Module I Week I Quiz I  2002A: Introduction to PET/CT

9:00PM  Welcome/Syllabus Review

9:15PM  Pretest 2002A  30min.

9:30PM  TOPIC: Lecture: Historical Origins of Nuclear Medicine and PET:

Objectives:  30min.

1. Explain the origin of Positron Emission Tomography and the people who help make it happen.
2. List the benefits of PET/CT in the clinical practice of medicine.

10:00PM  TOPIC: Lecture: Nuclear Decay Mathematics:

Objectives:  60min.

1. Explain how to use the TI 30IIXS calculator for Nuclear Mathematics
2. Apply the calculator in solving radioactive decay equations.

11:00PM  Session completed
Module I Week I Quiz II

9:00PM  TOPIC: Quiz Review: *Radioactive Decay, Pre-Calibration, Post Calibration using the calculator*  

9:30PM  TOPIC: Lecture: *Background Radiation:*  
Objective: 90min.  
1. Discuss the major sources of ionizing radiation.  
2. Review the various radioisotopes found in the PET department.

11:00  Session Completed

Module I Week I Exam

9:00PM: TOPIC: Exam Reviewed

11:00PM  Session completed

Module I Week II Quiz I

9:00PM TOPIC: Quiz Review: *Atomic Structure, Nuclear Stability* 30 min. 

9:30PM TOPIC: Lecture: *Atomic Structure and Nuclear Stability*  
Objectives: 90 min.  
1. Describe the properties of electromagnetic and particulate radiations.  
2. Describe the structure of an atom, and its components and properties.

11:00PM  Session completed
Module I Week II Quiz II

9:00PM TOPIC: Quiz Review: **Alpha and Beta Decay**  
30min.

9:30PM TOPIC: Lecture: **Alpha and Beta Decay**

Objectives:  
1. List the nuclear families and state their characteristics.  
2. Write the correct form of radionuclide notation.

11:00 Session completed

Module I Week II Exam

9:00PM Exam Reviewed

11:00 Session completed

Module I Week III Quiz I

9:00PM TOPIC: Quiz Review: **Gamma Decay, Positron Decay and Electron Capture.**  
30min.

9:30PM TOPIC: Lecture: **Gamma Decay, Positron Decay and Electron Capture**

Objectives:  
1. Explain annihilation and resultant processes.  
2. Review isomeric transformation in gamma decay.

11:00PM Session completed
Module I Week III Quiz II

9:00PM TOPIC: Quiz Review: **Photon Interaction in Matter** 30min.

9:30PM TOPIC: Lecture: **Photon Interaction in Matter**

Objectives: 90min.

1. Describe the interactions of charged particles with matter.
2. Discuss the processes of excitation and ionization

11:00 Session completed

Module I Week III Exam

9:00PM Exam Reviewed

11:00 Session completed

Module I Week IV Quiz I

9:00PM TOPIC: Quiz Review: **Gaseous Detectors used in the PET Lab.** 30min.

9:30PM TOPIC: Lecture: **Gaseous Detectors used in the PET Lab.**

Objectives: 90min.

1. Describe the construction and operating principles of gas filled detectors, including ionization chambers, Geiger Mueller Detectors, and Dose Calibrators.
2. Discuss the Dose Calibrator applications.
3. Discuss the quality control of the GM Survey Meter.
4. Discuss Quality Control of the Dose Calibrator.

11:00PM Session completed.
Module I Week IV Quiz II

9:00PM TOPIC: Quiz Review: **Scintillation Detectors**

9:30PM TOPIC: Lecture: **Scintillation detectors used in nuclear medicine and PET.**

Objectives: 90min.

1. Explain the operations of scintillation detectors and photomultiplier tubes.
2. Discuss count rate limitations relative to dead time, efficiency, geometry and attenuation.
3. Discuss the basic design and properties of various PET Scanners.
4. Explain the function of key components.

