Beginner Medical Linac Service Technician Course

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Medical Linac Service Technician Beginner

1. About the Course

   The beginner medical linac service technician is an on-line training module where students will learn basic principles of medical linear accelerators and cancer centers operations. It is a self-paced course with email access to an instructor. It consists of readings, videos and on-line labs. Students will familiarize themselves with the course materials over a six-week period.

2. Course Description

   Module 1 (1 weeks online):
   The student will review descriptions of the components used in a medical linear accelerator, be shown the differences between the two principal manufacturers, and discover how each component contributes to the creation of a high energy radiation beam that is used in cancer treatment. The students will also be exposed to other components within the medical linear accelerator that are needed to orient the radiation beam about the patient.

   Module 2 (3 weeks online):
   Students will review how the basic medical linac components interact with each other to produce a high energy radiation beam. The students will use a simulator environment which demonstrates how the configuration of each device contributes to the overall x-ray beam generation.

   Module 3 (2 weeks online):
   Students will be exposed to the cancer center environment, the role of radiation in cancer treatment, the roles of the service technician and other professionals in the cancer center, and other professional practice considerations to the role of medical linear accelerator service technician.

3. Learning Objectives

   Module 1:
   At the completion of module 1, students will identify the major components that are used in medical linear accelerators, and differentiate between those needed for electron beam acceleration, photon beam generation, and orienting the radiation beam about the patient.

   Module 2:
   At the completion of module 2, students will use a basic simulation program to explore different configurations of the medical linear accelerator. The student will configure operating parameters of major linear accelerator components and view their effect on the radiation beam properties.

Module 3:
At the completion of module 3, students have been exposed to the key job roles in a cancer center and the relationship to the medical linac service technician. A typical management structure of a cancer center is demonstrated; as well, students will be aware of the major safety hazards involved in servicing medical linear accelerators, and will interpret ethical requirements when working with patients and other medical professionals.

4. Course Outline

Module 1

Week 1 Topics and Assignments

For each topic, there is an overview component, and an advanced component.

Topics: Medical linac components

A. Electron Gun
B. Accelerator Waveguide
C. Bending Magnet
D. Target
E. Carousel
F. Flattening Filters
G. Beam monitoring Chambers
H. Collimator and MLC
I. Klystron and Magnetron RF sources
J. High Voltage Modulator
K. Cooling and pneumatic systems
L. Gantry
M. kV and MV imaging systems

Assignments: Review and interpret the components overview and advanced components course sections.

Assessment: Successfully complete the multiple-choice quiz for the advanced components with a pass rate of X% for each.

Module 2

Week 2, 3 & 4 Topics and Assignments

Topics: Medical linac system

A. RF driver and klystron saturation
B. Klystron pulse voltage and beam peaking

C. Beam loading
D. Bending magnet
E. Flattening filter
F. Beam finding
G. Beam steering

Assignments: Review two videos for each lab. Read lab requirements of each lab and complete all seven labs, and complete the multiple choice quiz for each lab.

Assessment: Complete Long-answer tests at the end of the module. Complete one for each topic (seven in total).

Module 3

Week 5 & 6 Topics and Assignments

Topics: Professional practice of medical linac servicing

A. Service engineer practice in the radiotherapy clinic
B. Management structure for health care institutions
C. Radiation Safety in medical linac servicing
D. Hazards when servicing medical linear accelerators
E. Professional Ethics
F. Patient privacy
G. Studies of major linear incidents
H. Professional practice considerations
I. Maintenance of competence

Assignment: Review and interpret the required content.

Assessment: Successfully complete multiple-choice quizzes for each section (seven in total) with a pass rate of X% for each quiz.

5. Additional Resources List

- Part 1 has online reading material as well as two video lectures, accessible through the web portal.
- Part 2 has two video lectures per topic, for a total of 14 video lectures, accessible through the web portal.
- Part 2 includes the Simac version 1 linac system simulator.
- Part 3 has online reading material, accessible through the web portal.
- Student resources in the student learning portal include a platform guide, Simac guide, and a course progress indicator.

Beginner Linac Service Course Syllabus

Chapter 1&2: Linac Components

- *-Video Lesson*
- *-Major Manufacturers*
- *-Linac Components*
- *-Electron Gun*
- *-Waveguides*
- *-Bending Magnet*
- *-Target*
- *-Carousel*
- *-Flattening Filters*
- *-Ion Chamber*
- *-Collimator*
- *-MLCs*
- *-Klystrons & Magnetrons*
- *-Modulator*
- *-Water Cooling*
- *-Pneumatic Systems*

Chapter 3: RF Driver

Chapter 4: Energy Correction with Bending Magnet

Chapter 5: Adjusting the Klystron Pulse Voltage

Chapter 6: Beam Loading

Chapter 7: Beam Finding

Chapter 8: Beam Symmetry

Chapter 9: Flattening Filters

SIMAC Labs

SIMAC Lab 1:

-Beam Loading
-Energy Correction with Bending Magnet
-Flattening Filters
-Beam Steering Part 1
-Beam Steering Part 2
-Adjusting the RF Driver
-Adjusting the Klystron Pulse Voltage
-Beam Finding

Professional Practice Module

Chapter 1: Introduction to Radiotherapy in Canada

-Medical Linac Service technician job requirements

Chapter 2: Role of Radiation in Cancer

-Radiotherapy Clinic Structure
-Roles in Radiotherapy
-Radiotherapy process, scheduling, and time course

Chapter 3: Health Care Institutions Governance and Leadership

-Health Care Staff types
-Budgets and financial accounts
-Health care leadership

Chapter 4: The legal framework for Class II service technicians

-Canadian Nuclear Safety Legal and regulatory overview for medical linear accelerators
-Occupational Health and Safety regulatory overview for medical linear accelerators

Chapter 5: Radiation Safety for Class II service technicians

-Radiation Safety Principles
-Radiation protection for medical linac servicing

Chapter 6: Hazards when servicing medical linear accelerators

-General safety conditions
-RF/microwave hazards
-Hazardous materials
-Mechanical hazards
-Electrical hazards
-Personal Protective Equipment

Chapter 7: Linear Accelerator Repairs and Return to Service

-Return to service process
-Instruments for linear accelerator quality assurance work
-Quality Assurance Protocols
-Frequency of quality assurance testing

Chapter 8: Professional practice for the linac service technician

-Medical and Professional Ethics
-Ethics and Law
-Duty to the public and environment
-Duty to the employer
-Patient Privacy
-Case Studies

Chapter 9: Maintenance of competence

-Maintenance of competence as an ethical obligation
-Membership in a provincial association for technologists
-Types of continuing education
-Sources of continuing education
-Keeping records of continuing education and continuing education plan