Course Number and Title: NMT 224 Radiopharmacy and Pharmacology

Campus Location:
Wilmington

Effective Date:
2021-51

Prerequisite:
CHM 111, NMT 115

Co-Requisites:
NMT 201, NMT 295

Course Credits and Hours:
2.00 credits
2.00 lecture hours/week
0.00 lab hours/week

Course Description:
This course introduces radiopharmaceutical synthesis, sterility testing, quality control, mechanisms of radionuclide localizations, and governmental regulations.

Required Text(s):
Obtain current textbook information by viewing the campus bookstore - https://www.dtcc.edu/bookstores online or visit a campus bookstore. Check your course schedule for the course number and section.

Additional Materials:
Nuclear Medicine Program Policy Manual Allied Health/Science Department Program Student Policy Manual

Schedule Type:
Classroom Course

Disclaimer:
Objectives derived from: Curriculum Guide for Nuclear Medicine Technologists, Wanda Mundy & Gregory Passmore; and Performance and Responsibility Guidelines, Society of Nuclear Medicine

Core Course Performance Objectives (CCPOs):

1. Select and explain methods of radionuclide production, kit preparation, and administration, and compare advantages and disadvantages of each method. (CCC 1, 6; PGC 1, 3)
2. Categorize and analyze the different types of radiopharmaceutical quality control and quality assurance. (CCC 1; PGC 1, 6)
3. Interpret, examine, and practice the regulations governing the use of radiopharmaceuticals in the daily operations of a nuclear medicine laboratory. (CCC 4; PGC 1)
4. Explain in detail the composition, construction, and theory of all nuclear medicine generators. (CCC 6; PGC 1)
5. Select appropriate data, and calculate patient doses for each in-vivo and in-vitro procedure. (CCC 2, 6; PGC 1)
6. Explain, justify, and illustrate methods of localization of radiopharmaceuticals and pharmaceuticals.(CCC 6; PGC 1)

See Core Curriculum Competencies and Program Graduate Competencies at the end of the syllabus. CCPOs are linked to every competency they develop.

Measurable Performance Objectives (MPOs):
Upon completion of this course, the student will:

