K S K V Kachchh University
B. Sc. (Physics) CBCS Syllabus
(In force from June 2016)

Semester – VI

US CEPH – 610 (Quantum Mechanics, Electromagnetism)

Unit-I

Quantum Mechanics

One-Dimensional Energy Eigenvalue Problems: Square-well Potential with Rigid walls; Square-well Potential with Finite walls; Square Potential Barrier; Alpha Emission; Bloch waves in a Periodic Potential; Kronig-Penney Square-well Periodic Potential; Linear Harmonic Oscillator: Schrodinger Method.

Ref. : Quantum Mechanics (Second Ed.) by G. Aruldhas
(Chapter 4, Art. 4.1 to 4.7)

Unit-II

Quantum Mechanics

Three-Dimensional Energy Eigenvalue Problems: Particle Moving in a Spherically Symmetric Potential; System of Two Interacting Particles; Rigid Rotator; Hydrogen Atom.

Ref. : Quantum Mechanics (Second Ed.) by G. Aruldhas
(Chapter 5, Art. 5.1 to 5.4)

Angular Momentum: The Angular Momentum Operators; Angular Momentum Commutation Relations; Eigenvalues and Eigenfunctions of L^2 and L_z.

Ref. : Quantum Mechanics (Second Ed.) by G. Aruldhas
(Chapter 8, Art. 8.1 to 8.3)

Unit-III

Electromagnetism

Special Techniques : Laplace's equation; The method of images.

Ref. : Introduction to electrodynamics by D. J. Griffiths
(Chapter 3, Art. 3.1, 3.2)

Electromagnetic Induction : Hysteresis; Maxwell's equations; Decay of free charge; Potentials of electromagnetic field; More about the Lorentz gauge condition; Field energy and field momentum.

Ref. : Electromagnetics (2^{nd} Ed.) by B.B. Laud.
(Chapter 5, Art. 5.7 to 5.12)

Unit-IV

Electromagnetism

Electromagnetic Waves : Plane waves in non conducting media; Polarization; Energy flux in a plane wave; Radiation Pressure and momentum; Plane waves in a conducting medium; The Skin effect.

Ref. : Electromagnetics (2^{nd} Ed.) by B.B. Laud.
(Chapter 6, Art. 6.1 to 6.6)

US CEPH – 610 PRACTICALS

(1) Acceleration due to Gravity by Keter's Pendulum (Variable Knife Edges)

(2) To Determined Coefficient of Thermal Conductivity of Rubber Tube

(3) To Determined Decay Constant by Thermocouple

(4) Viscosity by Log Decrement Method

(5) Michelsion Interferometer – to determine the wavelength Difference

(6) Refractive Index by Total Internal Reflection

(7) Dielectric Constant of a Liquid

(8) Planck's Constant by LEDs

US CEPH – 611 (Nuclear Physics)

Unit-I

Alpha Rays: Spectra and Decay : Range of alpha particles; Disintegration energy of spontaneous α-decay; Alpha decay paradox – Barrier penetration.

Ref. : Nuclear Physics by S. B. Patel
(Chapter 4, Art. 4.II.1 to 4.II.3)

Beta Rays : Spectra and Decay : Introduction; Continuous β–ray spectrum - difficulties encountered to understand it; Pauli's Neutrino hypothesis; The detection of neutrino; Parity non-conservation in beta decay.

Ref. : Nuclear Physics by S. B. Patel
(Chapter 4, Art. 4.III.1 to 4.III.3, 4.III.5, 4.III.6)

Unit-II

Introduction to Gamma Emission : Introduction; γ-ray emission – selection rules; Internal conversion; Nuclear Isomerism.

Ref. : Nuclear Physics by S. B. Patel
(Chapter 4, Art. 4.IV.1 to 4.IV.4)

Elementary Particles : Leptons; Hadrons; Elementary particle quantum numbers; Quarks; History of universe.

Ref. : Concepts of Modern Physics (Fifth Ed.) by Arther Beiser
(Chapter 13, Art. 13.2 to 13.5, 13.7)

Unit-III

The Liquid Drop Model of a Nucleus : Introduction; Binding energies of nuclei – plot of B/A against A; Weizsacher's semi empirical mass formula; Mass parabolas: Prediction of stability against β-decay for members of an isobaric family; Stability limits against spontaneous fission; Barrier penetration – Decay probabilities for spontaneous fission; Nucleon emission.