11:00PM Session completed

Module I Week IV Exam

9:00 TOPIC: Exam Reviewed and Post-Test

11:00 Session Completed

Module II Week I Quiz I  2002B: Radiobiology and Radiation Safety

9:00PM TOPIC: **Syllabus Review/Pre-Test**

Objective: 30min.

1. Review the syllabus to Radiation Safety and Radiobiology.
2. Complete Pre-Test for 2002B

9:30PM TOPIC: Lecture: **The History of Radiobiology**

Objectives: 90min.
1. Discuss the Law of Bergonie and Tribondeau
2. Review Fractionation Theory
3. Discuss Mutagenesis effects of radiation exposure.
4. Discuss the Effects of Oxygen as a radio-sensitizer.
5. Discuss the Law of Bergonie and Tribondeau
6. Discuss Fractionation Theory
7. Discuss Effects of Radiation on Reproductive Failure

11:00PM Session completed

**Module II Week I Quiz II**

9:00PM: TOPIC: Quiz Review: *History of Radiobiology, Cellular Anatomy and Physiology.* 30min.

9:30PM TOPIC: Lecture: *Cellular Anatomy and Physiology*

Objectives: 90min.

1. Indicate parts of the cell
2. Identify organic compounds and their functions
3. Identify inorganic compounds and their functions
4. Explain Mitosis
5. Explain Meiosis

11:00PM Session completed

**Module II Week I Exam**

9:00PM TOPIC: Exam Reviewed

11:00PM Session completed
Module II Week II Quiz I

9:00PM TOPIC: Quiz Review: *Cellular Effects of Radiation* 30min.

9:30PM TOPIC: Lecture: *Cellular Effects of Radiation*

Objectives: 90min.

1. Inspect the direct and indirect effects of radiation.
2. Evaluate the radiolysis of water.
3. Analyze the types of dose-response relationships.
4. Discuss target theory.
5. Explain Cell survival curves.

11:00PM Session completed

Module II Week II Quiz II

9:00PM TOPIC: Quiz Review: *Effects of Initial Exposure to Radiation.* 30min.

9:30PM: TOPIC: Lecture: *Effects of Initial Exposure to Radiation.*

Objectives: 90min.

1. Discuss the hematological, gastrointestinal, and central nervous system syndromes.
2. Describe the local tissue damage to the skin, eyes and gonads.
3. Explain hematologic and cytogenetic effects.

11:00PM Session completed

Module II Week II Exam

9:00PM TOPIC: Exam Reviewed

11:00 Session completed
Module II Week III Quiz I

9:00PM TOPIC: Quiz Review: **Effects of Long-Term Exposure to Radiation**  30min.

9:30PM: TOPIC: **Effects of Long-Term Exposure to Radiation.**

Objectives:  90min.

1. Discuss epidemiology.
2. Examine Risk Estimation Models.
3. Examine Radiation Induced malignancies.
4. Identify life span shortening.
5. Discuss genetic damage.
6. Explain irradiation of the fetus.
7. Analyze stochastic and non-stochastic effects.

11:00PM Session completed

Module II Week III Quiz II

9:00PM TOPIC: Quiz Review: **Protection of Personnel**  30min.

9:30PM TOPIC: Lecture: **Protection of Personnel**

Objectives:  90min.

1. Discuss the rationale for radiation protection.
2. Explain personnel dosimeters, dosimetry reports, and duties of the RSO.
3. Define and calculate the dose-limiting recommendations for PET/CT personnel.
4. Explain the basic structural shielding construction and list the items that influence this construction.
5. Describe how the PET/CT Technologist can decrease their radiation exposure during the patient preparation and scanning sequences.
6. Discuss how using distance can decrease radiation exposure.
7. Illustrate the Inverse Square Law.
8. Identify garments that can be worn to reduce radiation exposure and explain how each garment should be used.

11:00PM Session completed

**Module II Week III Exam**

9:00PM TOPIC: Exam Reviewed

11:00PM Session completed

**Module II Week IV Quiz I**

9:00PM TOPIC: Quiz Review: **Measuring Patient Dose from Computerized Tomography Scanners.** 30min.

