

Course Description

Physics

1- Diploma

Ph501: Radiation Physics

501ف: الفيزياء الإشعاعية

The basis and the theory of radioactive disintegration- The disintegration constant- The half-life and the mean life- successive radioactive transformations- Radioactive equilibrium- The natural radioactive series- Units of radioactivity.

Ph502: X-rays and its application

502ف: الأشعة السينية وتطبيقاتها

Properties of X- rays - X- ray scattering - X- ray diffraction and Bragg's law - Characteristic X- ray spectra - Application of X- ray in atomic and molecular physics- Application of X- ray in solid state physics - Application of X- ray in medicine.

Ph503: Radiogenic Isotopes

503ف: نظائر التحلل الإشعاعي

Artificial nuclear disintegration (Transmutation by protons- Transmutation by deuterons- Transmutation by neutrons- Transmutation by photons)- The discovery of artificial radioactivity- The artificial radio nuclides (Electron and positron emission- Orbital electron capture)- The transuranium elements- The artificial radio nuclides (Alpha emitters)- Isotope tables and nuclide charts.

Ph504: Detectors and Nuclear reactors

504ف: الكاشفات والمفاعلات النووية

Nuclear reactions - Reaction cross sections - Nuclear spectroscopy - Compound nucleus - Fission reactors and fusion - Ionization counters - Scintillation counters - Semiconductor detectors.

Ph505: Statistical Physics and application

505ف: الإحصاء وتطبيقاته

Introduction- Organizing data- Averages and variations- Elementary probability theory- The binomial distribution- Normal distribution- Chi- square and F distributions.

Ph506: Environmental Physics

506ف: فيزياء البيئة

The basic principles governing the structure, function, and temporal and spatial dynamics of populations and communities of plants and animals- How interacting populations of plants and animals change over time and space, in response to natural or human-created disturbance- Applications of these ideas to practical issues including fisheries, infectious diseases, tomorrow's food supplies, climate change, and conservation biology.

Ph507: Essentials of biophysics

507ف: أساسيات الفيزياء الحيوية

The structure of matter- Radiation units- Biological effects of radiation- Natural and manmade radiation- The system of dose limitations.

Ph508: Laser physics

508ف: فيزياء الليزر

Radiation transitions and emission line width- Decay of excited states- emission broadening and line width due to radiation decay- Additional emission broadening processes- Radiation and Thermal Equilibrium Absorption and Stimulated Emission- Equilibrium- Radiation bodies- Cavity radiation- Absorption and stimulated emission- Conditions for producing Laser- Absorption and gain- population inversion- Saturation intensity- Development and growth of a laser beam- Requirements for obtaining population inversions- Inversion and two level systems- Processes that inhibit or destroy inversions- Laser pumping requirements and techniques- Excitation or pumping threshold requirements- Specific excitation parameters associated with particle pumping- Laser cavity modes- Longitudinal and transverse laser cavity modes- Properties of laser modes- Laser Systems involving low density gain media- He- Ne and Argon ion laser - Laser systems involving high density gain media- Dye , Ruby and Neodymium laser.

Ph509: Materials Science

509ف: علم المواد

Introduction to the science of solid materials. Includes, metals- ceramics- plastics, semiconductors Composites materials as well as the properties of solid materials (Mechanical- Electronic- Thermal- Magnetic- Optical- Electrical- Dielectrical properties).

Ph510: Nuclear Analytical Techniques

510ف: أساليب التحلل النووي

Pulse signals in nuclear electronics- The NIM standard- Signal transmission- Electronics for pulse signal processing- Pulse height selection and coincidence technique- Electronic logic for experiments- Timing methods and systems- Computer controlled electronics- X- ray fluorescence- Neutron activation analysis- Ion beam spectroscopic techniques- Atomic absorption spectrometry.

Ph511: Clinical Physics

511ف: الفيزياء الطبية

Medical application of radio isotopes- Diagnosis by radio isotopes tracing- Production of radioactive materials- Radio nuclide imaging- Linear scanner- Diagnosis by trace element measurement in the body- Radio isotopes applications in therapy- Sterilization of medical materials.

Ph512: Superconductivity

512ف: مفرطات التوصيل

Introduction- The BCS theory- Magnetic properties of type I superconductor- Ginzberg-Landau theory- Magnetic properties of type II superconductor- Concluding topics.

