Course Specification

RARD 524: Physics of Radiation Therapy

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 524
   Course name: Physics of Radiation Therapy

2. ***Credits: 2(2-0-4)***

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

   3.1 Curriculum: Physics of Radiation Therapy

   3.2 Type of course: Required course

4. ***Instructors***
   4.1 Course Coordinator: Lect.Dr.PuangpenTangboonduangjit
   4.2 Instructors

Assist. Prof. Suvit	Punnachaiya
Lect. Dr. Puangpen	Tangboonduangjit
Lect. Dr. Nauljun	Stansook
Lect. Dr. Suphalak	Khachonkham
Lect. Pimolpun	Changkaew
Lect. Pongsakorn	Klongpad

5. ***Semester/Year:*** 2nd Semester, Academic Year 2020, 2nd year students
6. ***Pre-requisite:*** 1. Radiation and Nuclear Physics
   2. Basic and Radiological Imaging of Anatomy and Physiology
   3. Electronics instrumentation and radiation dosimetry

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 Be able to detect the functioning of radiotherapy machine
1.2 Be able to apply Cavity theory and validate dose measurement for TRS398 protocol both in photon and electron beams
1.3 Be able to compute dose parameters for manual dose calculation
1.4 Be able to distinguish dose calculation algorithms
1.5 Be able to identify the components and process of treatment planning system
1.6 Be able to validate the measure dose of brachytherapy technique both in air and in phantom.
1.7 Be able to communicate and share the knowledge by effective presentation skill
1.8 Be able to value the professional conduct of radiation therapy

Section 3: Course details

1. Course description

Radiotherapy machine, characteristics of clinical photon and electron beams, absolute dose measurement following TRS398 protocol, relative dose measurements using various detectors, monitor unit calculation, tissue inhomogeneity corrections, overview treatment planning system, model and principle based dose calculation algorithms, brachytherapy concept and dose measurement.

2. ***Hours per semester:*** Lecture 22 hours

   Practice 15 hours

3. ***Assignment feedback:*** Within 2 weeks

Section 4: Course Learning Outcomes

Course level learning outcomes	Programme level learning outcomes	Methods	Assessment
1 Be able to detect the functioning of radiotherapy machine	ELO 2, 4, 6	- Lecture - Demonstration - Experiment	- Paper Examination - Rubric experiment report assessment
2 Be able to apply Cavity theory and validate dose measurement for TRS398 protocol both in photon and electron beams	ELO 2, 4, 6	- Lecture - Demonstration - Experiment	- Paper/oral Examination - Rubric experiment report assessment
3 Be able to compute dose parameters for manual dose calculation	ELO 2, 6	- Lecture - Demonstration	- Paper/oral Examination
4 Be able to distinguish dose calculation algorithms	ELO 2, 6	- Lecture - Demonstration - Assignment	- Paper Examination - Assignment report
5 Be able to identify the components and process of treatment planning system	ELO 2, 6	- Lecture - Demonstration	- Paper Examination
6 Be able to validate the measure dose of brachytherapy technique both in air and in phantom.	ELO 2, 4, 6	- Lecture - Demonstration - Experiment	- Paper/oral Examination - Rubric experiment report assessment
7 Be able to communicate and share the knowledge by effective presentation skill	ELOs 2, 5, 6	- Assigned journal readings	- Rubric presentation skill assessment
8 Be able to value the professional conduct of radiation therapy	ELO 1, 2, 6	- Assigned journal readings	- Rubric presentation skill assessment

Section 5: Lesson plan and assessment

1. Lesson plan

Time	Topics	Instructors	Method	Assessment
2	1.Linac principle	Assist. Prof. Suvit	Lecture	Paper examination
2	1.Radiotherapy machine	Dr.Puangpen	Lecture	Paper examination
3	Lab 1: Linac-Control system	K.Pongsakorn/ Dr.Puangpen	Lecture/ Demonstration	Rubric experiment report assessment
3	Lab 2: Determination of the absorbed dose for high energy photon beams (TRS398)	A. Pimolpan/ Dr. Suphalak	Lecture/ Demonstration	Rubric experiment report assessment
2	2.Megavoltage photon beams I/II	Dr.Puangpen	Lecture	Paper/Oral examination
2	3. Manual dose calculation for photon beams/Practice	Dr.Nauljun	Lecture/ Demonstration	Paper examination
3	Lab 3: Relative measurement: PDD, Beam profile	A. Pimolpan/ Dr. Suphalak	Lecture/ Demonstration	Rubric experiment report assessment
2	4. Tissue inhomogeneity correction	Dr.Nauljun	Lecture	Paper examination
2	Introduction of treatment planning system (TPS) (Calculating 2D-3DCRT dose distribution using treatment planning system)	Dr.Suphalak	Lecture/ Demonstration	Paper examination
1	5. Model-based dose calculation	Lect.Dr.Puangpen	Lecture	Paper examination
1	6. Principle based dose calculation	Lect.Dr.Puangpen	Lecture	Paper examination
2	7. Electron beam therapy and Manual dose calculation	Dr.Nauljun	Lecture/ Demonstrate	Paper/Oral examination
2	8. Determination of the absorbed dose for electron beams	Dr.Nauljun	Lecture	Paper/Oral examination

Time	Topics	Instructors	Method	Assessment
3	Lab 4: Determination of the absorbed dose for electron beams and output factor measurement (TRS398)	Dr.Nauljun/ A. Pimolpun	Lecture/ Demonstration	Rubric experiment report
2	9. Basic Brachytherapy and Manual dose calculation	Dr.Puangpen	Lecture	Paper examination
2	10. Advanced Brachytherapy	Dr.Puangpen	Lecture	Paper examination
3	Lab 5: Calibration of brachytherapy source by using well-type chamber	Dr.Nauljun/ Dr.Suphaluck	Lecture/ Demonstration	Rubric experiment report
3	Journal presentation	Dr.Puangpen	Presentation	Rubric for presentation

2. Measurement and Evaluation of Student Achievement

2.1	Paper (short answer questions)	40%
2.2	Oral exam	10%
2.3	Experiment report	25%
2.4	Journal presentation	15%
2.5	Writing assignment	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. Philip Mayles, Alan Nahum, Jean-Claude Rosenwald. Handbook of radiotherapy physics therory and practice: Talor & Francis Group; 2007
2. Faiz M. Khan. The Physics of Radiation Therapy: Lippincott Williams & Wilkins, a Wolters Kluwer business, 4th edition; 2010
3. Frank H. Attix. Introduction to radiological physics and radiation dosimetry. John Wiley & Sons; 1986.
4. Pedro Andreo, Davis T.Burns, Alan E. Nahum, Jan Seuntjens, and Frank H. Attix. Fundamentals of ionizing radiation dosimetry: Wiley-VCH; 2017.