

## Courses Description

**College:** Science  
**Department:** Physics

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**Couse ID:** 102791      **Description:** Seminar

**Full Course Description:** Information research methods, presentation of information. The student chooses, by agreement with the instructor, a subject in one of the branches of physics to write a report and presents a seminar to students.

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**Couse ID:** 110102102      **Description:** General Physics (2)

**Full Course Description:** \*Charge and matter, electric field, Gauss's Law and its applications, electric potential, capacitance and dielectrics, current and resistance, electromotive force and circuits, magnetic force on a charge and on a wire carrying current, sources of magnetic field, Biot-Savart law, Ampere's law, electromagnetic induction, Faraday's law.

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**Couse ID:** 110102103      **Description:** General Physics Laboratory (1)

**Full Course Description:** Students perform some experiments of 3 hrs/week that related to the course content of 0102101. These experiments include:□  
Collection and analysis of data, measurements and errors, vectors, kinematics of rectilinear motion, force and motion, collision in two dimensions, rotational motion, simple pendulum, measurement of acceleration of gravity, measurement of coefficient of friction, specific heat of metals.□

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**Couse ID:** 110102104      **Description:** General Physics Laboratory (2)

**Full Course Description:** Students perform some experiments of 3 hrs/week that are related to the course content of 0102102. These experiments include:□  
Electric field mapping, specific charge of copper ions, Wheatstone bridge, power transfer, potentiometer, capacitors in series and parallel, analysis of RC circuits for dc current, Kirchhoff's rules, Ohm's law, magnetic field of a current, electromagnetic induction, mechanical equivalent of heat, converging and diverging lenses.□  
□

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**Couse ID:** 110102107      **Description:** General Physics

**Full Course Description:** Mechanics: kinematics and dynamics of motion of particles, circular motion, work and energy. Electricity: electric force, electric field, electric potential, current and resistance, capacitors, Magnetism: magnetic force, magnetic field. Thermal Properties of Matter: coefficient of linear expansion, specific heat and heat capacity, heat transfer, diffusion, first law of thermodynamics. Fluid Mechanics: density, pressure, gas laws, Archimedes principle, continuity equation, Bernoulli equation, viscosity, description of wave motion, velocity of waves, properties of alpha, beta, gamma and x-rays, radioactive decay and half-life period.  
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**Couse ID:** 110102108      **Description:** General Physics Laboratory

**Full Course Description:** Students perform some experiments of 3 hrs/week that related to the course content of 0102107. These experiments include:□  
Collection and analysis of data, measurements and errors, vectors, kinematics of rectilinear motion, force and motion, simple pendulum, Charles and Boyles laws of gases, specific heat for metals, viscosity, surface tension, electric field mapping, specific charge of copper ions, power transfer, Ohm's law□

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**Couse ID:** 110102109      **Description:** General Medical Physics

**Full Course Description:** Mechanics of motion and levers, light, sound waves and its medical applications, dynamics of fluids and its medical applications, electrostatic force, direct current, current in biological cells, principles of radiation, radiation production.□  
□

## Courses Description

**College:** Science

**Department:** Physics

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**Couse ID:** 110102141      **Description:** Thermal and Material Physics

**Full Course Description:** materials structure, chemeical bondings, heat capacity, specific heat, heat transfer, heat conduction, thermal expansion, heat diffusion

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**Couse ID:** 110102161      **Description:** Physics of Diagnostic Radiation

**Full Course Description:** \*

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**Couse ID:** 110102203      **Description:** General Physics (3)

**Full Course Description:** Fluid mechanics, simple harmonic motion, wave motion, sound waves, interference of sound waves, alternating current, electromagnetic waves, geometrical optics, interference, diffraction and polarization in optics.□  
□

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**Couse ID:** 110102211      **Description:** General Physics Laboratory (3)

**Full Course Description:** Students perform some experiments of 3 hrs/week. The experiments include:□  
Diffraction grating, single slit diffraction, prism spectrometer, Young's double slit, Newton's rings, polarization of light, inverse square law and the propagation of light, mirrors, concave and convex lenses, thermocouples, temperature coefficient of Resistance and thermostat.□

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**Couse ID:** 110102232      **Description:** Electronics

**Full Course Description:** Resistors, capacitors, inductors, AC circuits, diodes, diodes and applications, analysis of transistor circuits for small signals, bipolar junction transistor, small signal dc and ac bipolar amplifier.□  
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**Couse ID:** 110102261      **Description:** Modern Physics (1)

**Full Course Description:** Introduction to special relativity, structure of matter: Atomic structure: models of the atom. Quantum theory of radiation: Planck's radiation law, Compton Effect. Wave nature of matter: X-ray diffraction, particle diffraction, De Broglie postulate. Introduction to quantum mechanics: Schrodinger's equation, some applications.