Ref. : Nuclear Physics by S. B. Patel
(Chapter 5, Art. 5.1 to 5.7)

Unit-IV

Nuclear Energy : Introduction; Neutron induced fission; Asymmetrical fission – mass yield; Emission of delayed neutrons by fission fragments; Energy released in the fission of ^{235}U; Fission of lighter nuclei; Fission chain reaction; Neutron cycle in a thermal nuclear reactor; Nuclear reactors.

Ref. : Nuclear Physics by S. B. Patel
(Chapter 6, Art. 6.1 to 6.9)

Nuclear Physics in Other Areas of Physics : Introduction; The technique of NMR; Some experiments with NMR; The Mossbauer effect; Some experiments using Mossbauer effect.

Ref. : Nuclear Physics by S. B. Patel
(Chapter 9, Art. 9.1 to 9.5)

US CEPH – 611 PRACTICALS

(1) Mutual Inductance by Ballistic Galvanometer

(2) Passive Filters

(3) Colpitt Oscillator – Measurement of Frequency by C.R.O.

(4) Parallel Resonance – Determination of Band Width and Q – Factor

(5) Series Voltage Regulator

(6) Half Adder and Full Adder

(7) Wavelength of a LASER Light

(8) Numerical Integration

US CEPH – 612 (Statistical Mechanics, Plasma Physics, Biophysics)

Unit-I

Statistical Mechanics

Maxwell - Boltzmann Statistics : Introduction; Three kinds of Particles; M.B. Statistics applicable to ideal gas; Maxwell Boltzmann energy distribution law; Applications of M.B. distribution law; Mean, RMS and Most probable speeds; Doppler Broadening of spectral lines; Limitations of Maxwell - Boltzmann method; Experimental verification of Maxwellian distribution of molecular speeds.

Ref. : Heat Thermodynamics and Statistical Physics
by Brijlal, Dr. N. Subrahmanyam, P.S Hemne
(Chapter 11, Art. 11.1 to 11.5, 11.7 to 11.9)

Unit-II

Statistical Mechanics

Quantum statistics : Need of Quantum statistics; Development of Quantum statistics; ' h' as a natural constant; Indistinguishability of particles and its consequences; Bose - Einstein distribution law; Photon gas; Plank's radiation law; Fermi-Dirac distribution law; Maxwell-Boltzmann Distribution as a limiting case of B - E and F-D Distributions; Comparison of M – B, B – E and F – D Statistics; Difference between Classical and Quantum Statistics.

Ref. : Heat Thermodynamics and Statistical Physics
by Brijlal, Dr. N. Subrahmanyam, P.S Hemne
(Chapter 12, Art. 12.1 to 12.8, 12.13, 12.15, 12.16)

Unit-III

Plasma Physics

Motion of charged particles in Magnetic and Electric fields : Microscopic and Macroscopic description; Maxwell's equations and charge conservation; Motion of a charged particle in Electric and Magnetic fields; Uniform Magnetic field (E=0); Constant electric and magnetic fields; Uniform Magnetic field and Oscillating Electric field; Van Allen radiation belt.

Ref. : Elements of Plasma Physics by Dr. S. N. Goswami.
(Chapter 2, Art. 2.1, 2.2, 2.3, 2.3.1, 2.3.2, 2.4, 2.9.3)

Unit-IV

Biophysics

Sources of Bioelectric Potentials : What is Biophysics? Resting and Action Potentials; Propagation of Action Potentials; The Bioelectric potentials; The Electrocardiogram (ECG); Electroencephelogram (EEG); Electromyogram (EMG); Other Bioelectric potentials.

Ref. : Bio Medical Instrumentation and measurements by L. Cromwell (Chapter 3, Art. 3.1, 3.2, 3.3, 3.3.1 to 3.3.4)

Electrodes : Biopotential Electrodes; Micro Electrodes; Body Surface Electrodes.

Ref. : Bio Medical Instrumentation and measurements by L. Cromwell (Chapter 4, Art. 4.2, 4.2.1, 4.2.2)

C.R.O.

Cathode Ray Oscilloscope : Cathode Ray Oscilloscope; Cathode Ray tube; Deflection systems; Mathematical expression for electrostatic deflection sensitivity; Electromagnetic deflection system; Magnetic deflection in C.R. Tube; Uses of CRO.

Ref. : Electronics and Radio Engineering (Eighth Ed.) by M. L. Gupta (Chapter 36, Art. 36.1, 36.2, 36.7, 36.8 to 36.10, 36.20)

US CEPH – 612 PRACTICALS

Project Work / Field Visit