DSC-Major Physics Syllabus
(Credits: Theory-03, Practical/Tutorial-01)

Semester I

DSCPHYMAJ-1 (Theory): Mechanics	
45 Lectures	**3 Credits**
Vectors	
Vector algebra. Scalar and vector products, triple products. Vector differentiation, gradient, divergence, Curl and their significance.	
Ordinary Differential Equations	
1st order homogeneous differential equations. 2nd order homogeneous differential equations with constant coefficients.	
Laws of Motion	
Frames of reference. Newton's Laws of motion. Dynamics of a system of particles. Centre of Mass.	
Momentum and Energy	
Conservation of momentum. Work and energy. Conservation of energy. Motion of rockets.	
Rotational Motion	
Angular velocity and angular momentum. Torque. Conservation of angular momentum.	
Oscillations	
Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. Damped oscillations.	
Elasticity	
Hooke's law – Stress-strain diagram, Elastic moduli – Relation between elastic constants, Poisson's ratio, Expression for Poisson's ratio in terms of elastic constants, Work done in stretching and twisting a wire – Twisting couple on a cylinder.	
Special Theory of Relativity	
Special Theory of Relativity: Constancy of speed of light. Postulates of Special Theory of Relativity. Length contraction. Time dilation. Relativistic addition of velocities.	
Reference Books:	
• University Physics. F. W. Sears, M. W. Zemansky and H. D. Young, 13/e, 1986. Addison-Wesley. • Mechanics Berkeley Physics, V.1: Charles Kittel, et al. 2007, Tata McGraw-Hill. • Physics – Resnick, Halliday & Walker 9/e, 2010, Wiley. • Engineering Mechanics, Basudeb Bhattacharya, 2nd edn., 2015, Oxford University Press.	

- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

DSCPHYMAJ -1 (Practical): Mechanics-Lab	
30 Lectures	**1 Credit**

List of Experiments

1. Measurements of volume of a hollow cylinder using Vernier calipers, Screw gauge and Traveling microscope.
2. To determine the height of a building using a Sextant.
3. To study the motion of a spring and calculate (a) Spring Constant (b) Value of g.
4. To determine the Moment of Inertia of a Flywheel.
5. To determine g and velocity for a freely falling body using Digital Timing Technique.
6. To determine the moment of inertia of a) cylindrical, b) rectangular bar about an axis passing through its centre of mass
7. To determine the value of g by Bar Pendulum.
8. To determine the value of g by Kater's Pendulum.
9. Determination of rigidity modulus of the material of a wire by static method.
10. Determination of rigidity modulus of the material of a wire by dynamic method.
11. To determine the modulus of rigidity of a wire by Maxwell's needle.
12. To determine the Young's Modulus of a wire by Optical Lever method.
13. To determine the elastic constants of a wire by Searle's method.

Reference Books:

- Advanced Practical Physics for students, B. L. Flint and H. T. Worsnop, 1971, Asia Publishing House.
- Engineering Practical Physics, S. Panigrahi & B. Mallick,2015, Cengage Learning India Pvt. Ltd.
- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
- Physics through experiments, B. Saraf, Vikas Publications, 2013
- A lab manual of Physics for undergraduate classes, 1st Edition, Vikas Publications.
- B.Sc. Practical Physics Revised Ed, C. L. Arora, S. Chand & Co. 2007

Semester-II

DSCPHYMAJ-2 (Theory): Electricity and Magnetism

45 Lecture	3 Credits

Vector Analysis

Review of vector algebra and vector differentiation;

Vector Integration: Line, surface and volume integrals of Vector fields. Gauss-divergence theorem and Stoke's theorem of vectors (statement only).

Electrostatics

Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential. Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic fields. Dielectric medium, Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric.

Magnetism

Magnetostatics: Biot-Savart's law and its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law.

Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para-and ferro-magnetic materials.

Electromagnetic Induction

Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in a magnetic field.