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**Couse ID:** 110102262      **Description:** Modern Physics (2)

**Full Course Description:** Hydrogen atom, many electrons atoms, molecules, introduction in: statistical physics, solid state physics, and nuclear physics.

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**Couse ID:** 110102263      **Description:** Applied Radiation Physics

**Full Course Description:** Radioactivity: radioactive transformations. Interaction of radiation with matter: alpha particles, beta particles, gamma rays. Radiation dosimetry: absorbed dose, exposure dose measurement. Radiation detectors: particle detectors, photon detectors, nuclear track detectors. Radiation protection: shielding.

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**Couse ID:** 110102281      **Description:** Mathematical Physics (1)

**Full Course Description:** Series, Complex numbers: the complex plane, complex algebra, complex series, complex functions, applications in quantum mechanics. Vector analysis: triple products, application in mechanics (work, torque). Directional derivatives, gradient, line integrals, the divergence theorem. Stoke's theorem, Gauss law in static electricity. Determinants and matrices. Coordinate transformation: linear transformation, orthogonal transformation, eigenvalues and eigenvectors, diagonalisation of matrices. Fourier series: periodic functions, sinusoidal functions, applications on Euler and Lagrange equations.

## Courses Description

**College:** Science

**Department:** Physics

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**Couse ID:** 110102282      **Description:** Mathematical Physics (2)

**Full Course Description:** Calculus of variations: Euler equation, Lagrange's equations. Special functions: gamma function, beta function, error function, Legendre function, Laguerre function, Bessel function, Hermite function. Partial differential equations: in cartesian, polar, and cylindrical coordinates. Integral transforms with applications. Laplace transforms. Fourier transforms. Green's functions. Functions of complex variables: Cauchy-Riemann condition. Residue theorem

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**Couse ID:** 110102283      **Description:** Computer Applications in Physics Laboratory

**Full Course Description:** Personal computer application in simulation programs in one and two dimensional motions, Newton's laws of motion, potential and kinetic energies, work and energy, conservation of mechanical energy, momentum and collision, rotational motion, electric field, Gauss's law, electric potential, capacitance, capacitors, current and resistance, magnetic field, Faraday's law, inductors, some simulations in optics and modern physics

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**Couse ID:** 110102311      **Description:** Electronics Laboratory

**Full Course Description:** Students perform some experiments of 3 hrs/week that are related to the course content of 0102232. The experiments include: □  
Measurement techniques using the oscilloscope, analysis of RC for AC circuits, RLC circuit analysis, properties of diodes & transistors, using diodes in rectifiers and filters, Zener diode. Diode circuits, clippers and clamps. Transistor response, transistor as amplifier. Compensated and uncompensated operational amplifiers. □

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**Couse ID:** 110102312      **Description:** Advanced Physics Laboratory (1)

**Full Course Description:** Students perform some experiments of 6 hrs/week that are related to modern physics, optics, quantum optics and solid state physics. The experiments include: □  
Velocity of sound in liquids, electrical conductivity, tangent galvanometer, polarization, Michelson interferometer, measurement of charge of the electron to Boltzmann constant, Hall effect, Roland grating, measurement of dielectric constant for liquids, laser diode, Faraday's effect, Kerr effect. □

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**Couse ID:** 110102321      **Description:** Physical Optics

**Full Course Description:** Light transfer, Doppler effect. Energy transfer: Poynting vector. Superposition, interference and diffraction of light: partial and spatial superposition. Optics in solids: double refraction, optical activity. Optical resonances: frequency resonance. Coherence of light. Lasers: basic principles, types of lasers.

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**Couse ID:** 110102322      **Description:** Waves and Vibrations

**Full Course Description:** Simple harmonic and damped motion, forced oscillations, critically damped oscillations, motion of longitudinal and transverse waves, waves in transmission lines, electromagnetic waves, Maxwell equations.

