatic fields; electric fields in dielectric materials; solutions for the electrostatic boundary-value problems; the magnetic field; magnetic materials; electromagnetic induction and the flow of power; Maxwell's equations; plane electromagnetic waves; Poynting vector.

Course Code: PHYCS 350 **Course Title:** Solid State Physics I
Structure of crystals; diffraction of x-rays; thermal properties of solids; free electron theory of metals; the band theory of solids; Maxwell-Boltzmann and Fermi-Dirac distributions; phonons and lattice vibrations; atomic bonding; non-crystalline solids; introduction to semiconductors.

Course Code: PHYCS 353 **Course Title:** Physics of Materials
Introduction to materials; microstructure and properties; ferrous and non-ferrous alloys; ceramic materials; polymers and plastics; composite materials; magnetic materials.

Course Code: PHYCS 364 **Course Title:** Meteorology
Survey of the atmosphere; weather observations; synoptic charts and forecasts; radiation and atmospheric heat exchange; horizontal winds; clouds; precipitation and fog formation and condensation of cloud droplets; formation and growth of ice crystals; rain and snow; weather radar; atmospheric storms; hurricanes and tropical cyclones; severe thunderstorms; lighting and hail; tornadoes.

Course Code: PHYCS 365 **Course Title:** Thermal Physics
Fundamental concepts in thermodynamical systems; equations of state; the first law of thermodynamics; consequences of the first law; entropy and the second law of thermodynamics; combined first and second laws; thermodynamic potentials; the principle of equation of energy; equation of state of an ideal gas; classical theory of specific heat; statistical thermodynamics and applications.

Course Code: PHYCS 366 **Course Title:** Environmental Physics
A broad course concerning the identification and measurement of environmental problems; the prevention and alleviation of existing problems. It is a calculation-based course. Topics covered: essentials of environmental physics; environmentally friendly energies; global climate change; physics of natural disasters; nuclear energy (carbon free energy); noise and noise pollution; state of the atmosphere; electrosmog.

Course Code: PHYCS 371 **Course Title:** Sensors and Transducers
State of the art of the sensors and transducers used to measure: Electrical, Electromagnetic, Mechanical, thermal and chemical quantities. Comprehend, analyze and evaluate uncertainties of measured data.

Course Code: PHYCS 372 **Course Title:** Advanced Metrology
This course is an introduction to several advanced instruments and techniques used in physics and chemistry: Photometers, Photometric Light Sources, pH Measurement and Control, Pulse Height Analyzers, Scintillation Counters and semiconductor devices, Thin Film Analyzers, Radiometry, Interferometers and Acoustic Wave Interferometers, Mass Spectrometers, Electron Microscopes and X-Ray Microscopy

Course Code: PHYCS 373 **Course Title:** High Precision Metrology
Time is one of the fundamental quantities in nature, and it plays a very important role in the vast majority of measurements made, either directly or through its relationship to two other often-measured quantities—frequency and phase. This course treats the important aspects of the measurement of time, frequency and phase.

It provides general information on the measurement of time, addresses frequency standards, and discusses time interval, frequency and phase meters, along with classification of noise types and origins.

Course Code: PHYCS 382 **Course Title:** Astronomy

The celestial sphere and elementary celestial mechanics; coordinate systems of the celestial sphere; time keeping systems; planetary motions; planetary phenomena and the solar system; the stars stellar motions; stellar populations and evolution; stars with special properties; nebulae; celestial objects observed outside the optical spectrum.

Course Code: PHYCS 383 **Course Title:** Space Science and Technology

Two-body orbital mechanics; the trajectory equation; low and high earth orbits; in-plane and-out-of plane orbit changes; the general ballistic missile trajectories; lunar trajectories; interplanetary trajectories; satellite information systems; satellite orbits; launchers, structure and subsystems; satellite frequency bands and telecommunication; remote sensing.

Course Code: PHYCS 391 **Course Title:** Intermediate Physics Lab

Experiments in modern physics, atomic and molecular physics and physical optics including Atomic spectra, X-ray, Electron diffraction, Photoelectric effect, Frank-Hertz experiment, Geometrical optics, Light diffraction, interference, and polarization.

Course Code: PHYCS 392 **Course Title:** Advanced Physics Lab I

Experiments in higher physics courses; Atomic and molecular physics, Solid state physics, Laser Physics and Nuclear physics.

Course Code: PHYCS 397 **Course Title:** Internship

The Internship course is designed to provide an opportunity to gain work experience related to the student's specified field of science, in a supervised workplace environment for a period of 8 consecutive weeks. The student shall submit a report upon completion.

Course Code: PHYCS 408 **Course Title:** Medical Physics

Energy; work and power of the body; measurements of pressure in the body; the physics of the lungs and breathing; physics of the cardiovascular system; electricity within the body; application of the electricity and magnetism in medicine; sound in medicine; physics of the eyes and vision; radiation dosimetry; biological effect of radiation; radiation protection guides.

Course Code: PHYCS 421 **Course Title:** Mathematical Physics

Calculus of variation; tensor analysis; coordinate transformation; partial differential equation; Green's function; functions of a complex variables; contour integration.

