



**CHRIST**  
COLLEGE (AUTONOMOUS)  
IRINJALAKUDA, KERALA  
Reaccredited by NAAC with 'A++' grade

## DEPARTMENT OF PHYSICS (UNAIDED)

Offers

### Certificate Course

# "BASICS OF BIOMEDICAL PHYSICS"

### Course Highlights

- Fundamentals of medical instrumentation
- Ultrasound and X- ray imaging
- Principles of NMR
- Laser in medicine
- Internship



**DURATION  
3 MONTHS**

Starts on January 18, 2024



 **Contact**

Prof.V P Anto : 7907132445  
Ms. Megha P S : 8137075480

**Basics of Biomedical Physics**

**Time : 1 hr**

**Max marks : 30**

**Section A: Short Answer Questions (2 marks each)**

*Answer any 5 questions from the following (5 x 2 = 10 marks)*

1. Define X-ray and explain its basic working principle.
2. What is the primary difference between ultrasound and X-ray imaging techniques?
3. What are the main types of radiation used in nuclear imaging?
4. Briefly explain the concept of ionizing and non-ionizing radiation with examples.
5. What is the role of a contrast agent in X-ray imaging?
6. What are the key safety precautions in the use of X-ray machines in medical settings?

**Section B: Long Answer Questions (5 marks each)**

*Answer any 2 questions from the following (2 x 5 = 10 marks)*

7. Describe the principle of operation of an ultrasound machine. Explain how sound waves are used to create images of internal body structures.
8. Discuss the working principle and applications of nuclear imaging techniques, such as PET and SPECT.
9. Explain how lasers are utilized in medical applications, including their use in surgery and diagnostic procedures.

**Section C: Descriptive and Analytical Questions (10 marks each)**

*Answer any 1 question from the following (1 x 10 = 10 marks)*

10. Analyze the role of X-ray imaging in diagnosing bone fractures. Include a discussion on image formation, the need for contrast agents, and the benefits and risks involved in using X-ray radiation.
11. Provide a detailed comparison of X-ray, ultrasound, and nuclear imaging in terms of their principles, applications, advantages, and limitations in medical diagnostics.

# Basics of Biomedical Physics - CPCC62

## Value Added Certificate Course

### Teacher Coordinator Report 2023-24

Number of students	31
Date of examination	24/04/2024
Total students who passed exam	31
Total course duration	30 Hrs.

#### Feedback analysis:

- ✓ Students provided valuable feedback on various aspects of the course, including the content, teaching methods, and overall experience. The practical components of the training were especially praised for their relevance to future research pursuits.
- ✓ Collaborative learning through teamwork during the sessions fostered greater engagement and interaction.
- ✓ All students (100%) reported enjoying the course, finding the classes both informative and engaging.
- ✓ There was a strong demand for similar courses that focus on practical and research-oriented skills. Students expressed interest in continuing to develop their knowledge and skills in biomedical physics.

Course

Dr. V. P Joseph, Professor, Department of Physics (Self)  
Ms. Megha P S, Assistant Professor, Department of Physics (SF)

Coordinators:

## **Summary Report: Certificate Course in Basics of Biomedical Physics**

The *Basics of Biomedical Physics* certificate course, launched by the Department of Physics self on January 18, 2024, aimed to introduce Physics students to the fundamental principles of physics applied to biomedical sciences. 31 students completed the course. The course covered essential topics, including medical imaging techniques (X-rays, MRI, CT scans), radiation physics, biomedical instrumentation, and biomechanics. Students learned the basic working principles of medical technologies, the role of physics in diagnostics and treatment, as well as safety measures in handling medical equipment.

By the end of the course, students were expected to have a solid understanding of how physics impacts healthcare, including an awareness of medical imaging processes, radiation safety, and the functioning of biomedical devices. The course successfully provided foundational knowledge, preparing students for potential careers in medical physics, biomedical engineering, or healthcare technology, while fostering a deeper appreciation for the interdisciplinary nature of modern medical sciences.