Reference Books

- Electricity and Magnetism, E. M. Purcell, 1986, McGraw-Hill Education
- Electricity and Magnetism, Vol.I, J. H. Fewkes and J.Yarwood, 1991, Oxford Univ. Press
- Electricity and Magnetism, D. C. Tayal, 1988, Himalaya Publishing House.
- University Physics, R. L. Reese, 2003, Thomson Brooks/Cole.
- Introduction to Electrodynamics, D. J. Griffiths, 3rd edition, 1998, Benjamin Cummings.

DSCPHYMAJ-2(Practical): Electricity and Magnetism Lab

30 Lectures	1 Credit

List of Experiments

1. To use a Multimeter for measuring

- Resistances
- AC and DC Voltages
- DC Current
- Checking electrical fuses.

2. Ballistic Galvanometer:

- Measurement of charge and current sensitivity
- Measurement of CDR
- Determine a high resistance by Leakage Method
- To determine Self Inductance of a Coil by Rayleigh's Method.

3. To compare capacitances using De'Sauty's bridge.

4. Measurement of field strength B and its variation in a Solenoid (Determine dB/dx)

5. To study the Characteristics of a Series RC Circuit.

6. To study a series LCR circuit and determine its

- Resonant frequency
- Quality factor

7. To study a parallel LCR circuit and determine its:

- Anti-resonant frequency and
- Quality factor Q

8. To determine a Low Resistance by Carey-Foster's Bridge.

9. To verify the Thevenin and Norton theorems

10. To verify the Superposition and Maximum Power Transfer Theorems

Reference Books

- Advanced Practical Physics for students, B. L. Flint and H. T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, M. Nelson and J. M. Ogborn, 4th edition, reprinted 1985, Heinemann Educational Publishers
- A Textbook of Practical Physics, I. Prakash and Ramakrishna, 11th edition, 2011, Kitab Mahal
- Engineering Practical Physics, S. Panigrahi and B. Mallick, 2015, Cengage Learning

Semester III

DSCPHYMAJ-3 (Theory): Waves and Optics	
45 Lecture	**3 Credits**
Superposition of Two Collinear Harmonic oscillations	
Linearity and Superposition Principle. Oscillations having equal frequencies and Oscillations having different frequencies (Beats).	
Superposition of Two Perpendicular Harmonic Oscillations	
Graphical and Analytical Methods. Lissajous Figures with equal and unequal frequency and their uses.	
Wave Motion	
Transverse waves on a string. Traveling and standing waves on a string. Normal Modes of a string. Group velocity, Phase velocity. Plane waves. Spherical waves, Wave intensity.	
Sound	
Simple harmonic motion-forced vibrations and resonance, Fourier's Theorem-Application to sawtooth wave and square wave–Intensity and loudness of sound-Decibels, Intensity levels, Acoustics of buildings: Reverberation and time of reverberation-Absorption coefficient, Sabine's formula-measurement of reverberation time-Acoustic aspects of halls and auditorium.	
Wave Optics	
Electromagnetic nature of light. Definition and Properties of wave front. Huygen's Principle.	
Interference	
Interference: Division of amplitude and division of wavefront. Young's Double Slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: measurement of wavelength and refractive index.	

Diffraction

Fraunhofer diffraction- Single slit; Double Slit. Multiple slits and Diffraction grating. Fresnel Diffraction: Half-period zones. Zone plate. Fresnel Diffraction pattern of a straight edge, a slit and a wire using half- period zone analysis.

Polarization

Transverse nature of light waves. Plane polarized light–production and analysis. Circular and elliptical polarization.