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**Couse ID:** 110102329      **Description:** Astrophysics

**Full Course Description:** Photosphere, chromospheres and corona, sun spots and magnetic fields on the sun, solar activity, solar wind and solar-terrestrial relationship, main sequence stars, collapsed stars, Pulsars, interstellar medium, galaxies and active galaxies. □  
□

## Courses Description

**College:** Science

**Department:** Physics

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**Couse ID:** 110102331      **Description:** Electricity and Magnetism (1)

**Full Course Description:** Electrostatics, electrostatic field, divergence and curl of electrostatic fields, electric potential, work and energy in electrostatics, conductors and insulators, special techniques for calculating potentials, Laplace's equation, method of images, multipole expansion, electrostatic fields in matter, polarization and dipole moment density, field of a polarized object, electric displacement, linear dielectrics, magnetostatics, Lorentz force law, Biot-Savart law, divergence and curl of the magnetic field, magnetic, vector potential, magnetostatic field in matter, magnetization, field of a magnetized object, linear and nonlinear media.

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**Couse ID:** 110102332      **Description:** Electricity and Magnetism (2)

**Full Course Description:** Propagation of electromagnetic waves, Maxwell's equations, electromagnetic waves. Plane electromagnetic waves: propagation, reflection and transmission of waves. Boundary conditions in conductors and insulators. Electromagnetic radiation: dipole and quadrupole radiation, wave guides and cavities, retarded potentials, radiation from a point charge.

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**Couse ID:** 110102341      **Description:** Thermodynamics

**Full Course Description:** Basic principles, Equations of state. Temperature and the Zeroth law. Heat, work and the first law of thermodynamics. Entropy and the second law of thermodynamics. Thermodynamic potentials. Kinetic theory.

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**Couse ID:** 110102351      **Description:** Classical Mechanics

**Full Course Description:** Gravitation: universal law of gravitation, gravitational field, gravitational potential and potential energy, inertial mass and gravitational mass. Central forces: reduced mass, energy equation, effective potential, equations of central motion, planetary motion and Kepler laws. Dynamics of many particle system: center of mass, linear momentum, angular momentum, energy, elastic collision, inelastic collision.

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**Couse ID:** 110102361      **Description:** Special Theory of Relativity

**Full Course Description:** Principles of relativity, the constancy of the velocity of light, Lorentz transformation. Minkowski mapping of the unchanging spacetime. Measurement of length and time. Velocity transformation. Doppler effect. Twin paradox. Relativistic Dynamics: mass, momentum. Equivalence of mass and energy. Collisions. Relativistic electromagnetism

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**Couse ID:** 110102362      **Description:** Quantum Mechanics (1)

**Full Course Description:** Wave functions and uncertainty principle: wave-particle duality, interpretation of the wave function, wave packets, Heisenberg uncertainty principle. Schrodinger's equation: time-dependent Schrodinger's equation, conservation of probability, expectation values and operators, time independent Schrodinger's equation, energy quantization, properties of energy eigenfunctions. One dimensional examples. Formal quantum mechanics: Dirac notation, dynamical variables and operators, commuting observables. Angular momentum. Schrodinger's equation in three dimensions. The hydrogen atom.

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**Couse ID:** 110102363      **Description:** Medical Physics

**Full Course Description:** Forces in the body, physics of the skeleton, energy, work and power in the body, concepts of heat, cold, and pressure, physics of capillary system, electricity in the body, physics of x-ray technology, physics of radiation therapy.

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**Couse ID:** 110102364      **Description:** Quantum Mechanics (2)

**Full Course Description:** Interaction of electrons with electromagnetic fields, operators and spin using determinants, addition of angular momentum and spin, theory of time-independent approximation methods, real hydrogen atom, atomic radiation, theory of time-dependent approximation methods, collision theory in quantum mechanics, identical particles

## Courses Description

**College:** Science

**Department:** Physics

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**Couse ID:** 110102383      **Description:** Computational Physics

**Full Course Description:** Solution of some physics problems with different methods using personal computers, programs for calculus computations, applications of Monte Carlo method, solutions of problems in quantum mechanics, Fourier analysis, matrices and determinants, electrostatic potential, heat flow and the wave equation.

