Course Specification

RARD 632: Advanced Physics in Nuclear Medicine

Institution Name: Mahidol University

Campus/Faculty/Department: Faculty of Medicine Ramathibodi Hospital, Department of Diagnostic and Therapeutic Radiology

Section 1: General information

1. ***Course number and name***
   Course number: RARD 632
   Course name: Advanced Physics in Nuclear Medicine

2. ***Credits: 2(1-1-3)***

3. ***Curriculum and type of course***

   3.1 Curriculum: Advanced Physics of Nuclear Medicine

   3.2 Type of course: Required course

4. ***Instructors***
   4.1 Course Coordinator: Lect.Dr. Krisanat Chuamsaamarkkee
   4.2 Instructors
   Lect.Dr.KrisanatChuamsaamarkkee
   Lect.Dr. PutthipornCharoenphun
   Lect. SasithornAmnuaywattakorn
   Lect. SasivimolPromma
   Lect. SuchavadeeMusikarat
   Lect. SiripongVittayachokkitikhun
   Lect. KittipongThongklam

5. ***Semester/Year:*** 2nd Semester, 2nd year students
6. ***Pre-requisite:*** RARD 527 Medical Image Processing
   RARD 520 Radiobiology
   RARD 526 Physics of Nuclear Medicine
7. ***Co-requisite:*** None
8. ***Classroom:*** To be announced

9. ***Revision Date:*** Nov 2019 ***By:*** Committee

Note: Revised course learning outcome, course description, and evaluation

Section 2: Purpose and objective

1. Course Learning Outcomes

1.1 Have a comprehensive knowledge ofthe QC for nuclear medicine instrument and able todevelop and design the specific QC programme for their institute

1.2 Explain the processes to perform an acceptance test of new nuclear medicine equipment and able toestablish the specification for purchase the new nuclear medicine equipment

1.3 Describe and apply the quantitative technique in application to clinical nuclear medicine

1.4 Demonstrate the understanding and able to construct the tracer kinetic model

1.5 Demonstrate the understanding and able to applythe computational technique in nuclear medicine

1.6 Utilize the advanced dosimetry method to compute dose from internalized radionuclide

1.7 Have a comprehensive knowledge of fundamental radiobiology in nuclear medicine

1.8 Discuss the current and future roles of nuclear medicine including up to date development of clinical nuclear medicine imaging in other biomedical research

1.9 Be able to communicate and share the knowledge on medical physics in nuclear medicine by effective presentation skills

1.10 Be able to value the professional conduct, professional development in team working and leadership skills

Section 3: Course details

1. Course description

This subject introduces the student to the advance physics of nuclear medicine. This will cover the establishing policy and Term of Reference (TOR) for purchase the nuclear medicine including the acceptance and other advanced quality assurance procedures for nuclear medicine equipment. This course covers the quantitative methods, tracer kinetic model, radiation biology, internal dosimetry and computation methods in nuclear medicine. This subject also includes relevant nuclear medicine techniques that used in other biomedical research.

Hours per semester: Lecture 15 hours
Practice30 hours

2. ***Assignment feedback:*** Within 2 - 4 weeks

Section 4: Course Learning Outcomes

Course level learning outcomes	Program level learning outcomes	Methods	Assessment
1 Student can develop and design the complex QC programme for nuclear medicine instrument	ELO 2	-Lecture -Demonstration - Experiment	- Paper/oral Examination - Report/Assignment
2 Student can establish the specification for purchase the new nuclear medicine equipment and understand the processes to perform an acceptance test of new equipment	ELOs 2, 4, 6	- Lecture - Demonstration - Simulation	- Paper/oral Examination - Report/Assignment
3 Student can understandand apply the quantitative technique in nuclear medicine	ELOs 2, 6	- Lecture - Demonstration	- Paper/oral Examination - Report/Assignment
4 Student can understand and construct the tracer kinetic model	ELOs 2, 6	- Lecture - Demonstration	- Paper/oral Examination - Report/Assignment
5 Student can understand and apply the computational technique in nuclear medicine	ELOs 2, 6	- Lecture - Demonstration - Experiment	- Paper/oral Examination - Report/Assignment
6. Student can compute dose from internalized radionuclide with advanced dosimetry method	ELOs 2, 6	- Lecture - Demonstration	- Paper/oral Examination - Report/Assignment

Course level learning outcomes	Program level learning outcomes	Methods	Assessment
7.Student can understand and apply the advance radiobiology in nuclear medicine	ELOs 2, 6	- Lecture - Assigned Reading	- Paper/oral Examination - Report/Assignment
8. Student can understand and apply nuclear medicine in other biomedical research	ELOs 2, 5, 6	- Lecture - Assigned Reading	- Paper/oral Examination - Report/Assignment
9. Student can communicate and share the knowledge on medical physics in nuclear medicine by effective presentation skills	ELOs 2, 5, 6	- Lecture	- Presentation - Rubric
10.Student can value the professional conduct, professional development in team working and leadership skills	ELOs 1, 2, 5, 6	- Lecture	- Presentation - Rubric - Group Assignment