Reference Books

- Fundamentals of Optics, F. A. Jenkins and H. E. White, 1976, McGraw Hill
- Principles of Optics, B. K. Mathur, 1995, Gopal Printing
- Fundamentals of Optics, H. R. Gulati and D. R. Khanna, 1991, R. Chand Publications
- University Physics, F. W. Sears, M. W. Zemansky and H. D. Young, 1986. Addison-Wesley

DSCPHYMAJ-3 (Practical): Waves and Optics Lab

30 Lectures	1 Credits

List of Practicals

1. To investigate the motion of coupled oscillators
2. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment and to verify λ^2 – T Law.
3. To study Lissajous Figures
4. Familiarization with Schuster's focussing; determination of angle of prism.
5. To determine the Refractive Index of the Material of a Prism using Sodium Light.
6. To determine Dispersive Power of the Material of a Prism using Mercury Light
7. To determine the value of Cauchy Constants.
8. To determine the Resolving Power of a Prism.
9. To determine wavelength of sodium light using Fresnel Biprism.
10. To determine wavelength of sodium light using Newton's Rings.
11. To determine the wavelength of Laser light using Diffraction of Single Slit.
12. To determine wavelength of (1) Sodium and (2) Spectral lines of the Mercury light using plane diffraction Grating
13. To determine the Resolving Power of a Plane Diffraction Grating.
14. To measure the intensity using photo sensor and laser in diffraction patterns of single and double slits.

Reference Books

- Advanced Practical Physics for students, B. L. Flint and H. T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, M. Nelson and J. M. Ogborn, 4th edition, reprinted 1985, Heinemann Educational Publishers
- A Textbook of Practical Physics, I. Prakash and Ramakrishna,11th edition, 2011, Kitab Mahal, New Delhi.

Semester IV

DSCPHYMAJ-4 (Theory): Thermal Physics

45 Lectures	3 Credits

Laws of Thermodynamics

Thermodynamic Description of a system: Zeroth Law of thermodynamics and concepts of temperature. First law and internal energy, conversion of heat into work, Various Thermodynamic Processes, Applications of First Law: General Relation between CP and CV, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Coefficient, Reversible and irreversible processes, Second law and Entropy, Carnot's cycle and theorem, Entropy changes in reversible and irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero.

Thermodynamic Potentials

Enthalpy, Gibbs and Helmholtz Free energy, Internal Energy functions, Maxwell's relations and applications - Joule-Thomson Effect, Clausius-Clapeyron equation, Expression for $C_p - C_v$, $\frac{C_p}{C_v}$, and TdS equations

Kinetic Theory of Gases

Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases.

Theory of Radiation

Blackbody Radiation, Spectral distribution, Concept of Energy density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh-Jeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law.

Reference Books

- Thermal Physics, S. Garg, R. Bansal, and C. Ghosh, 1993, Tata McGraw Hill.
- A Treatise on Heat, M. N. Saha and B. N. Srivastava, 1969, Indian Press.
- Thermodynamics, E. Fermi, 1956, Courier Dover Publications.
- Heat and Thermodynamics, M. W. Zemansky and R. Dittman, 1981, McGraw Hill
- Thermodynamics, Kinetic theory and Statistical thermodynamics, F. W. Sears and
- G. L. Salinger, 1988, Narosa
- University Physics, R. L. Reese, 2003, Thomson Brooks/Cole.
- Thermal Physics, A. Kumar and S. P. Taneja, 2014, R. Chand Publications.

DSCPHYMAJ-4 (Practical): Thermal Physics Lab

30 Lectures	1 Credit

List of Experiments

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. Measurement of Planck's constant using blackbody radiation.
3. To determine Stefan's Constant.
4. To determine the coefficient of thermal conductivity of Cu by Searle's Apparatus.
5. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
6. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
7. To determine the temperature coefficient of resistance by Platinum resistance thermometer.
8. To study the variation of thermo emf across two junctions of a thermocouple with temperature.
9. To record and analyze the cooling temperature of a hot object as a function of time using a thermocouple and suitable data acquisition system
10. To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge

Reference Books

- Advanced Practical Physics for students, B. L. Flint and H. T. Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, M. Nelson and J. M. Ogborn, 4th edition, reprinted 1985, Heinemann Educational Publishers
- A Textbook of Practical Physics, I. Prakash and Ramakrishna, 11th edition, 2011, Kitab Mahal, New Delhi.
- A Laboratory Manual of Physics for Undergraduate Classes, D. P. Khandelwal, 1985, Vani Publication.

