المقررات الدراسية في قسم الفيزياء
بكلية الآداب والعلوم الأبيار

الفصل الأوّل

رقم المُقرّر	اسم المُقرّر	الوحدات	الساعات	مُتطلّبات المُقرّر
0101	لغة انجليزية I	3	3	-
1100	رياضة عامة I	4	5	-
4101	فيزياء عامة I	3	5	-
4102	عملي فيزياء I	1	3	4101
5103	كيمياء عامة I	3	3	-
5104	عملي كيمياء I	1	3	5103
0011	حضارة اسلامية	2	2	-
		17	24	

الفصل الثاني

رقم المُقرّر	اسم المُقرّر	الوحدات	الساعات	مُتطلّبات المُقرّر
0010	لغة عربية	3	3	-
0102	لغة انجليزية II	3	3	0101
1101	رياضة عامة II	4	5	1100
4103	فيزياء عامة II	3	5	4101
4104	عملي فيزياء II	1	3	4103
5105	كيمياء عامة II	3	3	5103
5106	عملي كيمياء I	1	3	5105
		18	24	

الفصل الثالث

رقم المُقرّر	اسم المُقرّر	الوحدات	الساعات	مُتطلّبات المُقرّر
1200	التفاضل والتكامل I	3	3	1101
1202	معادلات تفاضلية I	3	3	1101
2002	إحصاء عامّ	4	4	-
4201	ميكانيكا غير نسبية	2	3	4101-1101
4202	اهتزازات وموجات	2	3	4101-1101
4203	ديناميكا حرارية	2	3	4101-1101
0103	أساسيات الانجليزية للعلوم	2	3	0102
		18	22	

الفصل الرابع

رقم المُقرّر	اسم المُقرّر	الوحدات	الساعات	مُتطلّبات المُقرّر
1201	التفاضل والتكامل II	3	3	1200
1203	مُتغيرات مُركبة I	3	3	-
1302	معادلات تفاضلية II	3	3	1202
4204	عملي فيزياء III	2	6	4201
4211	بصريات فيزيائية	3	3	4103-4202
4212	كهربية ومغناطيسية	3	4	4103-1200
4214	تيار مُتردد	1	2	4103
		18	24	

الفصل الخامس

رقم المُقرّر	اسم المُقرّر	الوحدات	الساعات	مُتطلّبات المُقرّر
4213	عملي فيزياء IV (4)	2	6	4212-4211
4300	مُقدّمة في الفيزياء الحاسوبية	2	3	1101
4301	فيزياء حديثة	3	3	4202-4201
4302	الميكانيكا التقليدية	3	3	4202-4201-1202-1201
4303	الكترونيات I	3	3	4214
4305	فيزياء رياضية	2	3	1203-1201
4306	النظرية الكهرومغناطيسية	2	3	4212-1302-1201
		17	24	

الفصل السادس

رقم المُقرّر	اسم المُقرّر	الوحدات	الساعات	مُتطلّبات المُقرّر
4304	عملي فيزياء V (5)	3	9	4303-4301
4309	فيزياء نووية I	3	4	4307 or 4318
4314	الكترونيات II	3	3	4303
4316	فيزياء حاسوبية	2	3	4305-4300-1302-1201
4318	فيزياء الكمّ I	3	3	4302-4301
4334	طرق بحث	1	1	4309-4308-4307
		15	23	

الفصل السابع

رقم المُقرّر	اسم المُقرّر	الوحدات	الساعات	مُتطلّبات المُقرّر
4213	فيزياء الجوامد I	3	3	4307 or 4318
4315	عملي فيزياء VI (6)	3	9	4308
4410	فيزياء الكمّ II	3	4	4307 or 4318
4412	مُقرّر اختياري I	2	2	مُقرّرات الفصل الخامس
4419	مشروع تخرّج	3	-	4309-4308
4432	مواضيع خاصّة	2	2	-
		16	20	

