## BMPC2003 MEDICAL BIOPHYSICS (3-0-0)

**Course Objectives :**

1. To understand the fundamental principles of bioelectrical phenomena, including membrane potentials, action potentials, and their propagation mechanisms.
2. To analyze the electrical properties of excitable membranes and model them using equivalent electrical circuits.
3. To explore the electrical activities of the brain (EEG), heart (ECG), retina (ERG), and ocular system (EOG) and their biomedical applications.
4. To evaluate the effects and applications of ionizing radiation and radioisotopes in biomedical research.
5. To develop an understanding of dielectric properties, space-time constants, and their implications for excitable membranes.

**Module-I (10Hrs)**

Bioelectrical Phenomena: Membrane Potential, Local and propagator types, Diffusion potential, phase boundary potentials, Generator Potentials, Monophonic as Biphasic Action Potentials (AP). Properties & Propagation of AP, factors influencing propagation of AP. Electrical properties of excitable membranes, Membrane Capacitance, Resistance, conductance, equivalent electrical circuit diagram for excitable membranes & pacemaker potentials.

**Module-II (8Hrs)**

Bioelectrical Phenomena: Membrane Potential, Local and propagator types, Diffusion potential, phase boundary potentials, Generator Potentials, Monophonic as Biphasic Action Potentials (AP). Properties & Propagation of AP, factors influencing propagation of AP.

**Module-III (8Hrs)**

Electrical properties of excitable membranes, Membrane Capacitance, Resistance, conductance, equivalent electrical circuit diagram for excitable membranes & pacemaker potentials.Electrical activity of brain (EEG) different wave forms, & their characteristics.

**Module-IV (8Hrs)**

Electrical Activity of Heart (ECG),EelctroRetinoGram(ERG), Electro-Occologram (EOG), Receptor potentials, Stimuli, Electrical stimulus, strength-duration relationship, Dielectric properties of Bio-membrane, Space Constant & Time Constant for excitable membrane.

**Module-V (08Hrs)**

Ionizing radiations, U-V & I-R radiations, radioisotopes & their use in biomedical research, Radioactive decays, Half-life period, Half Value Layer, Linear Energy Transfers (LET), Relative Biological Efficiency (RBE) and Interaction of radiation with-matter

**Course Outcomes (CO) After completing this course, students will be able to:**

1. Recall the fundamental concepts of bioelectrical phenomena, including diffusion and phase boundary potentials.
2. Explain the properties and mechanisms of action potential propagation in excitable membranes.
3. Apply the concepts of membrane capacitance, resistance, and conductance to construct equivalent electrical circuit diagrams.

4. Analyze the electrical activity patterns of the brain, heart, retina, and ocular system using relevant biomedical tools (EEG, ECG, ERG, EOG).
5. Evaluate the interaction of ionizing radiation with biological matter, including its effects, efficiency, and applications in medical research.
6. Create models or simulations to demonstrate space and time constants in excitable membranes, emphasizing dielectric properties.

**Books:**


1. Radiation Biophysics, Second Edition - by Edward L. Alpen - Academic Press; 2 edition (January 15, 1998
2. Bio-Physics – Roland Glaser- Springer; 2nd printing edition (November 23, 2004)
3. The Biomedical Engineering Hand Book- 3rd Ed- (Biomedical Engineering Fundamentals) - Joseph D. Bronzino – CRC –Tylor-Francis – 2006 (Section- III – Bio-Electrical Phenomena)