

Faculty of Science

Department of Physics

Study Plan for the Bachelor Degree in Physics

2019 / 2020

Vision:

Excellence in learning and teaching physics, scientific research and community service.

Mission:

Graduating students who are skilled and scientifically qualified in the field of physics by providing a stimulating educational and research environment to meet the labor market requirements.

Program Objectives:

1. Preparing graduates who are able to employ their practical and scientific capabilities to meet the needs of the labor market.
2. Developing students' skills in scientific thinking and problem solving in the field of physics and its applications.
3. Developing students' criticism and scientific research skills.
4. Encourage scientific research for faculty members in the field of physics.
5. Activating community service through volunteer programs conducted by students and faculty members.
6. Establishing the concept of professional ethics for students and working with them.

Intended Learning Outcomes (ILOs):**Student will be able to:**

1. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies
2. An ability to identify, formulate, and solve complex physics problems by applying principles of physics, science, and mathematics.
3. An ability to develop and conduct appropriate experimentation, analyze, and interpret data, and use physics judgment to draw conclusions
4. An ability to apply physics design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
5. An ability to communicate effectively with a wide range of audiences
6. An ability to recognize ethical and professional responsibilities in the field of physics, and make informed judgments that consider the impact of physics in global, economic, environmental and societal contexts.
7. An ability to function effectively as a part of a team, take on leadership positions, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

*** The Intended Learning Outcomes was changed according to dean council decision number (2021/2022/-30-20); 30/5/2022**

Framework for Physics bachelor's degree (135 Cr. Hrs.)

Classification	Hrs			Percentage
	Compulsory	Elective	Total	
University Requirements	12	12	24	18 %
Faculty Requirements	21	0	21	16 %
Program Requirements	75	12	87	64 %
Support Courses	0	0	0	0.0 %
Free Electives	0	3	3	2.0 %
Total	120	90	135	100 %

Course Numbering: Example (General Physics 1)

1	1	0	2	1	1	0	1
Faculty Code		Dept. Code		Course Level		Knowledge Field	Sequence

Knowledge Areas

Number	Knowledge Field	Cr. Hr.
0	General Physics	6
1	Experimental Physics	6
2	Light and Waves	15
3	Electronics and Electromagnetic	12
4	Thermodynamics and Statistical Mechanics	9
5	Mechanics	9
6	Modern Physics	15
7	Solid State Physics	3
8	Mathematical Physics and Computational Physics	9
9	Training/graduation project/ Research paper and seminar	0

1. University Requirements: (24Credit Hours)

1.2.Compulsory University Requirements: (12Credit Hours)

Course No.	Course Title	Cr. Hr.	Prerequisite	Co-requisite
01101101	Military Sciences*	3	Jordanian student	-
01101112	National Education*	3	Jordanian student	-
01101102	Arabic Language**	3	01100011	-
01101111	English Language**	3	01100012	-
Total		12		

*Non-Jordanian student has the right to register it or choose one of the courses offered by the university.

** If the student does not pass the level exams should be take the following courses:

Preparative Arabic language (01100011) Preparative English language (01100012) Preparative computer skills (0110005)

1.2.Elective: 12 Credit Hours from the following courses.

Course No.	Course Title	Cr. Hr.	Prerequisite	Co-requisite
01101103	Traffic Education	3	-	-
01101104	Innovation and Entrepreneurship	3	-	-
01101121	Life Skills	3	-	-
01101131	Islamic Education	3	-	-
01101132	Jerusalem and the Hashemite custodianship	3	-	-
01101141	Sports and Health	3	-	-
01101142	Environment and Society	3	-	-
01101151	Computer Skills	3	01100051	-
01101152	Internet and communication	3	-	-
01101161	Economics System and Concepts	3	-	-
01101171	Psychology and Society	3	-	-
01101172	Modern language		-	-
01101213	Communication Skills in Arabic	3	01101111	-
01101214	Communication Skills in English	3	01101112	-
01101243	Safety and First Aid	3	-	-
01101281	Scientific Research Methods	3	-	-
01101282	Introduction to Astronomy	3	-	-
03011101	Law in Our Life	3	-	-
03021201	Human Rights	3	-	-

2. Faculty Requirements: (21Credit Hours)

2.1Compulsory Faculty Requirements: (21Credit Hours)