الفصل الثامن

رقم المُقرّر	اسم المُقرّر	الوحدات	الساعات	مُتطلّبات المُقرّر
4404	ميكانيكا إحصائية	2	2	4307-4203
4405	عملي فيزياء VII (7)	3	9	4309
4411	فيزياء الجوامد II	3	3	4404-4308-4307
4416	فيزياء نووية II	2	3	4401-4309
4436	مُقرّر اختياريII	2	2	مُقرّرات الفصل السادس
		12	19	

- مجموع الوحدات الكُلّي: 131 وحدة.
- مدّة مشروع التخرّج: فصلين دراسيين فقط.
- إذا كان المُعدّل الدراسي للطالب أقلّ من 1.00 يُسجّل للطالب 12 ساعة فقط.
- إذا كان المُعدّل الدراسي للطالب أعلى من 1.00 وأقلّ من 1.60 يُسجّل للطالب 13 - 14 ساعة.
- إذا كان المُعدّل الدراسي للطالب أعلى من 1.60 وأقلّ من 2.00 يُسجّل للطالب 14 - 15 ساعة.
- إذا كان المُعدّل الدراسي للطالب أعلى من أو يساوي 2.00 يُسجّل للطالب الساعات المُقرّرة للفصل الدراسي.

توصيف المقررات الدراسية في قسم الفيزياء

4101 General Physics I (3)

Mechanics:

Standards and systems of units; vectors: representation, addition, subtraction, and multiplication; kinematics of linear motion: quantities of motion, motion with constant acceleration, motion with variable acceleration; dynamics: force, inertia, linear momentum, Newton's law of motion, gravitation, simple harmonic motion, work, energy, conservation of energy, conservation of linear momentum; kinematics of rotation, circular motion, rotation of rigid bodies, moment of inertia, conservation of angular momentum.

Properties of matter:

Elasticity, modulli of elasticity, energy stored, Poisson's ratio, hydrostatic pressure, atmospheric pressure, surface tension with application hydrodynamics, Bernoulli's equation and application, viscosity, Poiseuille's law and Stokes's law.

Heat:

Temperature and temperature scale, thermal expansion, quantity of heat, heat exchange, heat

transfer, heat and work, the first law of thermodynamics with applications.

Pre-requisite: Nil

4102 Practical Physics I (1)

Experiments are based on topics covered in **4101**.

Pre-requisite: Nil

4103 General Physics II (3)

Electricity and Magnetism:

Coulomb's law, electric field, Gauss's law with applications, electric potential, equipotentials,

Capacitors and dielectrics, current electricity, simple DC-circuits, magnetic field of a current, magnetic force on a conductor, electromagnetic induction, magnetic properties of matter, simple a-c circuits.

Optics:

Reflection and refraction of light at plane and spherical surfaces, defects of images, optical instruments, photometry, spectroscopy velocity of light, introduction to wave theory, interference of light waves.

Modern Physics:

Birth of modern physics, quantization of energy with application to Bohr's atom and photoelectric effect, production and uses of X-ray, radioactivity, decay law, nuclear radiations, fission, fusion, electron motion in electric and magnetic fields.

Pre-requisite: **4101**

4104 Practical Physics II (1)

Experiments are based on topics covered in **4103**.

Pre-requisite: Nil

4201 Non-relativistic Mechanics (2)

Review of Newton's Laws of motion and their applications with constant forces.

Motion of a particle in one dimension:

Momentum and energy theorems, variable forces depending on time Damping Force depending

on velocity, conservative forces depending on position, potential energy, falling bodies with air

resistance, the damped harmonic oscillator, forced harmonic oscillator.

Motion of a particle in two and three dimensions:

Kinematics in a plane, Kinematics in three dimensions, Momentum and energy theorems, Plane

and vector angular momentum theorems, The harmonic oscillator in two and three dimensions,

potential energy, motion under a central force, the central force inversely proportional to the

square of the distance, elliptic orbits and the Kepler problem.

Motion of a system of particles:

Center of mass, conservation of linear momentum, conservation of angular momentum,

conservation of energy for systems of particles, systems of variable mass, collision problems,

the two body problem, center of mass coordinates.

Pre-requisite: 4101

4202 Oscillations and Waves (2)

Oscillations:

Simple harmonic oscillations of mechanical and electrical oscillators, vector representation

of SHM, superposition of SHM's by vector addition and complex exponentials, Lissajous

figures, beats.

