Subject Code : P8GTE2

ELECTIVE COURSE I – BIOPHYSICS

Unit I - Atomic Structure

Historical background upto Bhor model. Significance of second and third postulates of Bohr's model. Derivation of radius and energy value. Quantization of levels. Using Rydburg's constant, Atomic spectra is signature of the element. Bhor – Sommerfeld model. Vector atom model. Quantum numbers, Selection rules. Pauli's exclusion principle. Emission spectra with respect to Na atoms to understand selection rules.

Unit II – Spectroscopy

Definition, Electromagnetic wave. Electromagnetic spectrum. Applications of each region of electromagnetic spectrum for spectroscopy. Introduction to molecular energy levels. Excitation, Absorption, Emission, Rational spectra. Energy levels of rigid diatomic molecules. Vibrational and rotational spectra. Energy levels of diatomic vibration molecules. Rotational vibrational Spectroscopy – IR spectroscopy. Principle construction and working of IR spectrometer. Application of IR Spectroscopy to biomolecules. Electron spectroscopy. UV – visible spectroscopy. Principle, construction and working of colorimeter, Spectrophotometer, Flurometer. Application to biomolecules (Proteins, DNA, HB, Chlorophyll)

Unit III – Radioactivity

Nucleus, Properties. Nuclear forces. Nuclear models (liquid drop and shell model). Radioactive nucleus. Revision of nuclear radiation and their properties – alpha, beta and gamma. Half life – physical and biological.
Handling and standardization of alpha and beta emitting isotopes. Radioimmunoassay. Radiopharmaceuticals and its uptakes. Production of radionuclide. Measurement of radiation – Dosimetry and detectors
Principle, construction and working open and batch dosimeter, GM counter, Scintillation counter (solid and liquid)

Unit IV – Thermodynamics as applied to biological systems

Enthalpy, Entropy, Free energy, Gibb's free energy (G). Helmholtz free energy (A). Chemical potential. Half cell potential. Redox potential. Structure and bioenergetics of mitochondria and chloroplast.

Thermoregulation

Thermometric properties and types of thermometers (clinical, thermocouple, bimetallic, platinum resistance, thermistor – thermometers). Body temperature and its regulation.

Unit V – Cell Membrane

Organization of plasma membrane. Mass transport. Diffusion – basics, Passive and active transport. Membrane potential, Nernst equation. Passive

electrical properties of cell (capacitance, resistance). Active electrical properties, Electrical model (equivalent) of cell membrane. Depolarization, Hyper polarization of membrane (neuronal). Generation of action potential. Types of biopotentials. Biopotential measurement instrument.

Reference Books:

1. Perspectives of modern physics – Arthur Beiser (Mc Graw Hill)
2. Nuclear Physics an introduction – S.B. Patel (New Age International)
3. Introduction to atomic spectra – H.E. White (Mc Graw Hill)
4. Text Book of optics and atomic physics – P.P. Khandelwal (Himalaya Publishing House)
5. Molecular cell biology – Ladish, Berk, Matsudara, Kaiser, Krieger, Zipursky, Darnel (W.H. Freeman and Co.)
6. Biophysics – Cotrell (Eastern Economy Edition)
7. Clinical Biophysics – Principles and Techniques – P. Narayana (Bhalani Pub. Mumbai.)
8. Biophysics – Pattabhi and Gautham (Narosa Publishing House)
9. Instrumentation measurements and analysis – Nakara, Choudhari (Tata MC. Graw Hill)
10. Handbook of analytical instruments – R.S. Khandpur (Tata Mc. Graw Hill)
11. Biophysical Chemistry – Upadhyay, Upadhyay and Nath – (Himalaya Pub. House, Delhi)