Semester V

DSCPHYMAJ-5 (Theory): Electronics

45 Lectures	3 Credits

Semiconductor Devices and Application

Semiconductor Diodes: P and N type semiconductors. Barrier Formation in PN Junction Diode. Qualitative Idea of Current Flow Mechanism in Forward and Reverse Biased PN junction Diode.

Rectifiers: half-wave, full-wave and bridge rectifiers, Calculation of Ripple Factor and Rectification Efficiency, L-type and π-type filters, Zener diode, voltage regulator.

Bipolar Junction transistors: n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations. Active, Cutoff & Saturation regions Current gains α and β. Relations between α and β. Load Line analysis of Transistors. DC Load line & Q- point. Voltage Divider Bias Circuit for CE Amplifier. H-parameter, Equivalent Circuit. Analysis of single-stage CE amplifier using hybrid Model. Input & output Impedance. Current, Voltage and Power gains. Class A, B & C Amplifiers.

Oscillators and Amplifiers

Feedback – positive and negative feedback, Barkhausen criterion, oscillator, Determination of Frequency of RC Oscillator

Characteristics of an Ideal and Practical Op-Amp (IC 741), Open-loop and closed- loop Gain. CMRR, concept of Virtual ground. Applications of Op-Amps: (1) Inverting and non-inverting Amplifiers, (2) Adder, (3) Subtractor, (4) Differentiator, (5) Integrator, (6) Zero crossing detector.

Digital Electronics

Binary systems, binary numbers, decimal to binary and binary to decimal conversions, binary addition and subtraction. Logic Gates - AND, OR, NOT gates- truth tables; NOR and NAND gates as universal gates. De Morgan's Theorem. Boolean Laws. Simplification of Logic Circuit using Boolean Algebra.

Binary Addition. Binary Subtraction using 2's Complement Method). Half Adders and Full Adders and Subtractors.

Reference Books

- Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
- Electronic devices & circuits, S. Salivahanan & N.S. Kumar, 2012, Tata Mc-Graw Hill
- Microelectronic Circuits, M.H. Rashid, 2nd Edn., 2011, Cengage Learning.
- Modern Electronic Instrumentation and Measurement Tech., Helfrick and Cooper, 1990, PHI Learning
- Digital Principles and Applications, A.P. Malvino, D.P. Leach and Saha, 7th Ed., 2011, Tata McGraw Hill
- Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, 2014, 6th Edn., Oxford University Press.
- Fundamentals of Digital Circuits, A. Anand Kumar, 2nd Edition, 2009, PHI Learning Pvt. Ltd.
- OP-AMP & Linear Digital Circuits, R.A. Gayakwad, 2000, PHI Learning Pvt. Ltd.

DSCPHYMAJ-5 (Practical): Electronics Lab

30 Lectures	**1 Credit**

List of Experiments

1. To study the voltage-current relationship of a PN junction diode and to determine the dynamic resistance of the diode at different currents
2. To draw the reverse characteristics of a zener diode and to study its voltage regulation characteristics using a variable load.
3. To study the PN junction diode as rectifier using half/full wave rectifier with or without filter.
4. To draw the voltage-current characteristics of a bridge rectifier with and without a filter.
5. To draw the output characteristics of a transistor in CE configuration and hence determine the AC current gain from the active region of the characteristics.
6. To use OPAMP as inverting, non-inverting, differential amplifier and as an adder.
7. To verify the truth tables of OR, AND, NOT, NAND, NOR gates and their simple combinations using IC.

Reference Books

- Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc-Graw Hill.
- Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
- OP-Amps & Linear Integrated Circuit, R.A. Gayakwad, 4th Edn, 2000, Prentice Hall.
- Electronic Principle, Albert Malvino, 2008, Tata Mc-Graw Hill.