Ph513: Nano-materials Technology**513ف: تقنيات المواد النانومترية**

Methods of measuring properties- Microscopy (Transmission electron Microscopy- Field ion Microscopy- Scanning Microscopy)- Spectroscopy (Infrared and Raman Spectroscopy- Photoemission and X ray Spectroscopy- Magnetic resonance).

Ph514: Nano materials applications**514ف: تطبيقات المواد النانومترية**

Introduction to the underlying principles and applications of the emerging field of Nanotechnology and Nanoscience. Intended for a multidisciplinary audience with a variety of backgrounds. Introduces tools and principles relevant at the nanoscale dimension. Discusses current and future nanotechnology applications in engineering, materials, physics, chemistry, biology, electronics, and energy.

Ph515: Solar cells**515ف: الخلايا الشمسية**

Introduction- Basic principles of heat transfer- Dimensionless numbers and their physical meanings- Measurements of solar radiation intensities- Solar collectors- Efficiency calculations of solar collectors- Factors effecting the efficiency of solar collectors- Solar energy storage- Solar cells- Applications.

Ph516: Thin Films**516ف: الأغشية الرقيقة**

General remarks- Methods of preparing thin films- Interface reflection and interference phenomena in thin film systems- Thick slabs and thin films.

Ph517: Advanced Quantum Mechanics**517ف: ميكانيكا كم متقدمة**

Approximation techniques- Dirac equation- Scattering theory- Many electron systems- Configuration interaction.

Ph519: Bioelectric Phenomena**519ف: الظواهر الكهربائية الحيوية**

Introduction- The basis of electricity (Dynamic and static)- Effects of electricity on humanbody.

Ph521: Laser treatment**521ف: العلاج بالليزر**

Laser as a heat source- its application in material processing and surgery. Holography-Simple mathematical analysis, Practical holography, Holographic interferometry, characterrecognition, stress analysis, data storage, holographic microscopy.

2- Master

Ph601: Advanced Radiation Physics (1) **601ف: فيزياء إشعاعية متقدمة (1)**

Detection of neutrons- Nuclear emission- Beta decay- X- ray fluorescence- Gamma rays and nuclear energy levels- Gamma ray spectroscopy- Alpha particles spectroscopy.

Ph602: Nano materials applications **602ف: تطبيقات المواد النانومترية**

Introduction to the underlying principles and applications of the emerging field of Nanotechnology and Nanoscience. Intended for a multidisciplinary audience with a variety of backgrounds. Introduces tools and principles relevant at the nanoscale dimension. Discusses current and future nanotechnology applications in engineering, materials, physics, chemistry, biology, electronics, and energy.

Ph603: Materials Science (1) **603ف: علم المواد (1)**

Atomic arrangement- Imperfections in atomic arrangement- Dislocations- Mechanical testing and properties- Creep mechanics- Fracture Mechanics- Fatigue- Wear- Strain- Hardening and annealing- Phase diagrams- Diffusion- Phase transformations.

Ph604: Advanced Quantum Mechanics **604ف: ميكانيكا كم متقدمة**

Approximation techniques- Dirac equation- Scattering theory- Many electron systems- Configuration interaction.

Ph605: Nano-materials Technology (1) **605ف: تقنيات المواد النانومترية (1)**

LPE, MBE, and MOCVD growth systems. Growth of DH structures. Growth of Quantum Wells. Strained Layers and Strained Quantum Wells. Quantum Dots and Dashes.

Ph606: Advanced Thermodynamics **606ف: ديناميكا حرارية متقدمة**

The Caratheodory formulation of the second law (Introductory remarks- Empirical entropy- Empirical entropy and heat - Thermodynamic temperature and entropy- Irreversible changes Subsequent development) Thermodynamic potentials (The potential functions- The Legendre differential transformation- Maxwell relations- General conditions for thermodynamic equilibrium) Applications to simple systems (Some properties of specific heat capacities- The perfect gas- Behaviour of real pure substances- The elastic rod or filament- The reversible electric cell- Surface tension- Piezoelectricity- The magnetocaloric effect- Thermal radiation- Fluctuations).