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**Couse ID:** 110102411      **Description:** Advanced Physics Laboratory (2)

**Full Course Description:** Students perform some advanced experiments of 6 hrs/week that are related to solid state physics, optics and atomic physics. The experiments include:□  
Electron diffraction, Rutherford backscattering, Zeeman effect, x-ray diffraction, electron spin resonance, Frank-Hertz experiment, Balmer series, measurement of specific charge of the electron (e/m), Millikan oil-drop experiment, Planck's constant, Gamma spectrometry.□

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**Couse ID:** 110102433      **Description:** Plasma Physics

**Full Course Description:** Maxwell's equations, propagation of electromagnetic waves in conducting media, plasma fluid model, magneto-hydrodynamics, waves in plasma, instabilities in plasma, kinetic theory in plasma

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**Couse ID:** 110102442      **Description:** Statistical Mechanics

**Full Course Description:** Maxwell-Boltzman statistics and application. Bose-Einstein statistics and application. Fermi-Dirac statistics and application. Concepts of Temperature and entropy, Thermodynamics of gases and application of statistical thermodynamics. Canonical and grand canonical ensemble.

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**Couse ID:** 110102461      **Description:** Atomic and Molecular Physics

**Full Course Description:** Interaction of one-electron atoms with electromagnetic radiation: mean transition rules within electric dipolar approximation, line spectra and life time, two-electron atoms: two-excitation levels and Auger effect, many-electron atoms: central field approximation, L-S and j-j couplings, interaction with radiation and electromagnetic fields, Wigner-Eckart theorem, x-rays, molecular spectra.□  
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**Couse ID:** 110102463      **Description:** Nuclear Physics

**Full Course Description:** Basic nuclear concepts, nuclear forces: the deuteron, scattering theory, conservation laws, nuclear models, electromagnetic interactions, weak interactions, strong interactions, radioactive decay, nuclear fission and fusion.

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**Couse ID:** 110102464      **Description:** Laser Physics

**Full Course Description:** Quantum theory: properties of operators, density operator. Dipolar transitions: matrix elements and symmetry principle, equation of motion for dipolar transitions, resonance: steady state behavior for dipolar transitions, lasers and their applications

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**Couse ID:** 110102465      **Description:** Radiation Physics

**Full Course Description:** Radioactivity: radioactive transformations. Interaction of radiation with matter: alpha particles, beta particles, gamma rays. Radiation dosimetry: absorbed dose, exposure dose measurement. Radiation detectors: particle detectors, photon detectors, nuclear track detectors. Radiation protection: shielding.□  
□

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**Couse ID:** 110102467      **Description:** Biophysics

**Full Course Description:** Molecular structure, function of biological macromolecules, measurement of fluorescence lifetime, molecular spectroscopes, fluorescence polarization, singlet oxygen, physics of traps, solute-solvent interactions, mechanisms and dynamics of solvent relocation, electrostatic forces, charged ions, molecular modeling, structure and fluorescence of protein, antibody structure and function.

## Courses Description

**College:** Science

**Department:** Physics

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**Couse ID:** 110102491      **Description:** Seminar

**Full Course Description:** Information research methods, presentation of information. The student chooses, by agreement with the instructor, a subject in one of the branches of physics to write a report and presents a seminar to students.□  
□

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**Couse ID:** 110102495      **Description:** Special Topics

**Full Course Description:** The content of this course is a study of a new topic in physics that is prepared by faculty member and subject to department approval.

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**Couse ID:** 1901021464      **Description:** Laser Physics

**Full Course Description:** Quantum theory: properties of operators, density operator. Dipolar transitions: matrix elements and symmetry principle, equation of motion for dipolar transitions, resonance: steady state behavior for dipolar transitions, lasers and their application

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**Couse ID:** 1901021471      **Description:** Solid State Physics

**Full Course Description:** Crystal lattice: Bravais lattice. Structure of solids: crystal structure. Elastic scattering of waves. Crystal bonding. Phonons. Thermal properties of crystalline solids, electron states: free electron model, nearly-free electron model, band theory, Fermi surfaces

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**Couse ID:** 1901021472      **Description:** Physics of Semiconductors

**Full Course Description:** Semiconductor crystal structure, crystal impurities, statistical properties of semiconductors. Transport of charge carriers in semiconductors. Diffusion and scattering, semiconductor devices

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**Couse ID:** 1901021474      **Description:** Nanophysics

**Full Course Description:** Introduces nanotechnology and nanoscience. The material covered includes nanofabrication technology , the interdisciplinary nature of nanotechnology and nanoscience and applications.

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**Couse ID:** 2201021351      **Description:** Classical Mechanics (1)

**Full Course Description:** Gravitation: universal law of gravitation, gravitational field, gravitational potential and potential energy, inertial mass and gravitational mass. Central forces: reduced mass, energy equation, effective potential, equations of central motion, planetary motion and Kepler laws. Dynamics of many particle system: center of mass, linear momentum, angular momentum, energy, elastic collision, inelastic collision.