Course	Course Name	Hrs	Theory	Practical	Prerequisite	Co-requisite
06051211	Programming Fundamentals	3	3		01100051	-
11011101	General Chemistry (1)	3	3		-	-
11011281	General Biology	3	3		-	-
11021101	General Physics (1)	3	3		-	-
11031101	Calculus (1)	3	3		-	-
11031141	Statistics and Probabilities	3	3		11031101	-
11031202	Calculus (2)	3	3		11031101	-
Total		21	21			

2.2Faculty Requirements Electives: (0 Credit Hours)

3. Department Requirements (87 Credit Hours)

3.1. Compulsory Department Requirements: (75 Credit Hours)

Course	Course Name	Hrs	Prerequisite
11032164	Ordinary differential equations	3	11032103 Sim
11021111	General physics laboratory (1)	1	11021101 Sim
11021202	General physics (2)	3	11021101 Pre
11021212	General physics laboratory (2)	1	11021202 Sim
11022121	Optics	3	11021202 Pre
11022161	Modern Physics	3	11021202 Pre
11022181	Mathematical Physics (1)	3	11021202 Pre
11022213	Intermediate physics laboratory	1	11022121 Sim
11022222	Vibrations and waves	3	11022181 Pre
11022231	Electronics	3	11021202 Pre
11022282	Mathematical Physics (2)	3	11022181 Pre
11022283	Computer Applications in Physics	3	11022161 Pre
11023114	Electronics laboratory	1	11022231 Sim
11023123	Laser physics	3	11023162 Sim
11023132	Electromagnetic (1)	3	11022181 Pre
11023151	Classical Mechanics (1)	3	11022181 Pre
11023162	Quantum Mechanics (1)	3	11022181 Pre 11022161 Pre
11023215	Advance Physics laboratory	2	11022213 Pre
11023233	Electromagnetic (2)	3	11023132 Pre
11023241	Thermodynamics	3	11022161 Pre
11023252	Classical Mechanics (2)	3	11023151 Pre
11023263	Quantum Mechanics (2)	3	11023162 Pre
11024124	Environmental Physics	3	11023241 Pre
11024142	Statistical mechanics	3	11023162 Pre 11023241 Pre
11024143	Energy Physics	3	11023241 Pre 11022181 Pre
11024271	Solid State Physics	3	11023162 Pre 11023263 Pre
11032103	Calculus (3)	3	11031202 Pre
08012152	Curricula of Sciences and teaching methods	3	4 th level
Total		75	

3.2. Compulsory Department Requirements: (75 Credit Hours)

Course	Course Name	Hrs	Prerequisite
11023164	Atomic and molecular Physics	3	11023162 Pre
11023172	Material Science	3	11022161 Pre
11023225	Medical Physics	3	11022161 Pre
11023234	Digital Electronics	3	11022131 Pre
11023253	Astro Physics	3	11023151 Pre 11023233 Pre
11024165	Nuclear Physics	3	11023162 Pre
11024226	Radiation Physics	3	11023162 Pre
11024266	Theory of Special Relativity	3	11022161 Pre
11024291	Selected Topics in physics	3	Department Approval
	Total	12	

4. Support Courses (0 Credit Hours)

5. Free Electives: 3 Credit Hours

Course No.	Course Title	Cr. hr.	Prerequisite	Corequisite
	Total	3		

Study Plan Guide for the Bachelor Degree in Physics

First Year				
First Term				
Course No.	Course Title	Hrs.	Prerequisite	Corequisite
11031101	Calculus (1)	3	-	
11021101	General Physics (1)	3	-	
11021111	General Physics Laboratory (1)	1	-	11021101
11011101	General Chemistry (1)	3	-	
11011281	General Biology (1)	3	-	
	University Requirement	3	-	
Total		16		
Second Term				
Course No.	Course Title	Hrs.	Prerequisite	Co-requisite
11021202	General Physics (2)	3	11021101	
11021212	General Physics Laboratory (2)	1		11021202
11031102	Calculus (2)	3	11031101	
06051211	Programming Fundamentals	3	01100051 or pass Computer Skills Entry Test	
11031141	Statistics and Probability	3	11031101	
	University Requirement	3		
Total		16		

