RADIATION ONCOLOGY RESIDENCY PROGRAM
Competency Evaluation of Resident

Resident's Name:	
Rotation:	PHYS 707: Clinical Rotation 4
Inclusive dates of rotation:	Feb. 26, 2016 – Aug. 25, 2016
Director or Associate Director:	

Evaluation criteria	**Not Competent**	**Marginally Competent**	**Fully Competent**	**Explanatory Notes & Mentor Signature**
Intensity-modulated Radiation Therapy (IMRT) - 1: 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. Understands the appropriate level of quality control tests for IMRT & VMAT				
b. Understands 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				
Brachytherapy – General Aspects				
a. The Resident will be familiar with procedures, hardware, and isotopes used for the treatment of the most common anatomic sites treated with sealed-source radionuclide therapy				
b. The physical characteristics, assay, handling, licensing, and disposal (if				

applicable) of brachytherapy sources will be learned by the Resident				
c. The Resident must be able to quality assure the computer system used to generate information utilized to plan and treat patients with radionuclide sources				
d. The Resident should be able to show competence in physics and dosimetric services in support of the clinical use of sealed radionuclide sources in the treatment of the following. If a case does not occur or is now extremely uncommon, the Resident should perform a mock treatment; or the requirement may be waived at the discretion of the Rotation Supervisor: • Biliary duct: intraluminal • Eye plaque • Permanent lung implants: planar • Permanent prostate seed implants: volume interstitial				
e. The Resident should be able to show competence in physics and dosimetric services in support of the HDR clinical treatments of the following. If a case does not occur or is now extremely uncommon, then the Resident should perform a mock treatment; or the requirement may be waived at the discretion of the Rotation Supervisor: • Vaginal cylinder HDR. • Tandem and Ring – Fletcher Suit – HDR. • Interstitial HDR. • Planar intraoperative HDR (IOHDR)				
f. The Resident should observe and actively participate in as many brachytherapy cases as reasonably possible such that they gain sufficient experience and confidence to do the case themselves. Because some cases do not occur very often, the Resident is expected to place a higher priority on the attendance of brachytherapy cases				
g. The Resident should be able to perform all aspects of the LDR and HDR QA independently (although the Resident will not be asked to do so if it is not within regulations). The Resident should participate in a				

minimum of two source exchanges				
h. The Resident will be familiar with federal, state, and local regulatory documents related to sealed-source therapy				
i. The Resident will learn and generate two mock treatment plans for an LDR and HDR case				
Brachytherapy - 1: Sealed Radionuclides Sources				
a. Demonstrates an understanding of how commonly used sources are generated				
b. Describes the decay, decay energies (mean energy), and half-lives of commonly used sources				
c. Describes the form and construction of sealed sources				
d. Describes and defines the different units of source strength that have been used in the past and the present				
e. Performs an example decay calculation of the total dose delivered for temporary and permanent implants				
f. Describes personal protection techniques (involving time, distance, and shielding) and safe handling of sealed sources				
g. Describes the appropriate methods of storing radioactive material (with regard to security and accountability)				
h. Performs routine receipt procedures and both checks into inventory and checks out temporary and permanent sources				
i. Performs a source room survey and a quarterly inventory				
j. Describes and, if possible, performs leak checks on sealed sources				
k. Demonstrates an understanding and gains hands-on experience of radioactive material packaging and transportation requirements, e.g., Title 49 of the U.S. Code of Federal Regulations (CFR)				

l. Demonstrates an understanding of the equipment used to calibrate sealed sources				
m. Describes the process by which sealed sources are calibrated				
n. Describes the process by which measurement equipment (e.g., electrometers, well ionization chambers) is calibrated				
o. Explains the theory of operation of a well ionization chamber				
p. Describes and performs an assay for sealed sources				
q. Demonstrates an understanding of licensing issues and requirements (e.g., NUREG 1556)				
r. Describes the operation and appropriateness of different survey instruments (e.g., Geiger–Müller counters, ionization survey meters, scintillation counters)				
s. Demonstrates an understanding of the regulatory requirements pertaining to sealed sources, e.g., state or federal regulations such as Title 10 of the U.S. CFR Part 35 (10CFR35)				
Brachytherapy - 2: Unsealed Radionuclides Sources				
a. Demonstrates an understanding of how commonly used radiopharmaceuticals (e.g., I-131, P-32, Sm-153, Sr-89) are generated				
b. Demonstrates an understanding of the decay, decay energies (mean energy), and half- lives of commonly used radiopharmaceuticals				
c. Describes personal protection techniques (involving time, distance, and shielding) and safe handling of unsealed sources				
d. Describes the process by which unsealed sources are calibrated				
e. Describes the process by which measurement equipment (e.g., dose calibrator) is calibrated				
f. Describes and, if possible, performs an assay for unsealed sources				

g. Demonstrates an understanding of licensing issues and requirements (e.g., NUREG 1556)				
h. Describes the operation and appropriateness of different survey instruments (e.g. Geiger–Müller counters, ionization chambers, scintillation counters)				
i. Demonstrates an understanding of the regulatory requirements for unsealed sources, e.g., state/provincial or federal regulations such as 10 CFR 35				
Brachytherapy - 3: Radiation Protection				
a. Demonstrates an understanding of shielding calculations for primary and secondary barriers (e.g., NCRP 151)				
b. Describes the key parameters necessary to perform a shielding calculation				
c. Describes or performs a shielding calculation for a brachytherapy vault				
d. Describes or performs a radiation survey for a brachytherapy vault				
e. Describes requirements for personal radiation safety badges				
f. Describes labeling, shipping, and receiving requirements for radioactive material				
g. Describes management of an isotope inventory				
h. Describes release criteria for radioactive patients (i.e., patients with temporary or permanent implants and radiopharmaceuticals)				
i. Describes how to handle changes in medical status for radioactive patients (i.e., in cases of medical emergency or death, as per NCRP 155)				
j. Explains the key concepts of state/provincial or federal regulations (e.g., Title 10 of CFR parts 19, 20, and 35)				
k. Demonstrates how to safely operate a remote afterloader unit, including emergency procedures				

