

Al Mustaqbal University  
College of Technology & Health Science  
Radiology Techniques Department

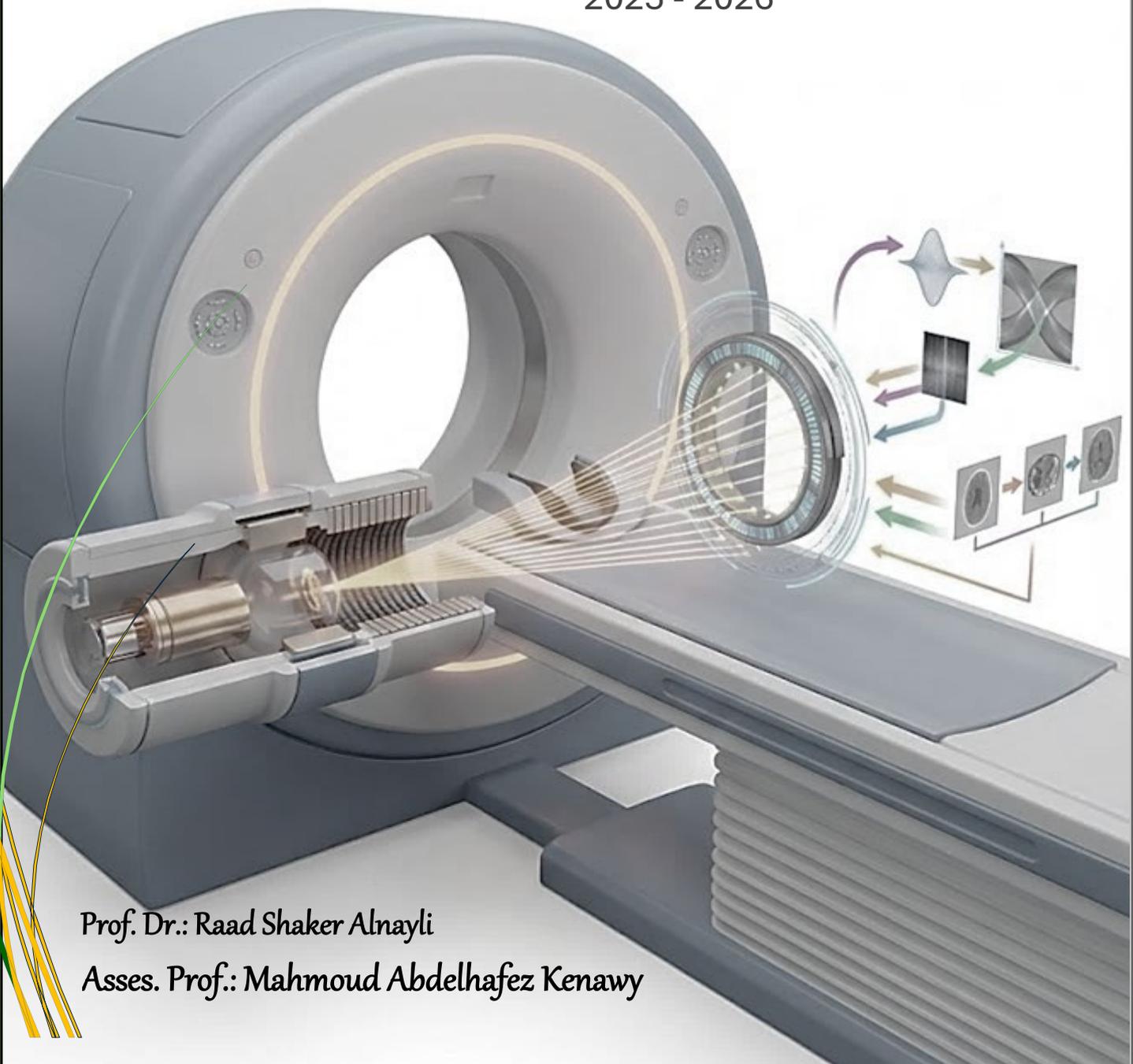


# Physics of CT

## The Second Stage

Second Semester – Lectures no. 3 & 4

2025 - 2026



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**Lecture information**

Lecture Number: 3 & 4

Lecture Title: Hardware and Physics of Computed Tomography (CT).

Topic: Components of the CT Scanner

Target Audience: Second-year students – Radiology Techniques Department

Suggested Duration: 90 Minutes Lecture + 30 Minutes Discussion

**OUTLINES:** we have two sections

➤ **Section 1: Main Parts of CT Scanner.**

❖ **The Gantry.**

- \* X-ray tube and its components.
- \* X- ray production.
- \* Detectors.
- \* Detection of X-ray.
- \* The milliamperere and kilovoltage generators.
- \* What is the effect of milliamperere and kilovoltage in X-ray production?
- \* The Slip Ring and what is its function?
- \* Collimators.
- \* X-ray filters (definition, important and their types in the CT machine)

❖ **Couch (CT Patient Table).**

- \* Couch Units.
- \* Couch Control Units.
- \* Velcro Patient Immobilisation Strap.

❖ **Data Acquisition System (DAS) (definition, function and its types).**

❖ **Image Reconstruction System (IRS) (definition, function and its types).**

❖ **Operating Console and Control Units and tools in it.**

➤ **Section 2 (Practical): Some important concepts within CT imaging.**

- ❖ X- Ray production factors (Kvp, mAs).
- ❖ Field of view (FOV).
- ❖ Rotation Time (RT).
- ❖ CT Pitch.
- ❖ Slice thickness and interval.
- ❖ Image windowing.
- ❖ Image filtering.
- ❖ Image resolution.
- ❖ The tree view of reconstructed images (Axial, Coronal & Sagittal).

➤ **Section 2 (Practical): Some important concepts within CT imaging.**

**Topic:** Technical Parameters and Image Visualization.

**Objective:** To understand how adjusting scanner parameters affects image quality, patient dose, and diagnostic capability.

### 1. X-Ray Production Factors (kVp & mAs)

The two primary settings that control the X-ray beam are **Kilovoltage Peak (kVp)** and **Milliampere-seconds (mAs)**. Think of these as the "Quality" and "Quantity" of the beam.

#### A. kVp (Kilovoltage Peak) - The "Quality"

- **Definition:** The peak voltage applied across the X-ray tube. It determines the **speed** and **energy** of the electrons hitting the target.
- **Function:** Controls the **Penetration** power of the beam.
- **Impact:**
  - **High kVp (120-140):** Used for dense areas (bone, large patients). It reduces beam hardening artifacts but lowers tissue contrast.
  - **Low kVp (80-100):** Used for pediatric patients or CT Angiography (to make the iodine contrast look brighter).

#### B. mAs (Milliampere-seconds) - The "Quantity"

- **Definition:** The product of the tube current (mA) and the scan time (s) per rotation.
- **Function:** Controls the **total number** of photons produced.
- **Impact:**
  - **Noise:** mAs is directly linked to image noise (graininess).
  - **↑ mAs = ↓ Noise:** A clearer, smoother image.
  - **↑ mAs = ↑ Dose:** The radiation dose increases linearly with mAs.