Damped Oscillations:

Damped oscillations in mechanical and electrical oscillators, heavy damping, critical damping, damped S.H. oscillations, logarithmic decrement, relaxation time, Q-values

Forced Vibrations and Resonance:

Undamped oscillator with a harmonic force, forced vibrations with damping, transient phenomena, power absorbed by a driven oscillator, resonance

Coupled Oscillations:

Spring coupled pendulums, normal coordinates and normal modes of vibrations, superposition

of normal modes.

Waves:

Wave equation, mathematical representation of waves, types of waves, speeds of some mechanical waves, interference of waves, reflection and transmission of transverse waves at a boundary, standing waves, wave groups, and phase and group velocities.

Sound waves:

Audible, ultrasonic and infrasonic waves, speed of sound waves, vibrating systems and sources

of sound, intensity of sound, the Doppler effect.

Pre-requisite: 4101

4203 Thermodynamics and the Kinetic Theory of Gases (2)

Fundamental Concepts:

Thermal Equilibrium, the zeroth Law, temperature scales, thermodynamic

equilibrium and processes, equations of state, equation of state of an ideal gas, equation of state of a real gas, expansivity and compressibility. P.V.T. surface for an ideal gas

The First Law of Thermodynamics:

Work in a volume change, other forms of work, the first Law of Thermodynamics, the mechanical equivalents of heat, Heat capacity, Heats of transformation, enthalpy, energy equation of steady flow.

Some consequences of the First Law:

The energy equation, the Gay-Lussac-Joule experiments and the Joule-Thomson experiment,

the Carnot cycle, the heat engine and the refrigerator.

Entropy and the Second Law of Thermodynamics:

The Second Law of Thermodynamics, Thermodynamic temperature, Entropy, the principle of

increase of entropy, the Clausius and Kelvin-Planck statements of the Second Law.

Thermodynamics Potentials:

The Helmholtz function and Gibbs function, thermodynamic potentials, the Maxwell relations,

The Clausius-Clapeyron equation, the third Law of thermodynamics

Introductory Kinetic theory :

Basic assumptions, molecular flux, equation of state of an ideal gas, the principle of equi-partition of energy, Classical theory of specific heat capacity, specific heat capacity of a solid.

Pre-requisite: 4101

4204 Practical Physics III (1)

Experiments are based on topics covered in **4101** and **4103**.

Pre-requisite: 4103

4211 Physical Optics (3)

Interference of beams of light:

i) Depending on the division of wavefront - Young's experiment, Fresnel prism, other apparatus.

ii) Depending on the division of amplitude (Michelson interferometer and applications, Jamin's interferometer).

iii) Involving multiple reflections. Plane Parallel film, Newton's rings, Fabry-perot interferometer, its uses.

Fraunhofer diffraction:

i) Single slit.

ii) Double slit.

iii) Diffraction grating.

Fresnel diffraction:

Fresnel's half period zones - Diffraction by circular aperture, Zone plate, Apertures and obstacles with straight edges, Cornu's spiral, Fresnel's integrals.

Absorption, Scattering and Dispersion:

Absorption by solids, liquids and gases, resonance and fluorescence of gases - scattering by small particles- Raman effect.

Dispersion of a prism:

Normal and anomalous dispersion their theory and experiments.

The Electromagnetic character of light (Introduction):

Transverse nature of light vibrations, Maxwell's equations for a vacuum, Displacement current, the equation for plane electromagnetic waves.

Polarization of light:

Polarization by reflection, polarization by double refraction, polarization by scattering.