DSCPHYMAJ-6 (Theory + Tutorial): Quantum Mechanics

45 Lectures (Theory) **15 Lectures (Tutorial)**	**Theory: 3 Credits** **Tutorial: 1 Credit**

Introduction to Quantum Mechanics

Blackbody Radiation: Rayleigh- Jeans law (statement only), Wein's distribution law (Statement only) and Planck's radiation law; Quantum theory of Light; Photo-electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson-Germer experiment. Wave description of particles by wave packets. Group and Phase velocities and relation between them. Two-Slit experiment with electrons. Wave amplitude and wave functions.

Uncertainty principle, introduction to operator physics and Schrödinger equation

Wave-particle duality, Heisenberg uncertainty principle (Uncertainty relations involving Canonical pair of variables): Derivation from Wave Packets impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle- application to virtual particles and range of an interaction.

Two slit interference experiment with photons, atoms and particles; linear superposition principle as a consequence; Matter waves and wave amplitude; Momentum and Energy operators; commutator algebra; Schrödinger equation for non-relativistic particles; stationary states; physical interpretation of a wave function, probabilities and normalisation; Probability and probability current densities in one dimension.

Simple applications of Schrödinger equation

One dimensional infinitely rigid box-energy eigenvalues and eigenfunctions, normalisation; Quantum dot as example; Quantum mechanical tunnelling in one dimension – across a step potential, rectangular potential barrier. Linear harmonic oscillator; Zero point energy and uncertainty principle.

Quantum Theory of Hydrogen Like Atoms

Time independent Schrodinger equation in spherical polar coordinates; separation of variables for second order partial differential equation; angular momentum operator and quantum numbers; Radial wave functions from Frobenius method; shapes of the probability densities for ground and first excited states; Orbital angular momentum quantum numbers l and m (concept only)

Reference Books

- Concepts of Modern Physics, A. Beiser, 2002, McGrawHill.
- Introduction to Modern Physics, F. K. Richtmyer, E. H. Kennard, and J. N. Cooper, 2002, Tata McGraw Hill
- Introduction to Quantum Mechanics, D. J. Griffith, 2005, Pearson Education.
- Physics for scientists and Engineers with ModernPhysics, Jewett and Serway, 2010, Cengage Learning.
- Modern Physics, G. Kaur and G. R. Pickrell, 2014, McGraw Hill
- Quantum Mechanics: Theory and Applications, A.K.Ghatak and S.Lokanathan, 2004, Macmillan
- Quantum Physics, Berkeley Physics, Vol.4. E. H. Wichman, 1971, TataMcGrawHill Co.

Semester VI

DSCPHYMAJ-7 (Theory + Tutorial): Solid State Physics

45 Lectures (Theory) **15 Lectures (Tutorial)**	**Theory: 3 Credits** **Tutorial: 1 Credit**

Crystal Structure

Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis – Central and Non-Central Elements. Unit Cell. Miller Indices. Reciprocal Lattice. Types of Lattices. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law.

Elementary Lattice Dynamics

Lattice Vibrations and Phonons: Linear Mono atomic and Diatomic Chains. Acoustical and Optical Phonons. Qualitative Description of the Phonon Spectrum in Solids. Dulong and Petit‟s Law, Einstein and Debye theories of specific heat of solids. T^3 law

Magnetic Properties of Matter

Dia-, Para-, Ferri- and Ferromagnetic Materials. Classical Langevin Theory of dia– and Paramagnetic Domains. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss.

Dielectric Properties of Materials

Polarization. Local Electric Field at an Atom. Depolarization Field. Electric Susceptibility. Polarizability. Clausius Mosotti Equation. Classical Theory of Electric Polarizability. Normal and Anomalous Dispersion. Cauchy and Sellmeir relations. Langevin-Debye equation. Ferroelectric Properties of Materials: Structural phase transition, Ferroelectric effect, Curie-Weiss Law, Ferroelectric domains, PE hysteresis loop.

Elementary band theory

Kronig Penny model. Band Gap. Conductor, Semiconductor (P and N type) and insulator. Conductivity of Semiconductor, mobility, Hall Effect. Measurement of conductivity (04 probe method) & Hall coefficient.