Section 5: Lesson plan and assessment

1. Lesson plan

Time (h)	Topics	Instructors	Method	Assessment
1	Review of Routine Quality Control for Nuclear Medicine Equipment	Lect.Dr. Krisanat	Lecture	Paper/Oral examination/Assignment
2	Advance QC and QA in Nuclear Medicine Equipment	Lect.Dr. Krisanat	Lecture	Paper/Oral examination/Assignment
2	Quantitative Method in Nuclear Medicine	Lect.Dr. Krisanat	Lecture	Paper/Oral examination/Assignment
2	Advance Internal Dosimetry	Lect.Dr. Krisanat	Lecture	Paper/Oral examination/Assignment
2	Tracer Kinetic Model	Lect.Dr. Krisanat	Lecture	Paper/Oral examination/Assignment
2	Computational Method in Nuclear Medicine	Lect.Dr. Krisanat	Lecture	Paper/Oral examination/Assignment
2	Small Animal Nuclear Imaging	Lect.Dr. Krisanat	Lecture	Paper/Oral examination/Assignment
2	Roles of Nuclear Medicine in Biomedical Research	Lect.Dr. Putthiporn	Lecture	Paper/Oral examination/Assignment
6	Lab 1Advance QC and QA	Lect.Dr. Krisanat/Lect.Dr. Putthiporn/Lect. Sasithorn/ Lect. Sasivimol/ Lect. Suchavadee	Laboratory/Case Study	Rubric Experiment Report
3	Lab 2Establishing TOR for purchasing new equipment	Lect.Dr. Krisanat/Lect.Dr. Putthiporn /Lect. Sasithorn/ Lect. Sasivimol/ Lect. Suchavadee	Simulation Based Study	Rubric Experiment Report

Time (h)	Topics	Instructors	Method	Assessment
6	Lab 3Acceptance Testing	Lect.Dr. Krisanat/Lect.Dr. Putthiporn/ Lect. Sasithorn/ Lect. Sasivimol/ Lect. Suchavadee	Laboratory/Case Study	Rubric Experiment Report
3	Lab 4Image Artefacts and Troubleshooting	Lect.Dr. Krisanat/Lect.Dr. Putthiporn/Lect. Wirote/Lect. Sasithorn/ Lect. Sasivimol/ Lect. Suchavadee	Case Study	Rubric Experiment Report
6	Lab 5Quantitative Method and Hand-on Internal Dose Calculation	Lect.Dr. Krisanat/Lect.Dr. Putthiporn /Lect. Sasithorn/ Lect. Sasivimol/ Lect. Suchavadee	Laboratory/Case Study	Rubric Experiment Report
3	Students Journal presentations	Lect.Dr. Krisanat/Lect.Dr. Putthiporn /Lect. Sasithorn/ Lect. Sasivimol/ Lect. Suchavadee	Assigned journal readings Class Discussion	Rubric Presentation Assessment

Measurement and Evaluation of Student Achievement

2.1	Theory (short answer questions)	45%
2.2	Lab Report	30%
2.3	Journal presentation	10%
2.4	Assignment	10%
2.5	Class discussion	5%

Section 6: Assessment and improvement of the course operation

1. Strategies to assess the effectiveness of the courses by the students
    - Assessment of instructor's teaching by student

2. Strategy to assess the instruction
    - Assessment of students' learning records
    - Assessment of instructor's teaching by student

3. Improvement of Instruction
    - Consider the students' learning records
    - Consider the students' assessment of instructor's teaching
    - Consider the program committee's comment

4. Verification of student achievement in the subject
    - By program committee and faculty-level academic committee

5. Review and action plan to improve the effectiveness of the course
    - Using the results from 1 - 4 as inputs to the instruction improvement

Learning Resources

1. Cherry, S.R., Sorenson, J.A. and Phelps, M.E., 2012. *Physics in Nuclear Medicine E-Book*. Elsevier Health Sciences.

2. De Lima, J.J. ed., 2016. *Nuclear medicine physics*. CRC Press.

3. Bailey, D.L., Huum, J.L., Todd-Pokropek, A. and Aswegen, A.V., 2014. *Nuclear medicine physics: a handbook for teachers and students*. Vienna: International Atomic Energy Agency (IAEA).

4. Waterstram-Rich, K.M. and Gilmore, D., 2016. *Nuclear Medicine and PET/CT-E-Book: Technology and Techniques*. Elsevier Health Sciences.

5. Hine, G.J. ed., 2016. *Instrumentation in nuclear medicine*. Academic Press.