

Course Specification

RARD 626: Magnetic Resonance Imaging

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 626
Course name: Magnetic Resonance Imaging

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

3. Curriculum and type of course

3.1 Curriculum: Magnetic Resonance Imaging
3.2 Type of course: Required course

4. Instructors

4.1 Course Coordinator: Asst.Prof. Dr. Sawwanee Asavaphatiboon
4.2 Instructors: Asst.Prof. Dr. Sawwanee Asavaphatiboon
Asst.Prof. Dr.Napapong Pongnapang
Asso.Prof. Dr. Sith Phongkitkarun
Asso.Prof. Dr. Suvipaporn Siripornpitak
Asst.Prof. Dr. Warapat Virayavanich
Lecturer Dr. Witaya Sungkarat
Lecturer Dr. Oranan Tritanon
Lecturer Adun Kampanthip
Lecturer Watcharee Prasertkulchai
Lecturer Prapa Sodkokuad
Lecturer PornpanYongvithitsatit

5. Semester/Year: 2nd Semester, Academic Year 2019, 1st year students

6. Pre-requisite: Anatomy and radiological imaging

7. Co – requisites: None

8. Classroom: To be announced

9. Revision Date: 31st July 2019

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

Section 2: Purpose and objective

1. Course Learning Outcomes

1.1 Student can explain advanced physical concepts, pulse sequences, k-space, data acquisition and image reconstruction of MRI

1.2 Student can distinguish image contrast in each MR sequences including special techniques

1.3 Student can identify the components and understand the function

1.4 Student can explain how to apply MR image and advanced MRI techniques for radiotherapy planning

1.5 Student can explain concept of image quality and perform quality control of MRI

1.6 Student can identify risk and safety of MRI

1.7 Student can communicate and share the knowledge by effective presentation skill

1.8 Student can value the professional conduct of MRI

Section 3: Course details

1. Course Description

Physics of MRI, data acquisition and image reconstruction; image quality and artifact; advanced techniques of MRI; ethics of magnetic resonance imaging

2. Hours per semester:

Lecture 15 hours

On the job training 45 hours

Self-study 30 hours

3. Assignments feedback: Within 2-4 weeks

Section 4: Course Learning Outcomes

Course level learning outcomes	Programme level learning outcomes	Methods	Assessment
1. Student can explain advanced physical concepts, pulse sequences, k-space, data acquisition and image reconstruction of MRI	ELO 2,6	- Lecture - Class discussion - Assigned readings	- Oral/paper Examination
2. Student can distinguish image contrast in each MR sequences including special techniques	ELO 2,6	- Lecture - On the job training - Class discussion - Assigned readings	- Oral/paper Examination - On the job report
3. Student can identify the components and understand the function	ELO 2,6	- Lecture - Class discussion - Assigned readings	- Oral/paper Examination
4. Student can explain how to apply MR image and advanced MRI techniques for radiotherapy planning	ELO 1,2, 3,6	- Lecture - On the job training - Class discussion - Assigned readings	- Oral/paper Examination - On the job report
5. Student can explain concept of image quality and perform quality control of MRI	ELO 2, 6	- Lecture - On the job training - Class discussion - Assigned readings	- Oral/paper Examination - On the job report
6.. Student can identify risk and safety of MRI	ELO 1, 2,6	- Lecture - Class discussion - Assigned readings	- Oral/paper Examination
7. Student can communicate and share the knowledge by effective presentation skill	ELO 4, 5	- Lecture - Assigned MRI journal presentation - Class discussion	- Oral/paper Examination - Rubric presentation skill assessment
8. Student can value the professional conduct of MRI	ELO 3,4	- Assigned readings	- Rubric writing assessment