Second Year

First Term

Course No.	Course Title	Hrs.	Prerequisite	Co-requisite
11032164	Ordinary Differential Equations	3		11032103
11022181	Mathematical Physics (1)	3	11021202	
11022161	Modern Physics	3	11021202	
11032103	Calculus (3)	3	11031202	
11022121	Optics	3	11021202	
	University Requirement	3		
Total		18		

Second Term

Course No.	Course Title	Hrs.	Prerequisite	Co-requisite
11022181	Mathematical Physics (1)	3	11021202	
11022231	Electronics	3	11021202	
11022282	Applications of computer in Physics	3	11022161	
11022213	Intermediate Physics Laboratory	1		11022121
11022222	Vibration and Waves	3	11022181	
	Department Electives	3		
Total		16		

Third Year

First Term

Course No.	Course Title	Hrs.	Prerequisite	Co-requisite
11023162	Quantum Mechanics (1)	3	11022181 11022161	
11023132	Electromagnetic (1)	3	11022181	
11023114	Electronics Laboratory	1		11022231
11023151	Classical Mechanics (1)	3	11022181	
11023123	Laser Physics	3		11023162
	University Requirement	3		
Total		16		

Second Term

Course No.	Course Title	Hrs.	Prerequisite	Co-requisite
11023263	Quantum Mechanics (2)	3	11023162	
11023233	Electromagnetic (2)	3	11023132	
11023241	Thermodynamics	3	11022161	
11023252	Classical Mechanics (2)	3	11023151	
11023215	Advance Physics Laboratory	2	11022231	
	University Requirement	3		
Total		17		

Fourth Year

First Term

Course No.	Course Title	Hrs.	Prerequisite	Co-requisite
11024142	Statistical Mechanics	3	11023241 11023162	
11024143	Energy Physics	3	11022181 11023241	
11024124	Environment Physics	3	11023241	
	Department Electives	3		
	University Requirement	3		
	University Requirement	3		
Total		18		

Second Term

Course No.	Course Title	Hrs.	Prerequisite	Co-requisite
11024271	Solid State Physics	3	11023162 11023263	
08012152	Curricula of Sciences and teaching methods	3	4 th level	
	Department Electives	3		
	Department Electives	3		
	University Requirement	3		
	Free course	3		
Total		18		

Description of Courses offered by the Department of Physics

11021101	General Physics (1)	3 Credit Hours	Prerequisite: No
Motion in one Dimension, Vectors, Motion in two Dimensions, Newton's law of motions, Circular Motion and Other Applications of Newton's Laws, Work Energy Theorem, Conservation of Energy, Linear momentum and Collisions, Rotation of a Rigid Object About a Fixed Axis			
11021202	General Physics (2)	3 Credit Hours	11021101 Pre
Electric charge, Electric force, Electric field, Gauss law, Electric potential, Electric potential Energy, Capacitance and dielectrics, Current and resistance, DC Circuits, Ohm's law, Kirchhoff's Laws, Magnetic field, Lorentz's Force Law. Sources of magnetic fields, Biot and Savart law, Ampere's law, electromagnetic induction, Faraday's and Lenz law. Induced electromotive force and self-inductance.			
11021111	General Physics laboratory (1)	1 Credit Hour	11021101 Sim
Measurements and Uncertainties, Vectors and Forces in Equilibrium, Motion in One Dimension, Projectiles Motion, Force and Motion, Simple pendulum, Newton's Laws of Motion, Friction, Conservation of Energy Principle, Conservation of Linear Momentum. Viscosity			
11021212	General Physics laboratory (2)	1 Credit Hour	11021202 Sim
Galvanometer Experiment, Ohm's law, Electric Field and Electric Potential, Capacitors, Wheatstone bridge, Electromotive Force, Kirchhoff's laws, Electric Circuits of Resistance, Capacitors and Inductance.			
11022213	Intermediate physics laboratory	1 Credit Hour	11022121 Sim
Experiment in applied Optics: Prism, Diffraction of Light through a Single Slit, Polarization of Light, Millikan's Oil Drop Experiment, Kerr Effect, Faraday's Effect, Measurement of Plank Constant, Diffraction of Light through a Multiple Slits, Michelson Interferometer.			
11023114	Electronic laboratory	1 Credit Hour	11022231 Sim
Experiments on Semiconductor devices, Diodes, Transistors, Rectification and Filtering, Voltage Stabilizer, Amplifiers, Electronic Timer.			

