**Medical Physics**

**PHYS 460 Medical Physics (3 Credits)** *Pre-requisites: Electricity & Magnetism*

**Description**

Medical Physics is a course concerned with the application of physics in medicine, especially (but not exclusively) in radiation medicine; i.e., radiation therapy, medical imaging, and nuclear medicine. The Course aims at offering quality education in the applications of physics and technology in medicine to physicists and potential scientists of similar scientific disciplines, enabling them to participate in promoting health and research. Topics covered will include imaging metrics, ionizing radiations and radiation safety, radioactivity, radiation therapy, computed tomography, nuclear medicine, ultrasound, magnetic resonance imaging, biomedical nanomagnetics, etc.

**Course Objectives and Learning Outcomes**

* Develop a basic understanding of medical physics concepts
* Develop critical-thinking skills
* Learn to integrate and apply various physics concepts to a single medical problem

By the end of the course, students will be expected to be able to

* Describe an imaging system and its physical principles for each of the imaging modalities covered (x-ray, CT, NM, US, MRI)
* Identify the key factors that affect image quality and address these factors for the different imaging modalities.

**Reference Books**

1. Medical Imaging Physics, by W.R. Hendee and E.R. Ritenour, ISBN 0471382264
2. Physics of Radiology, A.B. Wolbarst, ISBN 0838557694
3. The Essential Physics of Medical Imaging, J.T. Bushberg, et al., ISBN 0683301187

**Course Evaluation**

|  |  |  |  |
| --- | --- | --- | --- |
| **Weightage** |  |  | **Total** |
| Assignments/Homework |  |  | **15** |
| Quizzes |  |  | **15** |
| Presentation |  |  | **10** |
| Mid Term Exam |  |  | **30** |
| Final Examination |  |  | **30** |
| **Total** |  |  | **100** |

**Course Contents**

1. Medical physics: Introduction, imaging principles, intensity, resolution, contrast
2. Electrocardiograph (ECG): Basic principle and operation
3. Medical physics of ultrasound: Therapy and diagnostics
4. Medical physics of X-rays: X-ray production and detection, attenuation, computed tomography (CT), therapy and diagnostics, risks and precautions
5. Nuclear medicine: Radioisotopes, PET, SPECT, therapy and diagnostics, radiobiology, dosimetry, risks and precautions
6. Nuclear magnetic resonance (NMR): Magnetic Moment, Magnetization, magnetic relaxation, Magnetic resonance imaging (MRI)
7. Magnetic particle imaging (MPI): An emerging technique
8. Biomaterials: Loadbearing applications, biocompatibility, nanomaterials, biomedical nano-magnetics for diagnostics and therapy, magnetic hyperthermia treatment of cancer, controlled drug delivery, theranostics.