RADIATION ONCOLOGY RESIDENCY PROGRAM
Competency Evaluation of Resident

Resident's Name:	
Rotation:	Clinical Rotation 4
Inclusive dates of rotation:	
Director or Associate Director:	

Competency Assessment Scheme:

1. Unsatisfactory
    - Performance/Knowledge is below standard
2. Needs Improvement
    - Performance/Knowledge is below standards in certain areas and improvement is needed
3. Meets Expectations
    - Performance/knowledge that consistently meets high standards of competency
4. Above Expectations
    - Performance/Knowledge exceeds expectations
    - Performance/Knowledge is consistently high quality
5. Outstanding
    - Performance/Knowledge is exceptional and consistently superior

Evaluation criteria	Competency (from 1 – 5)	Explanatory Notes & Mentor Signature
Computed Tomography (CT) Simulators - General		
a. Demonstrates understanding of the nuances of CT simulators with those of diagnostic CT scanners (e.g., in terms of lasers, table top indexing, localization software, bore size)		
b. Demonstrates an understanding of the theory of CT imaging reconstruction and of the operation of a CT simulator		
c. Demonstrates an understanding of the major subsystems and components of a CT simulator		
d. Demonstrates an understanding of the room shielding and other radiation protection requirements of a CT simulator		
Computed Tomography (CT) Simulators - Selection		

a. Reviews the steps required to select a new CT simulator, including performance specification and feature comparison		
b. Reviews and understands the mechanical/architectural considerations relevant to installing a new CT simulator in both new and existing rooms		
Computed Tomography (CT) Simulators – Acceptance Testing & Quality Control		
a. Demonstrates an understanding of the mechanical tests performed during a CT simulator acceptance procedure		
b. Demonstrates an understanding of the tests of image quality and characteristics for a CT image and DRR for a CT simulator		
c. Demonstrates an understanding of the measurement of dose and the computed tomography dose index (CTDI) from a CT simulator for different body sites		
d. Demonstrates an understanding of the measurement of CT number as opposed to density calibration with kVp and CT number used in treatment planning systems		
e. Demonstrates an understanding of the alignment of internal and external laser systems in a CT simulator		
f. Demonstrates an understanding of network connectivity tests between other systems used in the radiation oncology process (e.g., treatment planning systems, treatment verification systems, PAC system)		
g. Demonstrates an understanding of the validation tests related to the transfer of CT-imaged objects to treatment planning systems		
Computed Tomography (CT) Simulators – Radiation Safety		
a. Demonstrates an understanding of state/provincial licensing of x-ray producing devices		
b. Explains the principles behind a radiation protection program, including the rationale for the dose limits for radiation workers and members of the public		
c. Describes the key parameters necessary to perform a shielding calculation		
d. Describes the significance of an isodose distribution plot for a CT simulator		

e. Demonstrates an understanding of structural shielding designs for a CT simulator and performs a shielding calculation (walls, ceilings, floor, and control area)		
f. Demonstrates an understanding of film processing and darkroom design		
Computed Tomography (CT) Simulators – Dose Calculations		
a. Understands the physical basis for the use of CT-simulator images in treatment planning as the current standard for dose calculations		
b. Understands the calibration of these CT-simulator images for computing radiation dose deposition in different tissues		
Computed Tomography (CT) Simulators – Quality Assurance		
a. Competently performs routine QA test processes for CT simulators and understands the QA test processes relationship to acceptance testing and commissioning measurements		
b. Understands the bases of recommended measurements for CT-simulators and the measurements tolerances specified by the AAPM, ACR, and other professional bodies		
c. Understands and competently determines the geometric accuracy of laser alignment, couch motion, gantry motion, and CT-simulator images for both static and moving objects		
d. Understands and competently assesses the quality of images produced by CT-simulators in any mode of operation and image reconstruction, and is able to discuss the impact of image artifacts and distortion on treatment planning		
e. Understands the connectivity requirements of a CT simulator to other computer systems that form part of a modern radiation therapy treatment process, including being familiar with Internet and DICOM-RT image data transfer protocols		
Computed Tomography (CT) Simulators – CT Protocols		
a. Demonstrates an understanding of the following parameters, their typical values, and how they are combined in CT protocols: slice thickness, pitch, kV, mAs, FOV, and scan length		