11023215	Advance Physics laboratory	2 Credit Hour	11022213 Pre
Experiments on Nuclear and Atomic Physics: Rutherford Experiment, Spectrum of Gamma Radiation, Electron Spin Resonance, Frank – Hertz, Black Body Radiation, Hall Effect, Diffraction of X-Ray, Diffraction of Electrons, Measurement of Charge and Mass of an Electron. Nuclear Magnetic Resonance.			
11022121	Optics	3 Credit Hour	11021202 Pre
Vibrations, Wave Motion and Equation of Motion, Waves, Longitudinal and Transverse waves, Polarization and Malus Law Reflection and Refraction and Snell Law, Geometrical Optics, Mirrors and Lenses, Interference, Huygens' Principle, Young's double slit, interference measurement, single slit and two slit diffraction, diffraction of X-rays and Bragg's law			
11022222	Vibrations and Waves	3 Credit Hour	11022181 Pre
Simple and damped harmonic motion, simple harmonic and damped oscillators, energy decay, forced vibrations, forced oscillator, synchronized vibrations, wave motion of oscillators, transverse wave motion, reflectance and permeability of transverse waves, longitudinal waves, longitudinal waves in gases and in solids, electromagnetic waves, Maxwell's equations, and the Poynting vector.			
11023123	Laser physics	3 Credit Hour	11023162 Sim
Emission and Absorption of Light, Einstein Relations, Inversion Population, Gain Factor, Optical Resonance, Laser types, Solid State Lasers, Gas laser, Diode lasers, Semiconductor Lasers, Liquid Dye Lasers, Laser of Free Electron, Modern Laser Types, Laser Characteristics, Laser Wavelength Lines, Coherent Laser Beam, Focused Laser Beams, Frequency Doubling, Application of Laser: Medical Applications, Industrial, Military, Measurements, Holography, Communications.			
11024124	Environment physics	3 Credit Hour	11023241 Pre
Properties of Gases and Liquids. Laws of thermodynamics and the human body, Energy transfers. Transport of Heat, Mass, and Momentum, Transport of Radiant Energy, Solar Radiation, Atmosphere and radiation, Noise pollution , water, wind, physics of ground, energy for living.			
11023225	Medical physics	3 Credit Hour	11022161 Pre
Biomechanics, biomechanical fluids, sound and hearing, light and vision, heat and heat temperature, electricity and magnetism in human body, using radiation and ionic radiations, radiation therapy, diagnostic radiology (Medical Imaging), radiobiology, dosimetry, radiation protection.			

11024226	Radiation physics	3 Credit Hour	11023162 Pre
Structure Of atoms, Radiations Source, Radioactivity, interaction of radiations with matter, Radiation unit and limit, X ray Predictions radiations detection, radiations dosimeters, radiation exposure, radiation hazard, radiation shielding, and Radiation in life.			
11022231	Electronics	3 Credit Hour	11021202 Pre
Direct current circuits, alternating current circuits, semiconductors, diode theory, diode circuits, special-purpose LEDs, transistors, transistor basics and bias circuits, voltage amplifiers, power amplifiers, field transistor effect and its circuits, operational amplifier theory, operational amplifier circuits and applications, generators wave and frequency generators, timer.			
11023132	Electromagnetic (1)	3 Credit Hour	11022181 Pre
Electrostatic Fields, The Electric Field Vector, The Flux Density Vector, The Gauss Theorem, Boundary Conditions, The Laplace-Poisson Equation, The Electrostatic Potential, The Legendre's Expansion of Potential, The Laplace Equations in Spherical Coordinates, Series Expansion of the Coulomb Potential, Legendre's Polynomials, A Conducting Sphere in a Uniform Field, Ampere's Law. Magnetic field in matter para and diamagnetic.			
11023233	Electromagnetic (2)	3 Credit Hour	11023132 Pre
The bound currents, magnetic field in linear materials. the force between currents, Magnetic Induction, the variable current with time, Maxwell equations, the conservation of charge and energy as well as momentum in electromagnetic fields, Electromagnetic waves, boundary conditions on traveling electromagnetic waves, the reflection and refraction laws in electromagnetic waves, electromagnetic radiation, waveguide.			
11023234	Digital electronics	3 Credit Hour	11022131 Pre
Number systems and Codes, Logic States, Decimal, Binary and Hexadecimal Systems, Hexadecimal to Binary Conversion, Binary to Decimal Conversion, Binary Addition and Subtraction, Basic logic Gates, Gate Invertors, Half Adder and Full Adder. Boolean Algebra and Reduction Techniques, Exclusive- OR and Exclusive- NOR Gates, Arithmetic Operations and circuits, Code Converters. Coder/Decoder, Integrated Circuits, Karnaugh Map for Three and Four Variables. Multiplexers, and De-multiplexers, Flip-Flops, Counter circuits.			
11023241	Thermodynamics	3 Credit Hour	Prerequisite: 11022161
Expectation values, Probability, ensemble theory, thermal equilibrium, temperature, fluctuations, partition function, Helmholtz free energy, ideal gas, atom in a box, atoms in a box, equipartition of energy, Planck's law and Stephen-Boltzmann's law, emission and absorption, photons in solids, Gibbs coefficient and Gibbs sum, Fermi-Dirac distribution and Bose-Einstein distribution.			