Pre-requisite: 4103

4212 Electricity and Magnetism (3)

Electrostatics:

The electric charge, Coulomb's Law, the electric fields and potentials, conductors and insulators,

Gauss's law and applications, the electric dipole, Poisson's and Laplace's equations and their

solutions in one independent variable, solution to Laplace's equation in spherical coordinates-

zonal harmonics and applications

Electrostatic field in Dielectric Media:

Polarization, fields outside and inside a dielectric, media, Gauss's Law in a dielectric, the electric

displacement vector, electric susceptibility and dielectric constant

Electrostatic Energy:

Potential energy of a group of point charges, electrostatic energy of a charge distribution, energy

density of an electrostatic field, Coefficients of capacitance and induction, capacitance

Electric current :

Nature of the current, current density, equation of continuity, conductivity, Ohm's law

Magnetic Field of Steady Currents:

The definition of magnetic induction, forces on current carrying conductors, the law of Biot and

Savart and applications, Ampere's circuital Law and applications, the magnetic vector and scalar

potentials

Effects of Non-Steady Currents:

Faraday's law, motional e.m.f., self inductance, mutual inductance, inductances in series and in parallel

Pre-requisite: 4103

4213 Practical Physics IV (2)

Experiments are based on topics covered in **4211 and 4212**.

Pre-requisite: concurrent with 4211 and 4212**.**

4214 Alternating Current (1)

Slowly varying currents:

Kirchhoff's law, elementary transient behavior, steady state behavior of a simple series circuits,

series and parallel connection of impedances, RC and RLC circuits, power and

power factors,

resonance

Theorems of circuit analysis:

Mesh current network analysis, Node voltage network analysis, Thevein's and Norton's theorem

superposition and reciprocity theorems

A.C motors and transformers

Pre-requisite: 4103

4301 Modern Physics (3)

Relativity:

The Michelson-Morley experiment, Fundamental Postulates of the special theory of relativity, time dilation and length contraction, clock synchronization and simultaneity, the Doppler effect, the Lorentz transformation, the Twin Paradox, relativistic momentum, relativistic energy, mass and Binding energy.

The Origin of Quantum Theory:

Quantization of electric charge, black body radiation, the photoelectric effect, X-rays and the Compton effect

The Old Quantum Theory:

Rutherford scattering, Thomson and Bohr models of the hydrogen atom, X-ray spectra

Pre-requisite: 4103, 4201, 4202

4302 Classical Mechanics (3)

Review of rotational kinematics and dynamics:

Angular quantities and their relation to linear quantities, kinematical equations of motion, torque, kinetic energy of rotation, moment of inertia

Rigid bodies:

The dynamical problem of the motion of a rigid body, rotation about an axis, the simple pendulum, the compound pendulum, computation of the center of mass and moment of inertia of rigid bodies.

Gravitation:

Center of gravity for extended bodies, gravitational field and gravitational

potential, gravitational equation

Moving Coordinate System:

Moving origin of coordinates, rotating coordinates system, laws of motion on the rotating earth, the Foucault pendulum, Larmor's theorem

The Rotation of a Rigid Body:

Motion of a rigid body in space, inertia tensor and it's diagonalization, Euler's equations of motion for a rigid body, Euler's angles, the symmetrical top

Lagrangian Dynamics:

Generalized equations, Lagrange's equation and applications, systems subject to constraints and examples, constants of the motion and ignorable coordinates, Hamilton's equation

Pre-requisite: 4201, 4202, 1201, 1202

4303 Electronics I (3)

Semiconductor Diodes:

Intrinsic semiconductor, p-, and n-materials, p-n Junction, Diode, Static characteristics and

Dynamic parameters of a junction diode, Zener Diode, Diode Applications (Half-Wave Rectification, Clipping and Clamping)

Transistors:

Bipolar Junction Transistor, Current Flow in BJT and its basic circuits configuration, Static characteristics and Dynamic parameters of BJT, Lood line, Z-, y-, and h-parameters, h - parameter, Equivalent circuits of BJT, Field Effect Transistor, Static characteristics and Dynamic Parameters of FET, Equivalent Transconductance model of FET.

Biasing the Transistor:

Location of the Quiescent Point for BJT and FET, basic biasing techniques and calculation of their stability index for both BJT and FET

Feedback principles:

Block Diagram Representation of Feedback System, stabilization of gain, improving frequency response and reduction of distortion in amplifiers by negative feedback on output and input resistances, examples of basic feedback connections

Small signal Amplifiers:

Frequency response of BJT coupled CE amplifier and FET common source

Amplifier, Bandwidth criteria for transistor Gain-Bandwidth product. Amplifier stability with feedback (Nyquist criteria)

Operational Amplifier:

Differential amplifier, ideal operational amplifier, basic circuit connection, input and output impedances, bias current offset, output offset voltage, Frequency response, slew rate, applications (Summer Comparator, voltage follower, integrator, Differentiator).