Brachytherapy - 4: Clinical Applications				
a. Describes the various brachytherapy sources that have been used clinically in the past and which are used today, as well as the rationale for source selection				
b. Describes how a brachytherapy program is developed				
c. Describes in detail the use and operation of the following different brachytherapy modalities and their advantages and disadvantages: i. Low dose rate (LDR) ii. High dose rate (HDR) iii. Pulsed dose rate (PDR; optional) iv. Electronic (optional)				
d. Describes and performs verifications of source strength (air kerma rate, S_k) and comparisons between measured and vendor's specifications				
e. Describes radiation protection for radiation workers and visitors				
f. Demonstrates an understanding of commissioning and acceptance of remote after- loaders (RALs)				
g. Demonstrates an understanding of gynecologic (GYN) and genitourinary anatomy				
h. Demonstrates an understanding of the treatment of cervical and endometrial cancers with LDR, HDR, and PDR (optional)				
i. Demonstrates an understanding of prostate cancer and its treatment with HDR and LDR				
j. Treatment planning i. Demonstrates an understanding of treatment planning commissioning ii. Performs brachytherapy treatment plans for a cylindrical GYN applicator iii. Performs brachytherapy treatment plans for cervical applicator (e.g., tandem and ovoids, tandem and ring) iv. Describes the differences between point- and volume-				

based treatment planning as per the ICRU 38 and the Groupe Européen de Curiethérapie (GEC) European Society for Radiotherapy and Oncology (ESTRO) recommendations v. Develops interstitial brachytherapy treatment plans (e.g., prostate cancer, GYN diseases, sarcoma) vi. Develops a brachytherapy treatment plan for an eye plaque (optional) vii. Performs an activity/dose calculation for microsphere therapy (optional)				
k. Demonstrates an understanding of applicator acceptance, commissioning, and the performance of periodic QA				
l. Demonstrates an understanding of and participates in/performs periodic spot checks, safety procedures, and source exchange QA, including source calibration				
m. Describes emergency training requirements for RALs (e.g., as specified in 10 CFR 35)				
n. Demonstrates an understanding of quality management programs as required by federal or state/provincial regulations for auditing				
o. Describes the criteria for recording/reporting and the subsequent handling of reportable events				
Brachytherapy - 4: Treatment Planning				
a. Demonstrates an understanding of the source strength of radioactive sources				
b. Describes dose rates and dose calculation formalisms for high-energy brachytherapy dosimetry (HEBD) and low-energy brachytherapy dosimetry (LEBD)				
c. Demonstrates an understanding of the performance of computerized planning of various imaging				

modalities of LDR and HDR				
d. Describes in detail the advantages and disadvantages of dose optimization				
e. Describes and performs secondary calculations as QA checks for computerized planning				
Brachytherapy - 5: Quality Assurance				
a. Demonstrates an understanding of and performs comprehensive periodic QA (daily, monthly, annually) of a remote afterloader				
b. Describes and performs periodic treatment planning QA				
c. Demonstrates an understanding of implant-specific QA				
Special Procedures - 1: Stereotactic Radiosurgery (SRS)				
a. Describes rationales for SRS treatments, examples of malignant and non- malignant lesions treated with SRS, and typical dose and fractionation schemes for linac-based and Co-60 SRS techniques				
b. Describes in general terms the components of commissioning an SRS sys- tem (e.g., accurate localization, mechanical precision, accurate and optimal dose distribution, and patient safety)				
c. Describes the stereotactic localization of a target (e.g., on the basis of angiography as opposed to CT and MRI) and how the accuracy of this localization is measured				
d. Describes the alignment of coordinate systems (e.g., target frame of reference with linac frame of reference) and how the mechanical precision of this alignment is measured				
e. Describes issues associated with dosimetry measurements for an SRS system (e.g., choice of dosimeter,				

phantom geometry, etc.)				
f. Describes the components of pre-treatment QA for an SRS system, including linac-based and Co-60 SRS techniques				
Special Procedures - 2: Stereotactic Body Radiation Therapy (SBRT)				
a. Explains the rationale for SBRT treatments, common treatment sites, and typical dose and fractionation schemes				
b. Describes immobilization and localization systems for SBRT treatments				
c. Describes the use of simulation imaging for SBRT target definition, including multi-modality imaging and 4D imaging for cases requiring motion management				
d. Describes treatment planning objectives for SBRT treatments, including dose limits, dose heterogeneity, dose gradient and fall-off, and beam geometry				
e. Describes treatment verification and delivery for SBRT treatments as well as use of in-room imaging				
f. Addresses the need for motion management in lung and abdomen SBRT treatments				
g. Describes treatment planning system validation tests, and in this context, tissue inhomogeneity corrections and small-field dosimetry measurements				