9:30PM TOPIC: Lecture: **Measuring Patient Dose from Computed Tomography Scanners.**

Objectives: 90min.

1. Discuss CT Scanner X-Ray Beam Geometry
2. Explain Methods of Measuring Patient Dose.
3. Describe Multiple Scan Average Dose curves.
4. Define CT Dose Index.
5. Measuring the CT Dose Index.
6. Discuss Spiral/Helical CT Scanner Dosimetry.
7. Explain methods for reducing the patient dose from the CT Scanner.
8. Illustrate dosimetry survey of CT Scanners.

11:00PM Session completed
Module II Week IV Quiz II

9:00PM TOPIC: Quiz Review: Radiation Safety in PET Imaging 30min.

9:30PM: TOPIC: Lecture: Radiation Safety in PET Imaging

Objectives: 90min.

1. Review cautions signs and labels.
2. Discuss the Do’s and Don’ts in PET Radiation protection.
3. Examine the Receiving and Monitoring of Radioactive packages.
4. Discuss Radioactive waste disposal.
5. Explain how to clean up a radioactive spill.
6. Discuss recordkeeping principles.

11:00PM Session completed

Module II Week IV Exam

9:00PM TOPIC: Exam Reviewed / Post Test

11:00 Session completed

Module III Week I Quiz I_2002C: Instrumentation

9:00PM TOPIC: Syllabus Review/ Pre-Test 30min.

9:30PM TOPIC: Lecture: CT Physics and Instrumentation.

Objectives: 90min.

1. Describe the physics of processes involved in the production of X-rays.
2. Describe the role of each component in the X-ray tube and its operation.
3. Discuss the proper adjustment of X-ray tube voltage and mA current settings in CT.
4. Name the principal parts of the CT Scanner.
5. Describe the function of each CT Scanner component.
6. Describe how a Helical CT scanner operates and the component changes that made this technology possible.

Module III Week I Quiz II

9:00PM TOPIC: Quiz Review: Overview of CT Physics and Instrumentation  30mi
9:30PM TOPIC: Lecture: Acquisition, Processing, and Display of CT Images.

Objectives: 90min.

1. Discuss how CT image data are acquired and processed.
2. Describe the calculation process of Hounsfield units.
3. Describe CT numbers values assigned to various tissues and how these values are assigned into meaningful display windowing.
4. List the parameters set by the operator for CT use and describe the effect of each on the images.

Module III Week I Exam

9:00PM Exam Reviewed

11:00PM Session completed

Module III Week II Quiz I

9:00PM TOPIC: Quiz Review: Overview of CT Quality Control Procedures  30min.
9:30PM TOPIC: Lecture: Overview of CT Quality Control Procedures

Objectives: 90min.

1. Identifying the quality control parameter for QC measurements.
2. Discussing the frequency of test requirements.
3. Examining the limits of a “Passing” Test.
4. Determining the Average CT Number of Water.
5. Evaluating the Standard Deviation of CT Number in Water.
6. Discussing High Contrast Resolution testing in CT.
8. Determining the Accuracy of Distance Measuring Device.
9. Recognizing the Distortion of Video monitors.
10. Discussing the Distortion of Film Images or Other Hard Copy Output
11. Determining the causes of a Flat CT Number.
13. Discuss the Accuracy of Localization Devices.
14. Discussing the quality control procedure for Bed Indexing.
15. Determination of Light Field Accuracy.
17. Discuss CT Number versus Patient Position.
18. Explain CT Number versus Patient Size.
19. Discuss CT Number versus Algorythm
20. Examine CT Number versus Slice Width
22. Recognize Radiation Scatter and leakage.

11:00 Session completed

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**Module III Week II Quiz II**

9:00PM TOPIC: Quiz Review: *An Overview of the Integration of CT Procedures into the combined PET/CT examination.*

30min.
9:30PM TOPIC: Lecture: **An Overview of the Integration of CT Procedures into the combined PET/CT examination**

Objectives: 90min.