Pre-requisite: 4214

4304 Practical Physics V (3)

Experiments are based on topics covered in **4301 and (4303 or Material lab experiments)**.

Pre-requisite: 4301, (4303 or 4351)

4305 Mathematical Physics (3)

Review of vector analysis; curvilinear coordinates; gradient, divergence, curl, and the Laplacian in the Cartesian and curvilinear coordinates; partial differential equations in physics, method of separation of variables, Hermite, Legendre and associate Legendre functions, Bessel functions and their properties; Fourier series and its applications, Fourier transformations; general properties of matrices and determinants, inverse of a matrix, orthogonal, Hermitian and unitary matrices, similarity, transformations and diagonalization of matrices, secular equation, determination of eigen values and eigen-vectors.

Pre-requisite: 1201

4306 Electromagnetic Theory (3)

Magnetic Properties of Matter:

Magnetization, the magnetic field produced by magnetized materials, Magnetic scalar potential and Pole density, sources of the magnetic field- magnetic intensity, the field equations, magnetic susceptibility and permeability, Hysteresis.

Maxwell's equations:

Generalization of Ampere's Law, displacement current, Maxwell's equations and their empirical basis, electromagnetic energy, Poynting vector, the wave equation, boundary conditions, the wave equation with sources.

Propagation of Electromagnetic Waves:

Plane monochromatic waves in non-conducting media, polarization, energy density and flux, plane monochromatic waves in conducting media

Waves in Boundary Regions:

Reflection and refraction at the boundary of two non-conducting media, reflection and transmission by a thin layer and interference, propagation between parallel connecting plates, waveguides

Radiation Emission:

Radiation from an Oscillating dipole, radiation from a half-wave antenna

Pre-requisite: 4212

4308 Solid State Physics I (3)

Crystallography and crystal structure:

Direct lattice, cell, crystal structure, Miller indices, reciprocal lattice, 1st Brillion Zone, symmetry operations, classification of crystal lattice and structure.

Crystal diffraction:

Properties of x- rays, diffraction, Laue method, rotating crystal method, powder method

Crystal binding:

Van der Waals crystals, ionic crystals, covalent crystals, metallic crystals, Bulk modules, Hydrogen bonds

Phonons and lattice vibrations:

Waves in mono- and diatomic-lattices, phonons lattice specific heat, model of Einstein and Debye, thermal elongation, thermal conduction, phonon scattering, normal and unklapp processes.

Free electron Fermi gas:

Free electron theory, electrical conduction, Hall effect, Band theory and classification of solids.

Pre-requisite: 4307

4309 Nuclear Physics I (3)

Basic Nuclear Properties:

Nuclear mass and charge, nuclear size, intrinsic angular momentum

Nuclear Structure:

Nuclear binding energy, average binding energy per-nucleon, saturation and short range of the nuclear force, separation energy systematic, abundance systematic of stable nuclide. Liquid-drop model, semi-empirical mass formula. Coulomb

energy of a spherical nucleus, asymmetry energy, mass parabolas, stability line. Basic concepts of the shell model

Interaction of Radiation with Matter:

Interaction of charged particles with matter, interaction of neutrons with matter, energy loss of neutrons, energy distribution of neutrons after collision, interaction of gamma radiation with matter, attenuation of gamma rays, Compton effect, photoelectric effect, pair production. interaction of positrons with matter.

Radioactive Decay:

Radioactivity, decay of a single isotope, production of a radioisotope, by nuclear bombardment, production by a decaying parent, widths of decaying states.

Gamma decay:

Energetics of gamma decay, decay constant, classification of gamma decays, internal conversion

Alpha Decay:

Energetic of alpha decay, decay constant, Hindrance factors, alpha particle spectra,

Beta decay:

Neutrino hypothesis, energetic of beta decay, decay constant, shape of beta spectrum, lifetime and classification of beta decays, electron capture decay, inverse beta decay, parity non-conservation of beta decay.