Section 5: Lesson plan and assessment

1. Lesson plan

Time(hr)	Topics	Instructors	Method	Assessment
2	Subject introduction and physics and MRI instruments	Lect.Dr.Sawwanee	- Lecture - Class discussion	- Oral Pre test - Examination
2	MRI theory : pulse diagrams and K-space	Lect.Dr.Sawwanee	- Lecture - Class discussion	- Oral Pre test - Examination
	Pulse sequences and MR Angiography and blood flow imaging physical principles	Lect.Dr.Sawwanee	- Lecture - Class discussion	- Oral Pre test - Examination
2	Principles of magnetic Resonance Spectroscopy (MRS)	Lect.Dr.Sawwanee	- Lecture - Class discussion	- Oral Pre test - Examination
2	MRI Artifacts	Lect.Dr.Napapong	- Lecture - Class discussion	- Oral Pre test - Examination
	Image quality & quality management in MRI (AAPM and ACR tasks)	Lect.Prapa	- Lecture - Class discussion	- Oral Pre test - Examination
2	Diffusion, perfusion and physical principles	Lect.Dr.Napapong	- Lecture - Class discussion	- Oral Pre test - Examination
	Principles of Cardiovascular MRI	Lect. Watcharee	- Lecture - Class discussion	- Oral Pre test - Examination
3	On the job training: Clinical application in Neuro	Lect. Adun/ Lect.Dr.Sawwanee	- On the job training - Class discussion	- on the job training report
3	On the job training: Clinical application in Body	Lect. Adun/ Lect.Dr.Sawwanee	- On the job training - Class discussion	- on the job training report

Time(hr)	Topics	Instructors	Method	Assessment
3	On the job training: Clinical application in MSK	Lect. Adun/ Lect.Dr.Sawwanee	- On the job training - Class discussion	- on the job training report
3	On the job training : Clinical application in Cardiovascular	Lect. Watcharee	- On the job training - Class discussion	- on the job training report
2	Functional magnetic Resonance (fMRI)	Lect.Dr.Witaya	- Lecture - Class discussion	- Examination
3	On the job training: fMRI analysis –I	Lect.Dr.Witaya	- On the job training - Class discussion	- on the job training report
3	On the job training: Image artifact and journal presentation I	Lect.Dr.Sawwanee	- On the job training - assigned Journal presentation - Class discussion	- on the job training report - Rubric presentation skill
3	On the job training: Image artifact and journal presentation II	Lect.Dr.Sawwanee	- On the job training - assigned Journal presentation - Class discussion	- on the job training report - Rubric presentation skill
3	On the job training: fMRI analysis –II	Lect.Dr.Witaya	- On the job training - Class discussion	- on the job training report
3	On the job training: Image quality & quality management in MRI	Lect, Prapa/ Lect.Dr.Sawwanee	- On the job training - Class discussion	- on the job training report

Time(hr)	Topics	Instructors	Method	Assessment
3	On the job training: Applications of MRI in radiotherapy treatment planning I	Lect. Pornpan	- On the job training - Class discussion	- on the job training report
3	On the job training: Applications of MRI in radiotherapy treatment planningII	Lect. Pornpan	- On the job training - Class discussion	- on the job training report
2	Clinical applications of MRI in Neurovascular Imaging I &II	Lect.Dr.Oranan	- Lecture - Class discussion	- Examination
1	Clinical applications of MRI in Body Imaging	Lect.Dr.Sith	- Lecture - Class discussion	- Examination
1	Clinical applications of MRI in Cardiovascular Imaging	Lect.Dr.Suwipaporn	- Lecture - Class discussion	- Examination
1	Clinical applications of MRI in Musculoskeletal Imaging	Lect.Dr.Warapat	- Lecture - Class discussion	- Examination

2. Measurement and Evaluation of Student Achievement

- 2.1 Theory Examination (short, long answer questions) 70%
- 2.2 On the job training report 20%
- 2.3 Journal presentation 10%

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. <http://www.sprawls.org/resources/>
2. <https://www.imaios.com/en/e-Courses/e-MR>
3. Stark DD. Magnetic resonance imaging. 3rd ed. St. Louis : Mosby; 1991.
4. Bushberg JT. The essential physics of medical imaging. 3rd ed. Philadelphia: Lippincott Williams & Wilkins; 2011.