1. Discuss the use of Oral and IV Contrast Agents.
2. Discuss the IV Pressure Injector for angiographic studies.
3. Evaluate the use of Timing Bolus’s.
4. Review contrast agents adverse reactions.

11:00PM Session completed

**Module III Week II Exam**

9:00 Exam Reviewed

11:00 Session completed

**Module III Week III Quiz I**

9:00PM TOPIC: Quiz Review: **PET Instrumentation** 30min.

9:30PM TOPIC: Lecture: **PET Instrumentation**

Objectives: 90 min.

1. List detector crystals that can be used for PET Imaging and describe their properties.
2. Explain the fundamental operation of dedicated and Hybrid PET Scanners and their design.
3. Describe the detection of True, Scatter, and random events.
5. Characterize the visual presentation of non-attenuated and attenuated corrected images.
Module III Week III Quiz II

9:00PM TOPIC: Quiz Review: Acquisition, Processing, and Display of PET Images.

30min.

9:30PM TOPIC: Lecture: Acquisition, Processing, and Display of PET Images.

Objectives: 90min.

1. Discuss 2D and 3D acquisition protocols.
2. Discuss scan protocol parameters.
4. Discuss Dynamic Acquisition modes.
5. Define SUV and explain how it is calculated and used.
6. Discuss critical elements in generating quantitative measurements.
7. Describe the process of data reconstruction.
8. Discuss the implications of image fusion and describe the PET/CT Scanner.

11:00PM Session completed.

Module III Week III Exam

9:00 Exam Reviewed

11:00 Session completed

Module III Week IV Quiz I

9:00PM: TOPIC: Quiz Review: An Overview of PET Quality Control Procedures.

30min.
9:30PM TOPIC: Lecture: **An Overview of PET Quality Control Procedures.**

Objectives: 90 min.

1. Discuss the daily quality control procedures performed on a Hybrid PET/CT Scanner.
2. Discuss the frequency of PET/CT Quality Control Procedures.
3. Analyze a typical Blank Scan.
4. Discuss Blank Scans.
5. Discuss Coincidence Timing Circuitry.
6. Review Singles.
7. Discuss Normalization
8. Discuss Well Counter Calibration.

11:00PM Session completed.

**Module III Week IV Quiz II**

9:00PM TOPIC: Quiz Review: **Troubleshooting Image Artifacts in PET/CT.** 30min.

9:30PM TOPIC: Lecture: **Troubleshooting Image Artifacts in PET/CT.**

Objectives: 90min.

1. Identify misregistration artifacts.
2. Review Patient Motion Artifacts.
3. Discuss Beam Hardening Artifacts.
4. Identify Contrast Material Artifacts.
5. Discuss Partial Volume Averaging Artifacts.
7. Analyze Metal Artifacts.
8. Identify Ring Artifacts.
Module III Week IV Exam

9:00 Exam Reviewed/ Post Test

11:00 Session completed

Module IV Week I Quiz I 2002D: PET/CT Methodology

9:00PM: TOPIC: Syllabus Review/ Pre Test  30min.

9:30PM  TOPIC: Lecture: Physics of Positrons and Production of PET Tracers.

Objectives:  90min.

1. Describe positron decay and the production of annihilation photons.
2. List positron emitting radionuclides and their properties.
3. Discuss Generator produced versus Cyclotron produced radionuclides.

11:00PM Session completed.

Module IV Week I Quiz II

9:00PM TOPIC: Quiz Review:  **PET Radiopharmacy and Quality Control**.  30min.

9:30PM TOPIC: Lecture: **PET Radiopharmacy Quality Control**  90min.

1. Discuss Radionuclidic Purity.
2. Discuss Radiochemical Purity.
3. Identify Chemical Impurities.
4. Discuss Microbiological Sterility Testing.
5. Discuss Pyrogen Testing.
6. Review the USP Quality Control requirements for F-18(FDG).

11:00PM Session completed.