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**Couse ID:** 2201021352      **Description:** Classical Mechanics (2)

**Full Course Description:** Non-inertial frames . Lagrangian mechanics, Hamilton's equations of motion, dynamics of rigid bodies, theory of small oscillations

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**Couse ID:** 2201021364      **Description:** Quantum Mechanics (2)

**Full Course Description:** Interaction of electrons with electromagnetic fields, operators and spin using determinants, addition of angular momentum and spin, theory of time-independent approximation methods, real hydrogen atom, atomic radiation, theory of time-dependent approximation methods, collision theory in quantum mechanics, identical particles.

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**Couse ID:** 2201021411      **Description:** Advnanced Physics Laboratory

**Full Course Description:** Students perform some advanced experiments of 6 hrs/week that are related to solid state physics, optics and atomic physics. The experiments include:□  
Electron diffraction, Rutherford backscattering, Zeeman effect, x-ray diffraction, electron spin resonance, Frank-Hertz experiment, Balmer series, measurement of specific charge of the electron (e/m), Millikan oil-drop experiment, Planck's constant, Gamma spectrometry□

## Courses Description

**College:** Science

**Department:** Physics

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**Couse ID:** 2201021431      **Description:** Introduction to Accelator Physics

**Full Course Description:** This course covers fundamental physical principles of accelerators; Overview of linear accelerators, storage rings for the generation of light, spallation sources and colliders; Physics of particle beams: longitudinal and transverse beam dynamics, synchrotron radiation, non-linear beam physics, storage ring lattice design; Description of major accelerator components□ including: radio frequency systems, cryogenic systems, vacuum systems, and powering systems; Introduction to applications using accelerators in the field of atomic, nuclear and particle physics, materials science, medical applications; New accelerator technologies□

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**Couse ID:** 2201021442      **Description:** Statistical Mechanics

**Full Course Description:** Maxwell-Boltzman statistics and application. Bose-Einstein statistics and application. Fermi-Dirac statistics and application. Concepts of Temperature and entropy, Thermodynamics of gases and application of statistical thermodynamics. Canonical and grand canonical ensemble.

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**Couse ID:** 2201021464      **Description:** Laser Physics

**Full Course Description:** Quantum theory: properties of operators, density operator. Dipolar transitions: matrix elements and symmetry principle, equation of motion for dipolar transitions, resonance: steady state behavior for dipolar transitions, lasers and their applications. □

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**Couse ID:** 2201021465      **Description:** Radiation Physics

**Full Course Description:** Radioactivity: radioactive transformations. Interaction of radiation with matter: alpha particles, beta particles, gamma rays. Radiation dosimetry: absorbed dose, exposure dose measurement. Radiation detectors: particle detectors, photon detectors, nuclear track detectors. Radiation protection: shielding

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**Couse ID:** 2201021471      **Description:** Solid State Physics

**Full Course Description:** Crystal lattice: Bravais lattice. Structure of solids: crystal structure. Elastic scattering of waves. Crystal bonding. Phonons. Thermal properties of crystalline solids, electron states: free electron model, nearly-free electron model, band theory, Fermi surfa

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**Couse ID:** 2201021473      **Description:** Solar Cells

**Full Course Description:** Introduces the solar cell as a simple current generator and defines the performance characteristics which are used to describe and compare solar cells. Describes, in general terms, how light energy is converted into electricity, the basic physics of the semiconductor, the semiconductor transport equations and the processes of light absorption. Different types of junctions which are exploited in photovoltaics. p–n junction, monocrystalline p–n junction devices, practical devices, using crystalline silicon and gallium arsenide cells as examples. Thin film photovoltaic materials.

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**Couse ID:** 2201021481      **Description:** Mathematical Physics (3)

**Full Course Description:** Dirac delta function, Sturm-Liouville theory, Greens functions calculus of variations s; asymptotic expansions; conformed mapping, integral transforms; Fourier transforms, , Tensor algebra.□

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**Couse ID:** 2201022333      **Description:** Electric Circuits

**Full Course Description:** Circuit Concepts, Circuit Laws , Analysis Methods(The Branch Current Method , The Mesh Current Method, Matrices and Determinants, The Node Voltage Method, Superposition, The´venin's and Norton's Theorems(, Waveforms and Signals, Transient Analysis, Sinusoidal Steady-State Circuit Analysis , AC Power, Polyphase Circuits. Frequency Response, Filters, and Resonance