11024142	Statistical mechanics	3 Credit Hour	11023162 Pre 11023241 Pre
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Statistics, Binomial Distribution, Macroscopic and Microscopic States, Entropy and the number of Microstates, Gibbs Paradox, Liouville's Theorem, Partition Function, Micro-canonical Ensemble, Quantum States and Phase Space, Canonical Ensemble, Energy Fluctuation in Canonical Ensemble

11024143	Energy physics	2 Credit Hour	11022181 Pre 11023241 Pre
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Energy, work and energy, power, energy conservation, electric energy and its generation and transfer, fossil fuels, oil, shale, natural gas, coal, nuclear energy, nuclear fission and fusion, solar energy, solar energy uses, electromagnetic waves, photovoltaic electricity, water energy, water wheels, dams, tides, wave energy, bioenergy, photosynthesis, biofuels, bioenergy sources and consumption, reuse, and recyclable waste.

11023151	Classical mechanics (1)	3 Credit Hour	11022181 Pre
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Matrices and vectors calculus, Newton's mechanics-single particle and the Motion in to dimension, Conservation Laws, Linear and Nonlinear Oscillations, Gravitation

11023252	Classical mechanics (2)	2 Credit Hour	11023151 Pre
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Calculus of Variation using Euler's equations, Lagrange equations of motion, Hamilton's equations of motion used to describe central force motion, Generalized Coordinates, dynamic of system of particle, center of mass, Elastic and inelastic collision, The energy, linear momentum and angular momentum.

11023253	Astro Physics	3 Credit Hour	11023233 Pre 11023151 Pre
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Stars (its movements, distances, luminosity, absolute magnitude, temperatures and sizes, multi-stars systems, variable stars distribution, inter-stellar mediums, births and ages of stars, death of stars(white dwarf, pulsating neutron stars, black hole),the Milky way, galaxies, the cosmos).

11022161	Modern physics	3 Credit Hour	11021202 Pre
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Special and general relativity, particle characteristics of waves, electromagnetic waves, black body radiation, Compton phenomenon, particle wave properties, De Broglie waves, principle of uncertainty, atomic structure, Bohr's atom, atomic excitation, quantum mechanics, wave equation, Schrödinger equation, particle in box, quantum theory of a Hydrogen atom