**Module IV Week I Exam**

9:00 Exam Reviewed

11:00 Session completed

**Module IV Week II Quiz I**

9:00PM TOPIC: Quiz Review: **PET/CT Oncology**  
9:30PM TOPIC: Lecture: **PET/CT Oncology**

Objectives:  
1. Discuss the principles of PET/CT FDG Oncology imaging.
2. Recognize the normal bio-distribution of FDG and list the organs with intense, moderate, or mild FDG activity.
3. Discuss the normal patterns of head an neck FDG activity.
4. Discuss the benign causes of increase FDG activity.
5. Describe the variations in FDG bio-distribution caused by improper patient preparation.
6. Discuss the various cancers that localizes FDG.

11:00PM Session completed

**Module IV Week II Quiz II**
9:00PM TOPIC: Quiz Review: **PET/CT Oncology and Patient Preparation Procedures.** 30min.

9:30PM TOPIC: Lecture: **Preparing the Patient for a PET/CT Oncology Procedure.**

Objectives: 90 min.

1. Explain the steps in properly preparing a patient for a FDG PET Scan.
2. Discuss the significance of peripheral blood glucose levels in FDG Imaging.
3. List the necessary historical information that should be obtained from each patient.
4. Describe patient positioning and comfort issues that can hinder the acquisition of a high quality scan.
5. Review Indications and contraindications of the whole body scan.
6. Discuss PET/CT procedural parameters.
7. Review processing protocols.
8. Discuss Normal’s and Abnormal’s case studies.

11:00PM Session completed.

**Module IV Week II Exam**

9:00 Exam Reviewed

11:00 Session completed

**Module IV Week III Quiz I**

9:00PM TOPIC: Quiz Review: **PET/CT Neurology** 30min.

9:30PM TOPIC: Lecture: **PET/CT Neurology**

Objectives: 90min.

1. Discuss the radiopharmaceuticals used in Brain PET imaging.
2. Review the methods of localization of F-18(FDG) in Brain PET.
3. Discuss the Contraindications associated with Brain PET scans.
4. Discuss patient preparation for Brain scan.
5. Review the procedure for a Brain PET scan.
6. Discuss proper patient history for a Brain PET scan.

11:00PM Session completed

Module IV Week III Quiz II

9:00PM TOPIC: Quiz Review: Clinical Indications for Brain PET 30 min.
9:30PM TOPIC: Lecture: Clinical Indications for Brain PET 90min.

Objectives:

1. Review procedures for Cerebrovascular Disease.
2. Discuss Brain PET and Tumor imaging.
3. Review the procedures for diagnosing Epilepsy.
4. Discuss Brain PET and Parkinson’s Disease.
5. Discuss diagnosing Dementia with PET.
6. Review Normal’s and Abnormal case studies.

11:00PM Session completed

Module IV Week III Exam

9:00PM Exam Reviewed

11:00 Session completed

Module IV Week IV Quiz I

9:00PM TOPIC: Quiz Review: PET/CT Cardiology 30min.
9:30PM TOPIC: Lecture: **PET/CT Cardiology**

Objectives:

1. Discuss various radiopharmaceuticals used for cardiac perfusion and viability imaging.
2. Discuss the method of localization of the various radiopharmaceuticals.
3. Review the average patient doses.
4. Discuss the methods for administering the radiopharmaceuticals.
5. Discuss the Contraindications for cardiac PET.
6. Review the patient preparation procedures.
7. Discuss the procedure for performing cardiac PET.
8. Discuss pertinent patient histories associated with cardiac disease.

11:00PM Session completed

**Module IV Week IV Quiz II**

9:00PM Quiz Review: **Clinical Indications for Cardiac PET**

9:30PM TOPIC: Lecture: **Clinical Indications for Cardiac PET**

Objectives:

1. Evaluating tissue damage for myocardial ischemia.
2. Reviewing myocardial necrosis in cardiac PET.
3. Discussing Normal’s and Abnormal case studies.

11:00PM Session completed

**Module IV Week IV Exam**

9:00PM Exam Reviewed/ Post-Test

11:00 Session completed