b. Demonstrates an understanding of how CT protocols consider multi-slice capabilities, tube heating, and maximum scan time		
c. Demonstrates an understanding of the relationship between image quality and patient dose from examination		
d. Demonstrates an understanding of the need to define dose-optimized imaging protocols for various body parts and sizes of patient		
e. Demonstrates an understanding of image artifacts that may arise in CT images, while being able to identify their causes and assess or mitigate their impact on radiation treatment planning		
f. Understands the different imaging protocols used in tumor motion management (e.g., voluntary breath hold, active breathing control, shallow breathing by compression, free breathing helical CT, 4D-CT)		
g. Understands the different CT image acquisition modes available with a modern CT simulator (e.g., prospective, retrospective, cine, helical, 4D, and image sorting based on breathing phase and breathing amplitude)		
Intensity-modulated Radiation Therapy (IMRT) - 1: Review of Inverse Planning		
a. Demonstrates understanding of the use of objective functions for IMRT optimization		
b. Understands the optimization processes involved in inverse planning		
c. Performs inverse planning optimization for a variety of treatment sites in sufficient number to become proficient in the optimization process		
d. Understands commonly used planning procedures and guidelines as well as optimization and dose calculation algorithms		
IMRT/VMAT - Planning		
a. Principles of IMRT/VMAT: The Resident will be familiar with the various commercially available systems for planning and delivery of IMRT/VMAT		
b. Theory of inverse planning: The Resident will learn how the clinical planning system optimizes a treatment plan. He/she will be familiar with the inputs to the cost function, how it is		

calculated, and be familiar with the interplay between sometimes competing objectives		
c. Special contouring techniques for IMRT/VMAT: The Resident will be able to convert “clinical” contours into inputs suitable for optimization. Target volumes are made unique and sometimes subdivided for various goals. Non-anatomical volumes are added to the patient anatomy, and margins are added to normal tissues		
d. Dose calculation and plan evaluation: The Resident will learn how the planning system calculates dose distributions from optimal fluence maps. He/she will evaluate treatment plans with respect to dose heterogeneity, plan complexity, and susceptibility to setup variations		
e. Practical training: The Resident will plan a number of practice cases under the guidance of a physics mentor (a prostate and a head & neck) and then move to dosimetry to plan/observe a number of live patient cases. The live cases will also involve the development of verification plans, documentation, and import to the record and verify system:		
i. Practice cases: two prostate, two head & neck ii. Live cases: two prostates, two head & neck		
Intensity-modulated Radiation Therapy (IMRT) - 2: IMRT and VMAT Delivery		
a. Understands various IMRT delivery techniques (e.g., compensators, static field IMRT, rotational delivery techniques) and their relative advantages and disadvantages		
b. Describes the differences between dynamic multileaf collimator (DMLC) and segmental multileaf collimator (SMLC) leaf sequencing algorithms in terms of delivery parameters and dose distributions		
c. Participates in IMRT or VMAT delivery for patients with a variety of treatment sites and understands the techniques and requirements for patient setup, immobilization, and localization		
Intensity-modulated Radiation Therapy (IMRT) - 3: IMRT and VMAT Quality Assurance		

a. Demonstrates an understanding of the appropriate level of quality control tests for IMRT/VMAT		
b. Demonstrates an understanding of commonly used QA procedures and guidelines, delivery and dosimetry equipment, and QA analysis techniques		
c. Calculates verification plans within the treatment planning system along with independent checks using secondary MU calculation software		
d. Performs IMRT/VMAT delivery QA measurements using 2D/3D array, film, or ion chamber techniques, an activity that includes analysis of results and determination of passing criteria (which will involve familiarity with the concept of gamma analysis)		
e. Performs and analyzes MLC QA measurements designed for accelerators used for IMRT/VMAT		
f. Reviews individual patient-specific QA results with staff physicists and physicians		
IMRT/VMAT QA – 3: Advanced		
a. IMRT/VMAT QA overview: The Resident will be able to describe the elements of systemic and patient-specific IMRT/VMAT QA. He will be able to indicate which features of an IMRT/VMAT plan must be validated before treatment and how they are tested within the clinic's QA program		
b. IMRT/VMAT QA techniques: The Resident will become proficient in each of the IMRT/VMAT QA systems used in the clinic and will be able to describe the strengths and weaknesses of each technique. He/she will be able to cite the specific reason for each test, know its thresholds for passage or failure, and know how to proceed if a plan fails QA:		
i. Ion Chamber Measurements • Selection of dose measurement points • Delivering IMRT/VMAT plan to phantom		
ii. EPID Portal Dosimetry • Generation of portal dose images • Dosimetric calibration of EPID • Measuring portal dose images • Evaluation techniques (profiles, isodose, gamma)		
iii. MU calculation • When MU calculation is appropriate		

iv. Detector array (e.g., MapCHECK, ArcCHECK) • Strengths and weaknesses compared to film and EPID		
c. Practical Experience: Resident will spend at least 2 weeks functioning as an IMRT/VMAT QA physicist, practicing all aspects of routine IMRT/VMAT QA		
Intensity-modulated Radiation Therapy (IMRT) - 4: Radiation Safety		
a. Understands IMRT delivery's effects on leakage radiation and its potential effects on patients and personnel exposure		
b. Understands the effects of different IMRT delivery techniques on the amount of leakage radiation produced		
c. Understands the effects of IMRT delivery on vault shielding requirements		