Ph607: Semiconductor technology **607ف: تكنولوجيا أشباه الموصلات**

Introduction to intrinsic semiconductors, n-type, p-type, doping, resistors, diodes, capacitors, bipolar transistors, MOSFETs, Fabrication overview, Electrical properties of silicon, Dielectric layers, Semiconducting layers, diffusion in solids, ion implantation system, Photolithography, Metallisation.

Ph608: Optical characterization

608ف: التحلل الضوئي للمواد

Optical Techniques: Near-Field Optical Microscopy, Absorption spectroscopy, Ellipsometry(Null and Spectroscopic), Modulation Spectroscopy, Photoluminescence, Raman Spectroscopy, and ARUPS.

Ph609: Laser spectroscopy

609ف: أطياف الليزر

Interaction of radiation with matter, strong field approximation, Rabi oscillations, line widths, Spectroscopic instrumentations and optical detectors, basic concept of laser, Doppler limited spectroscopy, laser induced absorption and fluorescence spectroscopy, optogalvanics spectroscopy, high resolution spectroscopy, double resonance techniques. Laser Raman spectroscopy, time resolved laser spectroscopy, measurement of ultrashort pulses, pump and probe techniques, Non linear laser spectroscopy, atom interferometry, polarizationspectroscopy, Laser cooling, slowing down of light multiphoton transitions, applications of laser spectroscopy.

Ph610: Advanced Atomic and Molecular Physics

610ف: فيزياء ذرية وجزيئية متقدمة

Configuration Interaction- Many Electron Atoms- Molecular Electronic Transitions- The Electric Properties of Molecules- The Magnetic Properties of Molecules- Scattering Theory.

Ph611: Statistics and its Applications (1)

611ف: الإحصاء وتطبيقاته (1)

Introduction- Organizing data- Averages and variations- Elementary probability theory- The binomial distribution- Normal distribution.

Ph612: Atomic and Nuclear Analytical Methods

612ف: طرق التحليل النووية والذرية

X-ray Fluorescence (XRF) and Particle-Induced X-ray Emission (PIXE) - Principle of XRF and PIXE Techniques - Theory and Concept - Modes of Excitation for XRF Analysis - X-ray Detection and Analysis in XRF - Source of Excitation and X-ray Detection in PIXE Analysis - Computer Analysis of X-Ray Spectra - Some Other Topics Related to PIXE Analysis - Applications of XRF and PIXE Techniques - Comparison Between EDXRF and WDXRF Techniques - Comparison Between XRF and PIXE Techniques - Rutherford Backscattering Spectroscopy - Scattering Fundamentals - Impact Parameter, Scattering Angle, and Distance of Closest Approach - Kinematic Factor - Stopping Power, Energy Loss, Range, and Straggling - Energy of Particles Backscattered from Thin and Thick Targets - Stopping Cross-Section - Rutherford Scattering Cross-Section - Principle of Rutherford Backscattering Spectroscopy - Fundamentals of the RBS Technique and its Characteristics - Deviations from Rutherford Formula - Accelerator, Beam Transport System, and Scattering Chamber.

Ph613: Magnetic properties of materials

613ف: الخواص المغناطيسية للمواد

Classification of magnetic materials- Preparing of magnetic materials- Fields inside magnetic materials- Methods of measuring properties of magnetic materials.

Ph614 Medical Biophysics

614ف: الفيزياء الحيوية الطبية

Introduction- Units of Exposure and Absorbed Dose- The Relative Biological Effectiveness- The Dose Equivalent- Dosimetry for Radiation External to the Body- Dose Due to Charged Particles- Dose Due to Photons- Dose Due to Neutrons- Dosimetry for

Radiation Inside the Body- Dose from a Source of Charged Particles Inside the Body- Dose from a Photon Source Inside the Body- Internal Dose Time Dependence-Biological Half-Life- Biological Effects of Radiation- Basic Description of the Human Cell- Stochastic and Nonstochastic Effects-Radiation Protection Guides and Exposure Limits- Health Physics Instruments- Survey Instruments- Thermoluminescent Dosimeters- Solidstate Track Recorders (SSTRs)- The Bonner Sphere (the Rem Ball)- The Neutron Bubble Detector- The Electronic Personal Dosimeter- Foil Activation Used for Neutron Dosimetry- Proper Use of Radiation.