1. Select and explain methods of radionuclide production, kit preparation, and administration, and compare advantages and disadvantages of each method.
    1. Identify the basics of technetium chemistry, and describe the methods of preparing technetium compounds.
    2. Identify the properties, characteristics, and uses of other radionuclides, including but not limited to I-123, Xe-133, I-131 and I-125.
    3. Describe five methods of separation that can be employed in the preparation of radioactive drugs.
    4. Relate the differences between specificity and sensitivity.
    5. Identify the physical and chemical properties and uses of other radionuclides, included but not limited to isotopes of iodine, xenon, indium, thallium, gallium, chromium, cobalt, krypton, fluorine, and phosphorous.
    6. Describe the procedure for preparation of radiopharmaceutical kits from 99mTc pertechnetate.
    7. Discuss the physical and chemical characteristics of positron emitters that make them appropriate isotopes for imaging radiopharmaceuticals.
    8. Illustrate and explain the biochemical pathways of radiopharmaceuticals labeled with commonly used positron emitters.
    9. Describe the technical tasks associated with synthesis of radiopharmaceuticals that are labeled with positron emitters.
    10. Describe techniques for administration of PET imaging agents that are unique due to the nature of the agents.
    11. Indicate the name of a radiopharmaceutical, and explain the method of localization and the biorouting of the compound.
    12. List ten characteristics of a good radiopharmaceutical for diagnostic use.
    13. Differentiate between a diagnostic and therapeutic radiopharmaceutical.
    14. Outline the characteristics of diagnostic and therapeutic radiopharmaceuticals in terms of patient dose, energy emissions, and toxicity.
2. Categorize and analyze the different types of radiopharmaceutical quality control and quality assurance.
    1. Describe methods of quality control for both commercially available radiopharmaceuticals as well as those prepared by individual radiopharmacies.
    2. Differentiate between radionuclidic and radiochemical purity, and select methods to check each.
    3. Describe two methods used in biological testing, and differentiate between sterility and pyrogenicity.
    4. Explain and justify the importance of record keeping, proper storage, disposal, and labeling information in compliance with department regulations.
    5. Explain and demonstrate the quality control procedures that should be performed on the generator eluate and the kit product when preparing in-house 99mTc radiopharmaceuticals.
    6. Describe methods of quality control that should be used to check commercially prepared radiopharmaceuticals.
    7. Examine and employ the requirements for quality control of PET imaging agents.
3. Interpret, examine, and practice the regulations governing the use of radiopharmaceuticals in the daily operations of a nuclear medicine laboratory.
    1. Differentiate between an investigational new drug (IND) and a new drug application (NDA).
    2. Examine the national and local transportation labs affecting radioactivity.
    3. Describe United States Pharmacopeia (USP) approved methods that can be used to test for sterility and apyrogenicity of pharmaceutical.
    4. Outline a record keeping system that is consistent with Nuclear Regulatory Commission (NRC) requirements for proper ordering, dispensing, labeling, storage, and disposal of radioactive materials.
4. Explain in detail the composition, construction, and theory of all nuclear medicine generators.
    1. Describe the composition of different generator systems with detailed attention to the Sn-113-In-113m and Mo-99-Tc99m systems.
    2. Describe problems associated with these systems and methods to detect and prevent occurrences such as breakthrough.
    3. Calculate activity present at any given time as well as describe the regeneration cycles for the two equilibrium systems.
    4. Relate the difference between secular and transient equilibrium using the Sn-113-In-113m and Mo-99-Tc-99m systems as examples.
    5. List positron emitters that are produced by generator systems and those produced by cyclotron systems.
5. Select appropriate data and calculate patient doses for each in-vivo and in-vitro procedure.
    1. Formulate all mathematical calculations needed to determine volume and concentration for each patient.
    2. Select information to input in departmental radiopharmacy computer.
    3. Formulate all mathematical calculations needed to determine volume and dose for all pharmaceuticals administered for each patient.
6. Explain, justify, and illustrate methods of localization of radiopharmaceuticals and pharmaceuticals.
    1. For each type of radiopharmaceutical, indicate which localization mechanism applies.
    2. Explain target to nontarget ratio.
    3. For each radiopharmaceutical, identify critical organ.
    4. For each radiopharmaceutical, explain and discuss possible side effects.
    5. For each pharmaceutical, identify the method of localization.
    6. For each pharmaceutical identify, explain and discuss possible side effects and precautions.
    7. Create a study guide for the memorization of pharmaceuticals and radiopharmaceuticals for clinical use.

Evaluation Criteria/Policies:
The grade will be determined using the Delaware Tech grading system:

90	–	100	=	A
80	–	89	=	B
70	–	79	=	C
0	–	69	=	F

Students should refer to the Student Handbook - https://www.dtcc.edu/handbook for information on the Academic Standing Policy, the Academic Integrity Policy, Student Rights and Responsibilities, and other policies relevant to their academic progress.

Core Curriculum Competencies (CCCs are the competencies every graduate will develop):

1. Apply clear and effective communication skills.
2. Use critical thinking to solve problems.
3. Collaborate to achieve a common goal.
4. Demonstrate professional and ethical conduct.
5. Use information literacy for effective vocational and/or academic research.
6. Apply quantitative reasoning and/or scientific inquiry to solve practical problems.

Program Graduate Competencies (PGCs are the competencies every graduate will develop specific to his or her major):

1. Integrate principles of theoretical knowledge and demonstrate entry-level skills pertaining to nuclear medicine in-vivo and in-vitro procedures, radiation safety, quality control, quality assurance, NRC regulations, patient care, radiopharmaceutical preparation and administration, instrumentation and medical informatics.
2. Perform all entry-level procedural computer analysis.
3. Exhibit critical thinking and problem solving skills during the practice of nuclear medicine.
4. Abide by the profession's code of ethics as stated in the American Registry of Radiologic Technologists (ARRT) and Nuclear Medicine Technology Certification Boards (NMTCB).
5. Competently perform all in-vivo and in-vitro procedures.
6. Exhibit verbal, nonverbal, and written communication skills during patient care, research, and professional scope of practice.

Disabilities Support Statement:
The College is committed to providing reasonable accommodations for students with disabilities. Students are encouraged to schedule an appointment with the campus Disabilities Support Counselor to request an accommodation needed due to a disability. A listing of campus Disabilities Support Counselors and contact information can be found at the disabilities services - https://www.dtcc.edu/disabilitysupport web page or visit the campus Advising Center.