Superconductivity

Experimental Results. Critical Temperature. Critical magnetic field. Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth. Isotope effect.

Reference Books

- Introduction to Solid State Physics, Charles Kittel, 8thEd.,2004,WileyIndiaPvt.Ltd.
- Elements of Solid State Physics, J.P.Srivastava, 2ndEd., 2006, Prentice-Hallof India
- Introduction to Solids, Leonid V. Azaroff, 2004, TataMc-Graw Hill
- Solid State Physics, N.W. Ashcroft and N. D. Mermin, 1976, Cengage Learning
- Solid State Physics, Rita John, 2014, McGrawHill
- Solid State Physics, H. Ibach and H. Luth, 2009, Springer
- Elementary SolidState Physics, M. Ali Omar, 1999, Pearson India
- Solid State Physics, M. A. Wahab, 2011, Narosa Publications

DSCPHYMAJ-8 (Theory + Tutorial): Nuclear And Particle Physics

45 Lectures (Theory) **15 Lectures (Tutorial)**	**Theory:3 credits** **Tutorial 1 credit**

General Properties of Nuclei

Constituents of nucleus and their Intrinsic properties, quantitative facts about mass, radii, charge density (matter density), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric moments, nuclear excites states.

Nuclear Models

Liquid drop model approach, semi empirical mass formula and significance of its various terms, condition of nuclear stability, two nucleon separation energies, Fermi gas model (degenerate fermion gas, nuclear symmetry potential in Fermi gas), evidence for nuclear shell structure, nuclear magic numbers, basic assumption of shell model, concept of mean field, residual interaction, concept of nuclear force.

Radioactive decay

(a) Alpha decay: basics of α-decay processes, theory of α- emission, Gamow factor, Geiger-Nuttall law, α-decay spectroscopy. (b) β-decay: energy kinematics for β-decay, positron emission, electron capture, neutrino hypothesis. (c) Gamma decay: Gamma rays emission and kinematics, internal conversion.

Nuclear Reactions

Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, reaction rate, reaction cross section, Concept of compound and direct reaction, resonance reaction, Coulomb scattering (Rutherford scattering).

Interaction of Nuclear Radiation with matter

Energy loss due to ionization (Bethe- Block formula), energy loss of electrons, Cerenkov radiation. Gamma ray interaction through matter, photoelectric effect, Compton scattering, pair production, neutron interaction with matter.

Detector for Nuclear Radiations

GM Counter: Basic principle of Scintillation Detectors and construction of photo-multiplier tube (PMT). Semiconductor Detectors (Si and Ge) for charge particle and photon detection (concept of charge carrier and mobility)

ParticleAccelerators

Linear accelerator, Cyclotron, Synchrotrons.

Particle physics

Particle interactions; basic features, types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model, colour quantum number and gluons.

ReferenceBooks

- Introductory nuclear Physics by Kenneth S. Krane (WileyIndiaPvt.Ltd.,2008).
- Concepts of nuclear physics by Bernard L. Cohen. (TataMcgrawHill, 1998).
- Introduction to the physics of nuclei & particles, R.A. Dunlap. (ThomsonAsia,2004).
- Introduction to High Energy Physics, D.H. Perkins, Cambridge Univ. Press
- Introduction to Elementary Particles, D. Griffith, John Wiley & Sons
- Quarks and Leptons, F. Halzen and A.D. Martin, Wiley India, New Delhi
- Basic ideas and concepts in Nuclear Physics-An Introductory Approach by
- K.Heyde (IOP-Institute of Physics Publishing, 2004).
- Radiation detection and measurement, G. F. Knoll (JohnWiley&Sons,2000).
- Physics and Engineering of Radiation Detection, Syed Naeem Ahmed (Academic Press, Elsevier,2007).
- Theoretical Nuclear Physics, J.M. Blatt & V.F.Weisskopf (DoverPub.Inc.,1991)