

Medical Physics Course Syllabus

This course is designed to be delivered by the purchasing institute or clinic.

Included content

Waveguides

Direct acceleration, Series adding of electron energy, Waveguides, Phase velocity and guide wavelength, Wave impedance, Accelerating timing, Real accelerator structures, Standing wave and traveling wave accelerating waveguides, Energy switches.

Learning objective: Understand the accelerating waveguide and its mode of operation

Electron Beams

Electron path through the medical linac, Gun emission, Electron energy gain, Bending magnet.

Learning objective: Understand the electron source and how it is controlled

Photon Beams

Classical theory of bremsstrahlung, Quantum mechanical theory of bremsstrahlung, Energy dependence of angular photon distribution, Thin and thick targets, Thick target spectrum, Beam quality specification, Bremsstrahlung directional dependence, Bremsstrahlung production efficiency, Bremsstrahlung in Simulator, Results of bremsstrahlung calculations in Simulator, Beam flattening, Energy dependence of beam flattening and beam flatness, Beam symmetry.

Learning objective: Understand the photon source and how it is controlled

Medical Linac Configuration

Medical linac configuration, treatment head configuration, Linac mode configuration.

Learning objective: Understand the major components in a linear accelerator and how they work together

Beam Steering

Beam symmetry, The Elekta beam steering system.

Learning objective: Understand beam steering

Beam Dosimetry & PRF

Ion chambers in medical linacs, Ion chamber current collection, Linac calibration, Dose rate control, Dose rate servo.

Learning objective: Understand beam dosimetry and how it is confirmed

Klystrons

Microwave power sources for medical linear accelerators, Klystron overview, Description of the klystron's mode of operation, Bunching process, Klystron saturation, Klystron modeling, Magnetic focusing, Klystron construction

Learning objective: Understand RF creation in a klystron machine

Magnetrons

Mode of oscillation, Magnetron anode and RF, Resonant modes, Mode separation, Magnetron cathode, Bunch formation in rotational motion, Output coupler and frequency tuning, Magnetron operating values

Learning objective: Understand RF creation in a magnetron machine

Modulators

Resonant charging, Pulse forming network (PFN), Thyatron switch, PFN discharge, Pulse transformer, Pulse noise

Learning objective: Understand linac power supply and pulse creation in a linac to achieve RF levels required

Waveforms

Pulse timing in a medical linear accelerator, Pulsed nature of the linear accelerator, Relationship between gun injection, reflected RF power, and beam output.

Learning objective: Understand timing aspects of a linac in order to accelerate electrons efficiently

Heat management

Sources of heat in medical linacs, Water cooling, Cooling circuits for two accelerator configurations, accelerator temperature control.

Learning objective: Understand heat management techniques used in linacs

AFC

Principles of an automatic frequency control system, AFC systems for linear accelerator frequency control, AFC components.

Learning objective: Understand linac AFC systems

Labs included

- Beam loading
- Bending Magnet
- Beam Finding
- Flattening Filters
- Beam Steering

- RF Driver
- Klystron Pulse Voltage

Other elements

- Quizzes for each section
- Simulator access