Pre-requisite: 4307

4311 Quantum Physics I (3)

Particles and waves:

The de Broglie postulates, measurement of electron wavelengths, wave packets, the probabilistic

interpretation of the wave function, interpretation of the Bohr quantization rule, the uncertainty principle, particle wave duality, some consequence of the uncertainty principle.

Schrodinger's theory of quantum mechanics:

Postulatory basis of quantum mechanics, time independent and time dependent Schrodinger equations, eigenvalue equations and associated properties of eigenstates, basic operators. Solutions of the time independent Schrodinger equation in one dimension for different square well potentials, step potentials, tunneling, expectation values and operators, parity of states, transition between energy states, the simple harmonic oscillator in one dimension, reflection and

transmission of waves, the Schrodinger equation in three dimensions, time dependent Schrodinger equation, Schrodinger equation for two or more particles

Pre-requisite: 4301, 4302

4314 Electronics II (3)

Active filters:

Low-pass filter, second order low-pass filter, high-pass filter, second order high-pass filter, band filter.

Rectification and control:

Shockley diode, silicon-controlled rectifier, applications

Power amplifier:

Class A,B and C operating point, load line, nonlinear distortion, efficiency.

Oscillators and multi-vibrators:

Design of oscillator circuits (feedback and negative resistance oscillator), phase shift oscillator, Hartley and Coliptte oscillator, quartz oscillator, tunnel diode oscillator, relaxation oscillator, free running multi-vibrator, flip-flop reset-set trigger flip-flop.

Digital electronics:

Binary system and pulses, logic gates (AND, OR, NOR, NAND, EXOR), binary addition, binary comparator, binary counter, flip-flops, JK flip-flop, shift registers, encoder and decoder, visual

displays

Modulation and demodulation:

Fundamentals of modulation, AM (frequency spectrum, power generation and demodulation), FM (frequency spectrum generation and demodulation).

Pre-requisite: 4303

4315 Practical Physics VI (3)

Experiments are designed to cover topics in Nucl. Phys, Solid st Phys., Electronics, radiation Phys., Material Science, or Medical Physics subjects

Pre-requisite: Consent of the department**.**

4316 Computational Physics (3)

Matrix algebra:

Matrix operations, determinant of a matrix, unit matrix and inverse matrix

Solution of linear equations:

Inverse matrix method, Crammer's method, Gaussian elimination method, Jacobi iteration method

Interpolation and curve fitting:

Lagrange interpolation algorithm, least squares fitting, goodness of fit

Derivatives and integrations:

First and second derivatives of a function, rectangles method, trapezoidal method, Simpson's method, multiple integrals

Differential equations:

Euler method, Runge-Kutta method, shooting method, finite difference method

Quantum computations:

Normalization, expectation values, solution of Schrodinger equation for a particle in a well, eigenvalues and eigenvectors

Monte Carlo method:

MC techniques, random numbers and generators, random distributions, example of applying MC

Pre-requisite: 1202, 1201

4334 Research Methods (1)

Pre-requisite: Nil

4410 Quantum Physics II (3)

One Electron Atoms:

The Schrodinger equation in spherical coordinates, separation and solution of the equation of relative motion, quantum numbers, eigen-values and degeneracy, eigen functions and probability densities, angular momentum operators, eigen value equations, angular momentum of one-electron-atom, eigen function, orbital magnetic moments, effects of an external magnetic field, the Stern-Gerlech experiment and electron spin, the spin-orbit interaction, total angular momentum, relativistic corrections for the one-electron atom model.

Perturbation theory:

The need for such a theory, one dimensional time independent perturbation theory, treatment of degenerate states, applications in one dimension

Identical Particles:

Quantum mechanical description of identical particles, symmetric and anti-symmetric eigen functions, the exclusion principle, the Helium atom, the Fermi gas.

Multi-electron Atoms:

The Thomas-Fermi model, the Hartree-theory, the periodic table, excited states of atoms, Alkali Atoms, LS-coupling, JJ-coupling, The Zeeman effect, Hyperfine structure, transition rates and selection rules, life times and line widths.