**Course Coordinators: : Prof. Dr. V. P Joseph, Professor, Department of Physics (Self)**

**Ms. Megha P S (Asst. Professor, Department of Physics (SF))**

**Certificate course**  
**BSc Physics(self) 2023 Admn**  
**BASICS OF BIOMEDICAL PHYSICS**

**Course Outcomes:**

CO1: Understand the fundamentals of medical instrumentation

CO2: Understand the principles of ultrasound and x-ray imaging

CO3: Understand the basic principles of NMR

CO4: Describe the applications of lasers in medicine

**UNIT 1 : Fundamentals of medical instrumentation**

Physiological systems of the body, sources of biomedical signals, basic medical instrumentation systems, performance, constraints and regulations, intelligent medical instrumentation systems. Origin of bioelectric signals, ECG, EEG, EMG.

(3 Hrs)

**UNIT 2 : Ultrasound and X ray medical imaging systems**

Ultrasonic Imaging-properties of ultrasound, modes of ultrasound transmission-pulsed, continuous, pulsed Doppler, ultrasound imaging, ultrasonic diagnosis, ultrasonic transducers. X-rays- Instrumentation for diagnostic X-rays, visualization of X-rays- flouroscopy, X-ray filters, Angiography. X-ray computed tomography – Computed tomography, basic principle, contrast scale, system components-scanning system, processing unit, viewing part, storage unit, Helical CT scanner

(4 Hrs)

**UNIT 3: Nuclear medical imaging systems**

Nuclear Medical imaging systems-radio isotopes in medical imaging systems, physics of radioactivity, uptake monitoring equipment, radioisotope rectilinear scanner, gamma camera, Emission computed tomography, Positron emission tomography (PET Scanner), Principles of NMR, Image reconstruction

techniques, Basic NMR components, Biological effects of NMR imaging, advantages of NMR imaging, MRI Scanning, Chemotherapy

(4 Hrs)

#### **UNIT 4 : Lasers in medicine**

Special properties of laser beam (coherence, collimation, monochromaticity), laser active medium, focal length of the laser lens, Laser-tissue interactions, Basic principles of Nd-YAG, CO<sub>2</sub>, and Argon Lasers, An overview of their clinical applications with special reference to Gynecology, pulmonary, neurosurgery, dermatology, ophthalmology. Photodynamic therapy, Laser safety measures.

(4 Hrs)

#### **Practicals & Internship (15 Hrs)**

Familiarization of X ray , Ultrasonic scanning , NMR, CT, ECG, EMG , EEG machines at various hospitals or diagnostic centres

Introduction to laser treatment at derma clinic

#### **Books of Study**

1. Biophysics: An Introduction“ by Rodney Cotterlie ,Wiley
2. Handbook of Biomedical Instrumentation”, R S Khandpur, Tata Mcgraw Hill
3. “Biomedical Instrumentation and measurement”, Leslie Cromwell, Prentice hall of India
4. Lasers in Medicine - An Introductory Guide, Gregory Absten, Springer Science Publications

18-01-2024  
Thursday Believe You Can and You're Halfway There 31-31



 **GPS Map Camera**

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18-01-2024  
Thursday } Believe You Can and You're Halfway There } Lm-31

CHRIST  
DEPARTMENT OF PHYSICS (UNAIDED)  
Presents  
Inauguration of Certificate Course  
'BASICS OF BIOMEDICAL PHYSICS'  
January 18, 2024  
3.00 pm  
Room No. SC 15  
Dr. Xavier Joseph  
( Vice Principal, Christ college )

 **GPS Map Camera**

Irinjalakuda, Kerala, India  
85VX+8R5, Irinjalakuda, Kerala 680121, India  
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# Certificate of Achievement



This certificate is proudly awarded to ABSAL K. A  
of B Sc. Physics 2023-2026 batch for successfully completing the certificate course  
in *Basics of Biomedical Physics* offered by the Department of Physics (Unaided),  
Christ College (Autonomous), Irinjalakuda with A grade.

Ms. Megha P S  
Course Coordinator

Prof. Dr. V P Joseph  
HOD  
Department of Physics (Unaided)