Course Code: PHYCS 422 **Course Title:** Particle Physics

Elementary particles and their family classifications; invariance principles and conservation laws; covariant formulation of Lorentz transformations; four-vector algebra; relativistic collisions; phenomenology of strong; weak and electromagnetic interactions; Salam-Weinberg exchange particles; parity violation; Cabbibo theory; SU(2) and SU(3) classifications and the Quark model of hadrons; Quark confinement; search for quarks; some cosmological applications.

Course Code: PHYCS 424 **Course Title:** Machine Learning in Physics

Data analysis with linear and nonlinear regression, logistic regression, and gaussian processes. Concepts in machine learning such as unsupervised and supervised regression and classification learning. Bayesian statistics and information theory, covering concepts such as information, entropy, posteriors, MCMC, latent variables, graphical models and hierarchical Bayesian modeling.

Course Code: PHYCS 425 **Course Title:** Computational Physics

Finite difference solution of ordinary and partial differential equations as applied in Newton's equation of motion in one and higher dimensions, oscillations and chaotic systems, central forces and many body problem, electric and magnetic fields and random processes.

Course Code: PHYCS 426 **Course Title:** Advanced Computational Physics

Wave equation; Spectral methods; Discrete Fourier transform; Fast Fourier Transform; Monte Carlo simulations; random walks; percolation; fractals; Methods of simulating quantum mechanical systems.

Course Code: PHYCS 427 **Course Title:** Quantum Mechanics II

Many-particle systems; variational principle; time independent and time dependent perturbation theory; Born and WKB approximations; scattering theory; methods of partial waves and s-wave scattering; entanglement. introduction to relativistic quantum mechanics.

Course Code: PHYCS 428 **Course Title:** Space and Time

Differential geometry; Reimannian geometry and Newtonian gravity; Einstein's field equations and variational principles in four-dimensional geometry; flat space-time; curved space-time; the very early universe; problems of singularity; horizon and flatness; the expanding and static universe hypothesis.

Course Code: PHYCS 430 **Course Title:** Laser Physics

The nature of light; polarization and coherence of light; detection of electromagnetic radiation; laser construction and operation; characteristics of laser light; laser pumping rate; oscillations; gain and threshold; optical resonators; multimode laser operation; specific lasers and pumping mechanisms; laser applications.

Course Code: PHYCS 444 **Course Title:** Electrodynamics

Propagation; reflection and refraction of electromagnetic waves in vacuum; dielectric media and conductors; radiation by point and system of charges; resonant cavities and waveguides; radiation from an oscillating dipole.

Course Code: PHYCS 462 **Course Title:** Statistical Physics

Principal concepts in probability theory, statistical concepts and examples, kinetic theory, partition functions, ideal Bosons and Fermions, canonical distributions, systems of interacting particles, kinetic theory of transport processes.

Course Code: PHYCS 465 **Course Title:** Solar Energy

Solar radiation; available solar radiation; selected heat transfer topics; radiation characteristics of opaque materials; radiation transmission through glazing; absorbed radiation; flat plate collectors; concentrating collectors; photovoltaic systems; indirect solar energy.

Course Code: PHYCS 470 **Course Title:** Nuclear Physics

Nuclear properties; angular momentum and parity; nuclear models; nuclear decay and radioactivity; detection of nuclear radiation; nuclear reactions; nuclear fission; nuclear fusion; accelerators; introduction to nuclear structures.

Course Code: PHYCS 484 **Course Title:** Astrophysics

Properties of matter and radiation; energy sources; atomic properties of matter; stellar evolution; stellar objects; interstellar medium; star formation; the expanding universe; the galaxy; the extragalatic universe; the big bang theory and evolution of the universe.

Course Code: PHYCS 491 **Course Title:** Advanced Physics Lab II

Training students in research level and high experimental Data acquisition, instrument control and automation using available software packages selected advanced level experiments from various field of physics as well as field trips.

Course Code: PHYCS 492 **Course Title:** Selected Topics in Modern Physics

Recent trends and advances in contemporary physics. An in-depth investigation or survey of a single or several topics as approved by the departmental council.

Course Code: PHYCS 499 **Course Title:** Senior Research Project

Advanced experimental or theoretical work with an orientation toward research. A written report that includes a critical analysis of the theoretical and experimental details is to be submitted to the supervisor upon the conclusion of the project. The grade is awarded on the basis of a written report and an oral presentation.

Major Support Requirements Courses Descriptions

Course Code: MATHS 132 **Course Title:** Calculus and Analytic Geometry II
Applications of definite integrals, L'Hopital's rule, integration techniques, infinite series, Taylor and Maclaurin series, parametric equations and polar coordinates

Course Code: MATHS 205 **Course Title:** Differential Equations
Differential equations of first order and their solution. Separable and exact equations. Equations convertible to separable type. Higher order linear equations with constant coefficients (homogeneous and non-homogeneous). Power series method for second order linear equations. Variation of parameters. Laplace transform technique. Applications of differential equations.

