**School of Engineering and Physical Sciences**
**Department of Mathematics and Physics**

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| **Course Name** | Biomedical Physics |
| **Course Code** | PHY 370 |
| **Course Credit Hours** | 3 |
| **Prerequisite** | PHY 108, MAT 350 |
| **Course Objective** *(Maximum two sentences, preferably one)* | This course is designed to introduce the physics of living systems and provide interpretation of experimental observations of various biomedical systems. |
| **Course Description** | Students understand how physics principles functioning in living systems, starting at the molecular, via the cellular, to the organ and system levels. They develop the basic concept in medical physics. They learn the principles of physics related to medical imaging and radiation therapy. |
| **Method(s) of Instruction(s)** | Interactive lectures, simulations |

**COURSE CONTENT BY TOPIC**

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| **Module #1** | **Physics of Human Body:** Biomechanical Descriptions of the Human Body, Sound and Hearing, Pressure and Motion of Fluids, Heat and Temperature, Electricity and Magnetism in Human Body, Optics and the Eye |
| **Module #2** | **Structure of Macromolecules:** Atomic and Molecular forces and behavior of macromolecules, structure determination, Properties and Structure of Cell & Nucleic Acid, Theories and Models of Cell Membrane |
| **Module #3** | **Nervous System:** Electrical activity of nervous system, Huxley-Hodgkin model, Neurotransmitters, Action potential, Regulatory Processes in Visual Systems, Visual Defects and Refractive Anomalies, Myopia and Hypermetropia, EEG, EMG, EOG, NCV |
| **Module #4** | **Cardio-vascular System:** General Design, Main Functions and Circulation, Cardiac Pump. Mechanical Work of the Heart. Heart Chamber, Valves, and Sounds, Haemodynamics, Blood Flow and Volume Dynamics, Blood Pressure, ECG, Einthoven's Triangle, Heart Disorders, Pacemakers, Defibrillators |
| **Module #5** | **Aspects of Medical Imaging and Technology:** Principles of Operation, 2D Fourier Image, Resolution and Design Tradeoffs in Projection, Tomography, Ultrasound, PET and MRI |
| **Module #6** | **Radiobiology:** Use of Ionizing Radiation in Diagnosis and Therapy, Radiation Safety, Effects on Living Cells and Organisms, Radiopharmaceuticals, Radiotherapy, Radiation Dosimetry |
| **Actual contact hours**: Lecture: 3 hours per week; 36 hours per semester | |

**TEXTBOOK REQUIREMENT**

1. Medical Physics: John R. Cameron
2. Medical Physics and Biomedical Engineering: B.H Brown, R.H Smallwood, D.C. Barber, P.V Lawford, D.R Hose, Churchill Livingstone
3. Comprehensive Biomedical Physics: Anders Brahme

**ASSESSMENT STRATEGY AND GRADING SCHEME**

NSU's grading and performance evaluation policies will be followed in assigning your grade. Please note that all final grades are subject to departmental review and approval. A guideline of course assessment is as follows-

| Class Attendance | Assignments/Project | Quiz | Midterm | Final |
|---|---|---|---|---|
| 5% | 10% | 20% | 30% | 35% |

## MAPPING OF COURSE OUTCOMES

| CLO-# | Outcome Types | Bloom's Taxonomy level (C- Cognitive, A- Affective, P- Psychomotor) | Delivery Method | Assessment Tools | |
|---|---|---|---|---|---|
| **CLO#1** | Understand the physical principles of the functioning of different parts of human body. | C2, P2 | Lecture, Demonstration and Discussion | Quiz, Assignment | Midterm Exam |
| **CLO#2** | Explain basic atom, binding theory, and electron configuration and observe relationship to proteins and amino acids. | C2, P3 | Lecture, Demonstration and Discussion | Quiz, Assignment | |
| **CLO#3** | Describe the basics of nervous system and its electrical conduction properties and related measuring techniques. | C2, P2 | Lecture, Demonstration and Discussion | Quiz, Assignment | |
| **CLO#4** | Explain the basics of cardio-vascular system and its electrical interactions and related measuring techniques. | C2, P3 | Lecture, Demonstration and Discussion | Quiz, Assignment | Final Exam |
| **CLO#5** | Apply the physical principles in variety of biomedical imaging modalities. | C3, P3 | Lecture, Discussion | Quiz, Assignment | |
| **CLO#6** | Explain the physical principles behind radiation technology in healthcare, safety, and relevant applications. | C2, P2 | Lecture, Discussion | Quiz, Assignment | |