Introduction to matrix mechanics:

Commutation relations between quantum mechanical operators and their relation to the Heisenberg uncertainty principle; matrix representation of operators and functions; matrix algebra; Schrodinger, Heisenberg and Interaction representations; transformations of representations

Pre-requisite: 4311

4404 Statistical Mechanics (2)

Probability concepts:

Probability calculations, elementary relations among probabilities, joint probability, Binomial distribution, mean values for a spin system, dispersion and standard deviation.

Classical statistical mechanics:

The need for statistical mechanics, energy states and energy levels, macro- and micro-states, statistical equilibrium, Maxwell-Boltzmann distribution law, partition function, temperatures, thermal equilibrium, application to ideal gas, most probable energy and velocity of gas molecules, average velocity and root-mean square velocity of molecules in an ideal gas.

Thermo-dynamical properties of a system in terms of partition function:

Conservation of energy of a system of particles, first law of thermo-dynamics , entropy, entropy and the second law of thermodynamics, entropy and heat, equation of state of an ideal gas, equation of state of a real gas, specific heat capacity of an ideal monatomic gas, the

principle of equipartition of energy.

Quantum statistics:

Fermi-Dirac distribution law, the electron gas, applications of F-D; statistics of electrons in metals, Bose-Einstein distribution law, the photon gas, specific heat capacity of solids, the ideal gas in quantum statistics, comparison of the three statistics.

Pre-requisite: 4203, 4311

4405 Practical Physics VII (3)

Experiments are designed to cover topics in Nucl. Phys, Solid St Phys., Electronics, radiation Phys., Material Science, or Medical Physics subjects

Pre-requisite: Consent of the department

4411 Solid State Physics II (3)

Semiconductors:

Intrinsic and non-intrinsic semiconductors, doping, mass action law, conduction and Hall effect.

Dielectrics:

Average and local electric field, dielectric Polarization, Ferroelectric crystals, piezo electricity.

Magnetic Properties:

Magnetism, diamagnetism, paramagnetism, ferromagnetism, spin- spin interaction, spin wave.

Defects and diffusion in crystals:

Defects in crystals, point defect, diffusion, cellar center, dislocations.

Optical properties of Dielectrics and Semiconductors:

Colors of crystals, excitons, Maser, laser, Luminescence.

Super conductivity:

Super conduction electrical, magnetic and thermal properties. Perfect diamagnetism, Meissner effect, critical field, BCS theory.

Pre-requisite: 4308

4416 Nuclear Physics II (2)

Nuclear reactions:

Conservation laws; Types of nuclear reactions;

Cross Section:

Definitions, energy and angular dependence, Coulomb cross-section, neutron cross section (qualitative); compound-nucleus reaction; formation and decay; direct reactions, optical model, surface interaction model, stripping reaction, transfer reaction.

Fission:

Energy release, details of the process, Fission cross-section.

Particles and Nuclei:

Subatomic particles, mass and spin, fermions and Bosons, electric charge and magnetic dipole moment, mass measurements, photons, leptons, decays, mesons, baryon ground states, excited states and resonances.

Symmetries and Conservation Laws:

Additive conservation laws: conserved quantities and symmetries, the electric charge, the Baryon number, lepton and muon number, particles and antiparticles, hypercharge (strangeness).

Angular Momentum and isospin:

Invariance under spacial rotation, Symmetry breaking by magnetic field, charge independence of hadronic forces, the nucleon isospin, isospin invariance, isospin of particles, isospin in nuclei.

P,C and T:

The parity operation, the intrinsic parities of subatomic particles, conservation and breakdown of parity, charge conjugation, time reversal, the two state problem, the neutral kaons, the fall of CP invariance.

Pre-requisite: 4309

4419 Graduation Project (3)

Pre-requisite: Consent of the department

4431 Independent Study (1)

Pre-requisite: Consent of the department

4432 Special Topics (2)

Pre-requisite: Consent of the department

4436 Electives (2)

Pre-requisite: Consent of the department.