11023162	Quantum mechanics (1)	3 Credit Hour	11022181 Pre 11022161 Pre
The Limitation of the Classical Physics, Heisenberg's Uncertainty Principles, Operators and Hilbert's Space, Reciprocal Relationships, Schrodinger's Equations, Wave Mechanics, Solving the Schrodinger's Equations in One Dimension, Schrodinger's Equations in One Dimension, Simple Harmonic Oscillator, Momentum, Rotational and Spin Momentum Effects, Hydrogen Atom, Solve the Schrodinger Equation for Hydrogen Atom.			
11023263	Quantum mechanics (2)	3 Credit Hour	11023162 Pre
A Review of the Model of the Hydrogen Atom, The interaction of the Electron with the Magnetic Field, Matrix Representation of Angular Momentum and Spin, Commutation of the Angular Momentum and the Spin, Time-Independent Perturbation Theory, The Hydrogen Atom and the Helium Atom, Collision and Scattering Theory, Applications of Quantum Mechanics in Nuclear Physics, Time-dependent Perturbation Theory.			
11023164	Atomic and molecular physics	3 Credit Hour	11023162 Pre
Classical atomic theories, quantum mechanics, hydrogen atoms, spin and angular momentum and magnetic moment of the electron, interactions with electric and magnetic fields, Zeeman effect, Stark effect, interaction with electromagnetic radiation, transition probabilities and Einstein coefficients, dipole approximation, quadrupole interactions, two electron atoms, the spin wave function and the Pauli's principle, stable and excited states, multi-electron atoms, Thomas and Fermi models, molecular structure and spectra of diatomic molecules.			
11024165	Nuclear physics	3 Credit Hour	11023162 Pre
Nuclear Properties, Nuclear Force, nuclear models nuclear decay, beta decay, gamma decay, an overview of nuclear reactions, fissions and fusion, some applications to orbital models, nuclear distortion, and uniform model, electromagnetic interactions, weak interactions.			
11024266	Theory of special relativity	3 Credit Hour	11022161 Pre
The foundations of classical mechanics, deviations from Newtonian dynamics, the essence and propagation of light, the description of relativistic motion, Lorentz-Einstein transformations, relativity and lengths and chronometry, accelerated motions, relative dynamics, mass of static and moving particles, equivalence of mass and energy, Lorentz transformations of energy and momentum, quadruple vectors ,Relativity Electromagnetism, Summary of relativistic Electromagnetic.			

11024271	Solid State Physics	3 Credit Hour	11023162 Pre 11023263 Pre
Definition of solid state, crystals grow, crystals, amorphous and nanoparticles, atomic bonding, crystal , miller indices, lattice constants, lattice defects, Fourier transformation in periodic systems, wave diffraction and reciprocal lattice and brillouin zone, x-ray diffraction, lattice vibrations and phonons, thermal properties of materials, heat capacity, plank distribution , density of state , Debye model, Einstein model, free electron (fermi gas) model, electric ,optical and thermal properties of electron gas.			
11023172	Material Science	3 Credit Hour	11022161 Pre
Classification of Materials, atomic structures and solid crystals structure, binding forces and crystal systems, diffusion , stable and unstable ,mechanical properties of metals ,stress and strain, electrical properties materials, conductors, semiconductors and insulators, thermal properties of materials, thermal conductivity and expansion, magnetic properties of materials, types of magnetic materials, magnetic storage systems, optical properties of materials, reflection, absorption and transparent			
11022181	Mathematical physics (1)	3 Credit Hour	11021202 Pre
Complex numbers, complex algebra and complex series, vector analysis, Green's and Stoke theorems, linear equations: matrices and determinants, Laplace transform, Cramer's rule, matrix operations, coordinate transformations, linear and orthogonal transformations, Fourier series, wave and periodic functions, Fourier transform, differential equations, partial differential equations, linear equations of first, second and third order (homogeneous and inhomogeneous).			
11022182	Mathematical physics (2)	3 Credit Hour	11022181 Pre
Conjugate variables, Euler's equation, Lagrange's equations, Gamma function, Beta function, Beta functions in terms of Gamma functions, Stirling's equation , Bessel 's equation, plots of Bessel's function and its zeros , differential equations solved by Bessel's equation, Laplace's equation applied to a constant temperature plate, wave equation, heat flow equation, contour integrals, residue theorem.			
11022283	Computer Applications in Physics	3 Credit Hour	11022161 Pre
Excel Applications: understand Worksheets, Create Spreadsheets and Enter Data, Graphical Objects, Add Graphics to worksheets, Perform calculations with Functions, Excel Applications in physics:in one dimensions, projectile motion, simple pendulum, simple harmonic motion, Kirchhoff's laws and electric circuits, Introduction to Matlab, basic mathematical operations, matrix, plotting and graphs using matlab, derivatives and integrations , scripts, numerical methods, Euler methods, applications in solving physical problems by matlab, introduction to Python program, using python to solve mathematical and physical problems.			