Course Code: MATHS 211 **Course Title:** Linear Algebra
Fields. Vector spaces. Linear dependence and independence. Bases. Dimensions. Subspaces. Quotient spaces. Linear transformations. Connection with matrices. Change of bases (PAQ and PAP). Eigen-values. Characteristic polynomial. Minimal polynomial. Canonical forms in simple cases. Real and complex inner-product spaces. Orthonormal bases. Orthogonal and complex unitary matrices and their eigen-values. Orthogonal and unitary reduction of real symmetric and complex Hermitian matrices.

Course Code: CHEMY 102 **Course Title:** General Chemistry II
Molecular orbitals of homonuclear diatomic molecules; thermochemistry: calorimetry, enthalpy, thermochemical equations, heats of formation; chemical kinetics: rate and concentration, concentration and time, activation energy, rate and temperature, catalysis; chemical equilibria: gaseous and aqueous equilibria, the equilibrium constant and the factors affecting an equilibrium system, solubility equilibrium; acids and bases: pH of acidic and basic solutions, hydrolysis of salts; acid-base neutralization: buffers, acid-base titration curves, indicators; entropy and Gibb's energy; introduction to electrochemistry: balancing redox equations, galvanic cells, standard cell potentials; organic Chemistry: IUPAC nomenclature of aliphatic and aromatic hydrocarbons, common functional groups. Related practical work.

Course Code: ENGL226 **Course Title:** Scientific Report Writing
This course aims to enable students in the College of Science to write professional and academic reports (between 2000-3000 words) related to their areas of specialization and intended work. It also deals with vocabulary and language structures essential for producing a full-length formal research report.

University Requirements Courses Descriptions

Course Code: ARAB 110 **Course Title:** Arabic Language Skills
This course focuses on basic Arabic skills including form, function, and meaning. It also helps the student to appreciate and understand structures and approach them from a critical point of view, through various genres in literature.

Course Code: HIST 122 **Course Title:** Modern History of Bahrain and Citizenship
Spatial identity of Bahrain: Brief history of Bahrain until the 18th century; the historical roots of the formation of the national identity of Bahrain since the 18th century; the modern state and evolution of constitutional life in Bahrain; the Arabic and Islamic dimensions of the identity of Bahrain; the core values of Bahrain's society and citizenship rights (legal, political, civil and economic); duties; responsibilities and community participation; economic change and development in Bahrain; Bahrain's Gulf, Arab and international relations.

Course Code: HRLC 107 **Course Title:** Human Rights Principles
This course deals with the principles of human rights in terms of the definition of human rights, scope, sources with a focus on the International Bill of Human Rights; The Charter of the United Nations; Universal Declaration of Human Rights; The International Covenant on Economics, Social and Culture rights; Convention against Torture and other Cruel, Inhuman or Degrading Treatment or Punishment; Mechanics and the Constitutional Protection of Rights and Public Freedoms in Kingdom of Bahrain.

Course Code: ISLM 101 **Course Title:** Islamic Culture
An introduction to the general outline and principles of Islamic culture, its general characteristics, its relationships with other cultures, general principles of Islam in beliefs, worship, legislation and ethics.

College Requirement Courses Descriptions

Course Code: CHEMY 101 **Course Title:** General Chemistry I
Atomic structure; formulas and names of chemical molecules; Avogadro's number and the mole; stoichiometry of chemical reactions; acid-base and redox reactions, solutions, concentration units, and colligative properties; gases and gas laws; electronic structure and the electron configuration; periodic properties and chemical bonding: ionic and covalent; Lewis structures and formal charge; molecular geometry and hybridization. Related practical work.

Course Code: BIOLS 102 **Course Title:** General Biology I
Properties of life; atoms, molecules and chemical bonds; biomolecules; cell structure and function; bioenergetics (intermediary metabolism); cell reproduction; Mendelian genetics; structure of DNA; RNA and protein synthesis; molecular genetics.

Course Code: PHYCS 101 **Course Title:** General Physics I
Units and measurements; brief review of vectors; Newton's laws of motion; projectile motion; work and energy; impulse and momentum; rotational dynamics; equilibrium of a rigid body.

Course Code: MATHS 131 **Course Title:** Calculus and Analytic Geometry I
Limits, Derivatives of Algebraic and Transcendental Functions, Related Rates, the Mean Value Theorem, Graphing Techniques, Optimization, Integrals, and the Fundamental Theorem of Calculus.

Course Code: ITCS 106 **Course Title:** Computer Programming I
This course introduces problem solving and fundamental programming concepts and techniques implemented by a high-level programming language. Topics include primitive and compound data types, syntax, semantics, expressions, assignment, input, output, conditional and iterative control structures, and functions. Related practical lab.

Course Code: ENGL 125 **Course Title:** English for Science I
This is the first of two integrated language courses designed specifically for science majors. Special attention is given to scientific vocabulary and the unique features of technical writing. The course includes an extensive reading programme via a self-access lab.

Course Code: ENGL 126 **Course Title:** English for Science II
English for Science is the second of two integrated language courses designed specifically for science majors. Special attention is given to scientific vocabulary and the unique features of technical writing.